EPA-420-R-87-101

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September 30, 1987

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SUBJECT: Final Data Report for Work Assignment No. B-9, Contract 68-03-3353, "Catalyst Evaluation," SwRI Project 08-1193-009

This work assignment is intended to evaluate the condition of catalysts removed from in-use vehicles. The catalysts were removed by EPA from 1983 and 1984 Model Year In-Use Technology Assessment (IUTA) vehicles. Forty-five catalysts were analyzed under this Work Assignment. Eleven catalyst samples were from Work assignment No. 8 and five catalyst samples were analyzed for MOD from previous Work Assignments. The catalysts represented monolith technology only. Catalysts used by several different manufacturers were included in the evaluation. The catalysts were either three-way or three-way plus oxidation catalysts, with single or dual biscuits. In addition to catalysts, oxygen sensors were also evaluated in this Work Assignment.

This letter report, along with the included data, is intended to be the final report of the results from the catalyst evaluation testing. It includes all the results from the laboratory analyses by whole converter X-ray, BET surface area, X-ray fluorescence (XRF), proton induced X-ray emission (PIXE), scanning electron microscope (SEM), and X-ray diffraction (XRD). Oxygen sensors were evaluated for leakage rate, cold light-off, voltage response, voltage output, surface area, and electron spectroscopy for chemical analysis (ESCA). Only a brief discussion of the analytical procedure, and no discussion of the trends observed in the evaluation of each catalyst, is included. A list of the converters evaluated in the program is presented in Table 1. A detailed description of the laboratory analytical procedures is presented in the final reports for Work Assignments No. 10 and 17 of Contract 68-03-3162, with the exception of PIXE and ESCA.

I. LABORATORY ANALYSIS

The laboratory analysis of the catalyst samples consisted of whole converter X-ray, BET surface area, XRF, PIXE, SEM, and XRD. The catalyst samples were examined as follows:

TABLE 1. LIST OF CATALYSTS FOR EVALUATION

Converter Number	Manufacturer	Engine Family	Type of Catalyst
219/0199*	Chrysler	BCR1.7V2HJ1	Dual biscuit 3W-Ox
A87/0131*	Chrysler	BCR1.7V2HJ1	Dual biscuit 3W-Ox
A87/0228*	Chrysler	BCR1.7V2HJ1	Dual biscuit 3W-Ox
A87/0345*	Chrysler	BCR1.7V2HJ1	Dual biscuit 3W-Ox
A87/0479*	Chrysler	BCR1.7V2HJ1	Dual biscuit 3W-Ox
A221/0198**	Chrysler	DCR2.2V2HAC3	Dual biscuit 3W-OX
A221/0310**	Chrysler	DCR2.2V2HAC3	Dual biscuit 3W-OX
A249/0486-1	Chrysler	ECR5.2V2HAP9	Single biscuit 3W
A249/0486-2	Chrysler	ECR5.2V2HAP9	Single biscuit 3W
A249/0486-3	Chrysler	ECR5.2V2HAP9	Dual biscuit 3W-OX
A280/0004L	Chrysler	ECR2.2V2HAC4	Dual biscuit 3W-OX
A280/0005L**	Chrysler	ECR2.2V2HAC4	Dual biscuit 3W-OX
A280/0006L	Chrysler	ECR2.2V2HAC4	Dual biscuit 3W-OX
A317/0196	Chrysler	ECR2.2V5FAA8	Dual biscuit 3W-OX
A317/1115	Chrysler	ECR2.2V5FAA8	Dual biscuit 3W-OX
A317/1151	Chrysler	ECR2.2V5FAA8	Dual biscuit 3W-OX
A337/0151	Chrysler	ECR2.2V5FAAX	Dual biscuit 3W-OX
A337/0227	Chrysler	ECR2.2V5FAAX	Dual biscuit 3W-OX
A240/0007**	Ford	DFM1.6V2GDK6	Dual biscuit 3W-OX
A240/0270**	Ford	DFM1.6V2GDK6	Dual biscuit 3W-OX
A279/0002L	Ford	EFM1.6V2GDK7	Dual biscuit 3W-OX
A279/0003L	Ford	EFM1.6V2GDK7	Dual biscuit 3W-OX
A279/0004L	Ford	EFM1.6V2GDK7	Dual biscuit 3W-OX
A316/0460-1	Ford	EFM3.8V5HHF7	Single biscuit 3W
A316/0460-2	Ford	EFM3.8V5HHF7	Single biscuit 3W
A316/0460-3	Ford	EFM3.8V5HHF7	Single biscuit OX
A316/0665-1	Ford	EFM3.8V5HHF7	Single biscuit 3W
A316/0665-2	Ford	EFM3.8V5HHF7	Single biscuit 3W
A316/0665-3	Ford	EFM3.8V5HHF7	Single biscuit OX
A338/0124-1	Ford	GFM3.8V5HHF9	Single biscuit 3W
A338/0124-2	Ford	GFM3.8V5HHF9	Single biscuit 3W
A338/0124-3	Ford	GFM3.8V5HHF9	Single biscuit OX
A338/0136-1	Ford	GFM3.8V5HHF9	Single biscuit 3W
A338/0136-2	Ford	GFM3.8V5HHF9	Single biscuit 3W
A338/0136-3	Ford	GFM3.8V5HHF9	Single biscuit OX
A220/0400**	GM	D4G3.8V2NEA3	Dual biscuit 3W-OX
A230/0649**	GM	D1G2.0V2XAJ4	Dual biscuit 3W
A230/0734**	GM	D1G2.0V2XAJ4	Dual biscuit 3W
A246/0092**	GM	D1G3.8V2NDA4	Dual biscuit 3W-OX
A334/0677	GM	E6G4.1V5NKA7	Dual biscuit 3W-OX
A254/0031	Toyota	DTY2.4V5FBB2	Dual biscuit 3W
A254/0037**	Toyota	DTY2.4V5FBB2	Dual biscuit 3W-OX
A254/0191**	Toyota	DTY2.4V5FBB2	Dual biscuit 3W-OX
A254/0275	Toyota	DTY2.4V5FBB2	Dual biscuit 3W
A306/0156	Volvo	EVV2.3V5FLH9	Single biscuit 3W
A306/0192	Volvo	EVV2.3V5FLH9	Single biscuit 3W

*Samples for MOD
**Samples from Work Assignment No. 8

1. Only whole converters were examined by whole converter X-ray radiographs.

2. The whole converters were visually inspected, weighed with and without any heat shields, and then carefully cut to expose the catalyst material. All catalyst samples were visually inspected and weighed.

3. Each converter was disassembled in a manner to expose the catalyst material with a minimum of disturbance.

   a. In step one, the catalyst was sectioned into quarter pieces. The upstream biscuit of the catalytic converter was sectioned as pictured in Figure 1. Each quarter has a length "L" the same as the length of the original uncut biscuit, but a height and width half of the original height and width (1/2H and 1/2W).

   b. In step two, one of the quarter sections (lower left) was further sectioned into three pieces as shown in Figure 1. The front piece had a length of 0.5 inch, the rear piece had a length of 0.5 inch, and the middle piece had a length of "L - 1.0 inches." From the center of the middle piece, a 0.5-inch sample was taken. Each of these three 0.5-inch samples underwent surface area analysis. A cube with 0.5-inch sides was cut from the front face and selected samples of the rear face from the upper right quarter. These samples were submitted for SEM analysis. The remainder of this quarter was submitted in its entirety for (XRD) analysis. Samples were scraped from an area no larger than 0.25 cubic inches along the center line of the catalyst. One sample each was taken 1 inch from the front and rear faces, and the third sample was taken at the midpoint of the length of the substrate and 0.5 inch from the outside surface.

   c. Two of the quarter sections shown in Figure 1 (Upper left and lower right) were not subjected to any immediate analysis when a whole catalyst was supplied. These samples were kept as additional material for future analysis. Partial catalyst samples were sectioned starting with step two.

   d. The downstream biscuit was sectioned by cutting the substrate into quarters similar to the upstream substrate. One sample each was taken 0.5 inch from the front face and the rear face of the upper right quarter as shown in Figure 2. Each of these two pieces underwent BET surface area analysis. The remaining middle section was submitted for XRD. The XRD samples from the B biscuit were scraped from an area not larger than 0.25 cubic inch along the center line and 1.0 inch from the front face. This was the only sample for XRD from the B biscuit. The entire quarter section, positioned diagonally from the section used for BET surface area analysis (lower left), was used for PIXE analysis. The remaining two quarter sections (upper left and lower right) from the four whole converters, when provided, did not undergo analysis at this time, but were saved for future work.

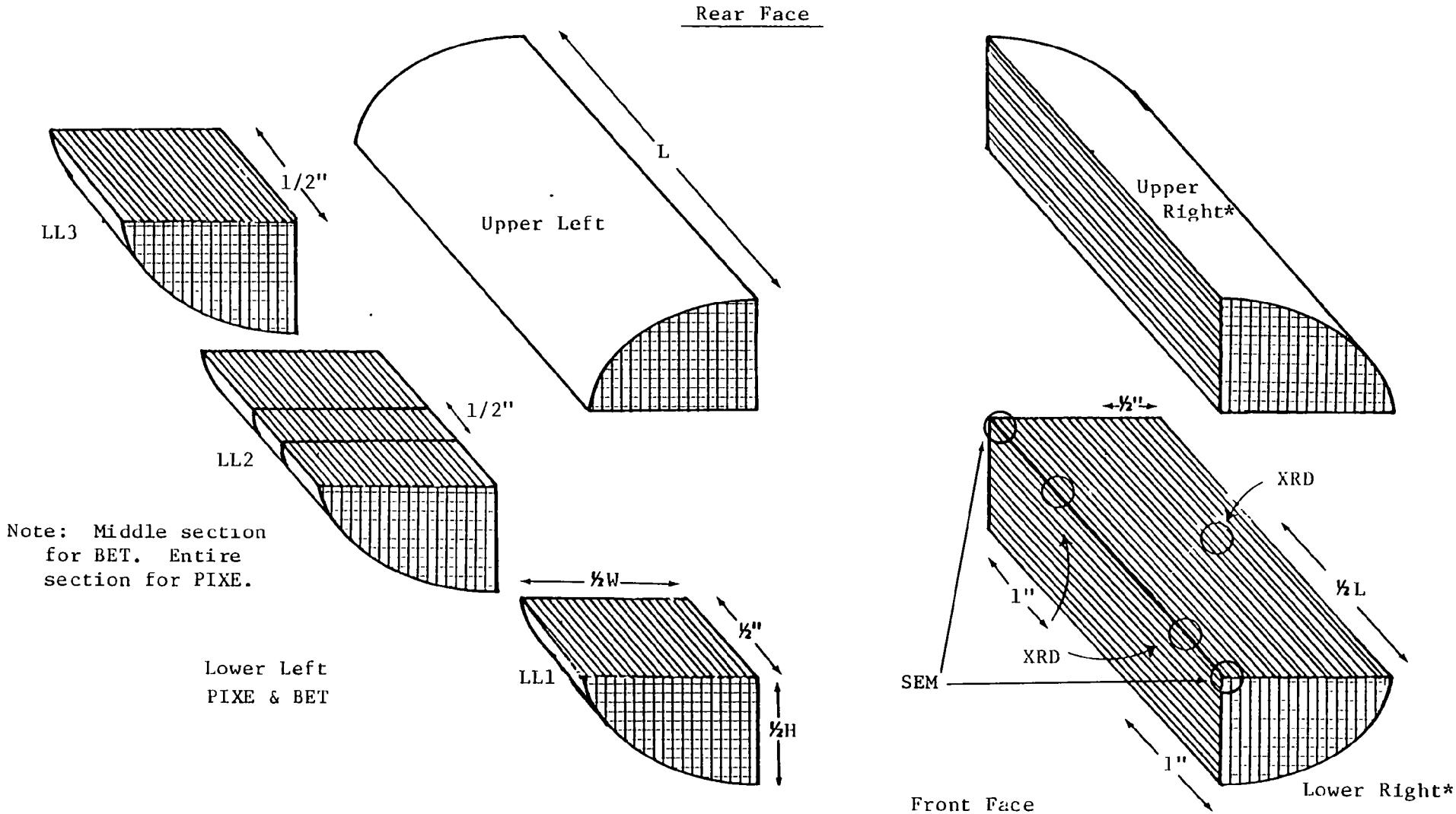


FIGURE 1. SAMPLE SECTIONS AND SAMPLE LOCATION FOR UPSTREAM (A) BISCUIT

*Sample location for XRD and SEM shown on lower right quarter for clarity. Actual sample location from upper right quarter.

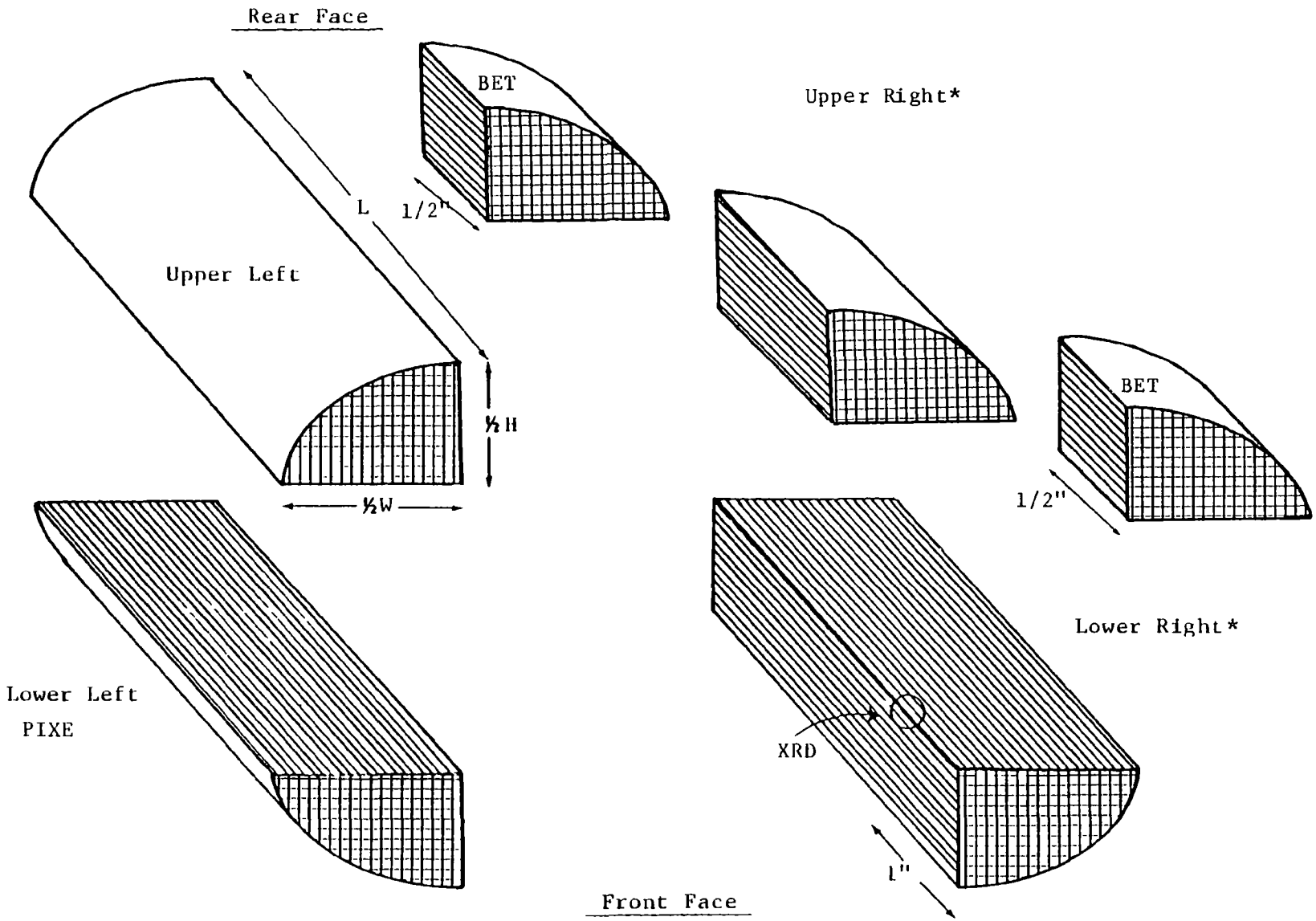


FIGURE 2. SAMPLE SECTIONS AND SAMPLE LOCATIONS FOR DOWNSTREAM (B) BISCUIT

*Sample location for XRD shown on lower right quarter for clarity. Actual sample location from upper right quarter.

All of the catalyst samples were handled in this manner. The flow schematic of a typical sample is presented in Figure 3.

A. Sample Identification

For the purpose of identifying the converters analyzed in this program, each converter was designated with the seven or eight digit EPA identification code. After the converters were opened, the upstream biscuit was labeled "A," and the downstream biscuit was labeled "B." Each quarter section from the A biscuit was designated according to its location within the can (UL-upper left, UR-upper right, LL-lower left, LR-lower right). The samples for BET surface area and PIXE were also designated with respect to their locations in the biscuit. The location along the length of the quarter section was labeled 1, 2, or 3, respectively, for the upstream, middle, or downstream position. The exception to this rule was for the B biscuit; no middle sample was taken for the BET surface area analysis. In this case, "2" indicated the downstream location. The labeling designations are listed in Table 2. The term "biscuit" is used to refer to each individual piece of ceramic honeycomb material in a converter.

B. Whole Catalyst X-Ray

Seventeen of the converters were examined by whole catalyst X-ray. The radiographs taken in this work assignment are included in Appendix A. Converters A317/0196, A317/1115, A316/0665-3, A306/0156, and A306/0192 had been fitted with couplings for placing thermocouples in the ceramic bed. The couplings were visible on the film but the holes drilled in the ceramic material were not visible. The upstream biscuit of converter A279/0004L showed evidence of melting on the inlet side. Converter A334/0677 showed evidence of a severe crack in the upstream biscuit. The radiograph was exceptionally dark for the upstream biscuit, with a triangular region of higher density material for the downstream biscuit. Additional observations upon opening the case will reveal additional details.

C. Sample Weighing

The weights of the various samples were determined in several stages. All of the whole converters were weighed whole, and each biscuit was weighed after opening. All of the partial samples were weighed, but these weights are only a determination of the amount of sample received. In order to do additional calculations on these converters, the weights of the biscuits before the samples were taken must be known or estimated. All of the weights are presented in Table 3.

D. Visual Inspection

Each whole converter and biscuit was inspected for visual signs of overheating or damage. Catalyst A279/0004L was severely melted. A large void had developed about two inches from the front face. The melted portion was not visible from the external surface of the biscuit. This was the only visible example of melting in this work assignment. Several samples had developed cracks. They were: A334/0677-A & -B, A279/0003L-B, A280/0004L-A, and A316/0665-1 & -2. Catalysts A306/0156, A306/0192, A317/0196, A317/1115, and A316/0665-3 had been drilled in an effort to place thermocouples into the center of the biscuit. All of the catalysts showed typical signs of usage (dark front faces with rust on outer surfaces).

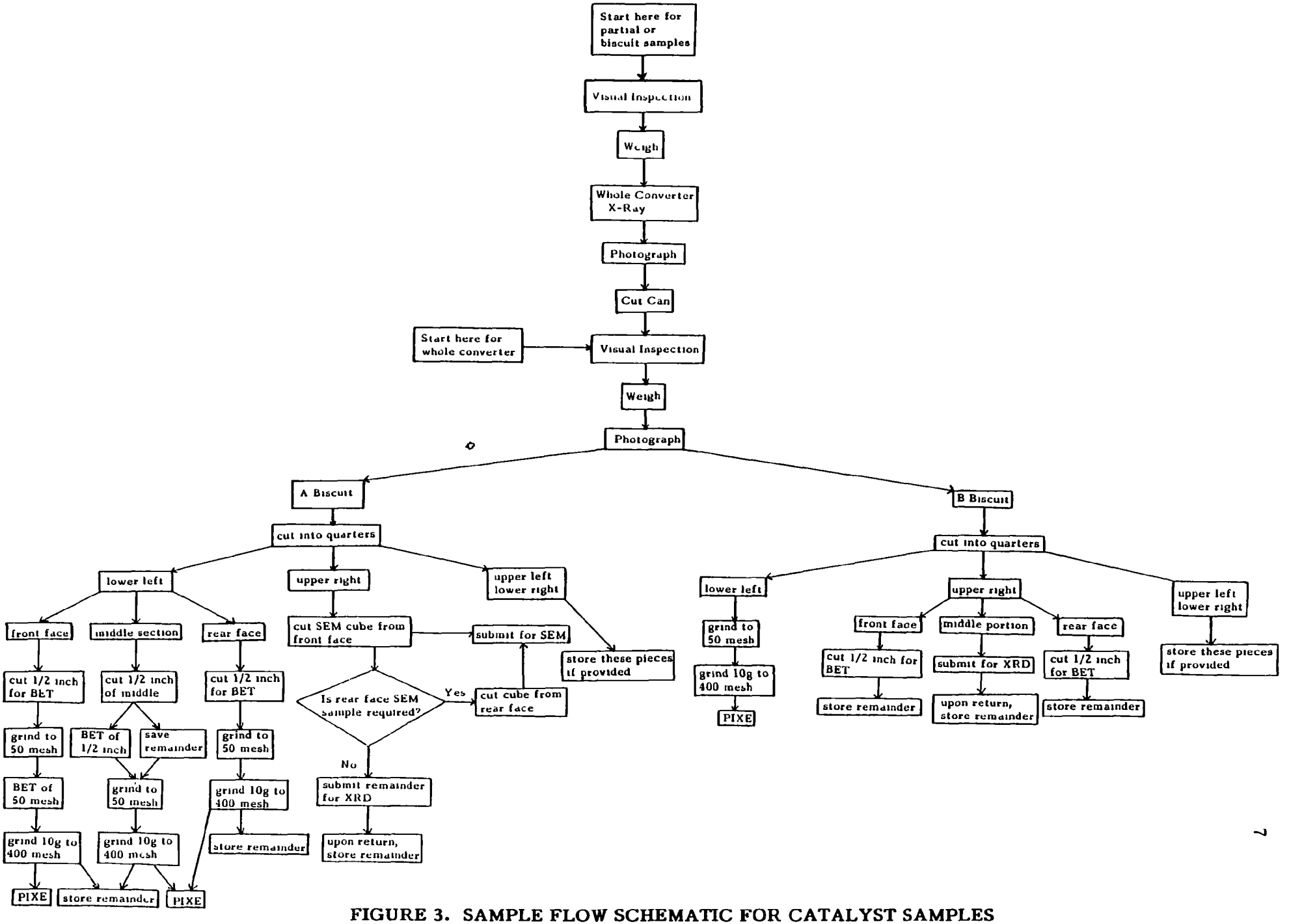


FIGURE 3. SAMPLE FLOW SCHEMATIC FOR CATALYST SAMPLES

TABLE 2. LABELING PROCEDURE CODE

Code	Description
A	Upstream biscuit
B	Downstream biscuit
UL	Upper left portion of biscuit
UR	Upper right portion of biscuit
LL	Lower left portion of biscuit
LR	Lower right portion of biscuit
1	Upstream piece of section
2	Middle piece of section or downstream when no middle piece taken
3	Downstream piece of section

TABLE 3. CONVERTER WEIGHT

Converter Number	Whole Converter, lbs.[c]	Biscuit Weights, g	
		Upstream (A)	Downstream (B)
A249/0486-1[a,b]	6.60	197.6/216.5	--
A249/0486-2[a]	6.78	176.4/205.7	--
A249/0486-3[a]	12.59	194.2/197.6	334.6/321.5
A280/0004L	9.72/9.22	1113.0	470.8
A280/0006L	10.00/9.48	1138.8	474.8
A317/0196	9.89	639.7	605.7
A317/1115	9.74	620.1	585.6
A317/1151	9.71	655.9	607.6
A337/0151	9.71	729.1	724.1
A337/0227	9.34	667.9	665.5
A279/0002L	9.63/8.02	413.6	547.9
A279/0003L	9.53/7.91	389.0	545.0
A279/0004L	9.63/8.02	402.6	544.2
A316/0460-1	--	98.7/101.4	--
A316/0460-2	--	114.9/118.3	--
A316/0460-3	--	179.0/187.2	--
A316/0665-1	7.60/6.80	422.3	--
A316/0665-2	4.79/3.93	438.9	--
A316/0665-3	7.51	691.9	--
A338/0124-1	--	89.7/93.1	--
A338/0124-2	--	88.2/91.9	--
A338/0124-1	--	164.9/165.9	--
A338/0136-1	--	93.1/88.9	--
A338/0136-2	--	94.4/94.2	--
A338/0136-3	--	163.0/171.5	--
A334/0677	11.56	1121.3	697.5
A339/0221[d]	11.70/9.80	--	--
A254/0031	--	202.5/204.3	205.9/195.8
A254/0275	--	203.4/201.6	203.3/203.5
A306/0156	7.57	957.2	--
A306/0192	7.50	919.1	--

[a]Whole converter weights from a previous work assignment. Partial sample weights from this work assignment. Biscuit weights not available.
[b]Weights with slash marks indicate that partial samples were received. First listed weight is for lower left portion, and second weight is for upper right portion.
[c]Whole converter weights with and without heat shields
[d]Sent back to EPA

E. Specific Surface Area

The specific surface areas of the whole lengths of all biscuits were measured with a Micromeritics Flowsorb II dynamic surface area analyzer using the multipoint analysis technique. This analysis was conducted "in-house" during this Work Assignment. The advantages for "in-house" analysis include a stricter control of the analytical procedures and ease of repeating questionable samples. Losses in surface area are due to thermal degradation and/or plugging of the sub-microscopic pores with metals and other deposits. A loss in the active surface area results in the reduction of contact between exhaust gases and the catalyst material. A low surface area generally indicates converter overheating. Conversely, a normal surface area does not necessarily indicate a normal catalyst, because the deposits can increase the apparent surface area while covering the surface and preventing contact with the exhaust gases. In this work assignment, the surface area of 0.5 inch pieces from the front, middle, and rear of the upstream biscuit and the surface area from the front and rear pieces of the downstream biscuit were analyzed. These large wedges were sealed in glass sample tubes and analyzed whole. Upon completion of the analysis of the LL1 piece, the sample was ground to a coarse powder (approximately 50 mesh). This sample was also analyzed for surface area. The results for the specific surface areas are presented in Table 4. The plots for the BET equation versus the relative pressure for each converter are included in Appendix B.

Nineteen samples were analyzed for MOD. These samples originated in previous work assignments. The samples were taken from the 50 mesh powder used to prepare the samples for PIXE and XRF. The results from these powder samples are included in Table 5. In general, the surface areas for the powder samples were higher than the unground strips. The plots for the BET equation versus the relative pressure for each sample are included in Appendix C.

F. X-Ray Diffraction

X-ray diffraction analysis of the samples was used to determine the crystal structure of the alumina. Gamma-alumina and several other very similar alumina structures are the original crystal structures used in the alumina washcoat. When a catalyst containing these types of alumina is overheated (temperatures greater than 1000°C), the crystal structure changes to the alpha-alumina form. This conversion in crystal structure can trap the active metals and change the active surface area of the catalyst. The Debye-Scherrer powder X-ray diffraction technique was used to determine the alumina crystal structure. This technique is well suited for the analysis of monolith catalysts because of the small quantities of sample required. In the case of monolith catalysts, the alumina is deposited as a thin wash-coat on the surface of the ceramic substrate. The alumina can be scraped off carefully and analyzed by subjecting to a collimated X-ray beam. The X-rays are diffracted by the various crystalline compounds within the sample. Each crystalline compound has a characteristic diffraction pattern. Amorphous compounds do not result in a discernable diffraction pattern. These patterns are compared to known compounds in a Powder Data File for identification. Table 6 lists the alumina crystal structure of each sample and any other crystalline compounds observed in the samples.

G. Proton Induced X-Ray Emission

Proton induced X-ray emission (PIXE) was used to determine the concentrations of noble metals and the accumulation of poisons. This technique

TABLE 4. CATALYST SPECIFIC SURFACE AREA

Biscuit No.	Specific Surface Area, m^2/g						Total Surface Area for Whole Biscuit, m^2	
	Front Biscuit(A)				Rear Biscuit(B)			
	LL1	LL2	LL3	Powder	UR1	UR2	Front	Rear
A221/0198	7.02±0.12	5.37±0.60	6.35±0.16	9.20±0.66	6.46±0.23	5.45±0.03	6800	2600
A249/0486-1	8.74±0.67	5.69±0.15	7.62±0.50	11.35±0.12	--	--	6100	--
A249/0486-2	7.06±0.11	4.97±0.14	6.09±0.34	10.07±0.25	--	--	4600	--
A249/0486-3	10.04±0.48	8.17±0.24	9.68±0.08	12.84±0.42	2.82±0.10	--	7300	--
A280/0004L	5.98±0.01	3.57±0.07	4.57±0.30	8.95±0.25	8.03±0.15	6.59±0.23	5200	3400
A280/0006L	7.69±0.06	7.55±0.48	7.14±0.03	9.74±0.33	6.77±0.30	8.54±0.02	8500	3600
A317/0196	10.05±0.04	7.60±0.06	9.67±0.04	11.04±0.11	12.07±0.52	11.18±0.19	5800	7000
A317/1115	10.57±0.08	10.31±0.62	4.74±0.01	14.56±0.32	9.99±0.37	11.37±0.66	5300	6300
A337/0151	13.24±0.11	9.62±0.04	10.71±0.03	10.83±0.12	9.16±0.03	7.07±0.02	8200	5900
A279/0002L	13.95±0.79	19.23±0.03	16.27±0.14	17.62±0.66	7.93±0.06	6.79±0.46	6800	4000
A279/0003L	10.98±0.13	16.74±0.24	13.54±0.01	13.83±0.21	9.55±0.19	7.27±0.07	5400	4600
A279/0004L	10.50±0.24	1.17±0.01	8.86±0.32	17.20±0.46	4.37±0.00	5.36±0.09	2800	2600
A316/0460-1	11.68±0.23	11.98±0.06	8.44±0.12	16.13±0.42	--	--	4300	--
A316/0460-2	11.40±0.76	12.00±0.27	11.17±0.26	12.02±0.29	--	--	5400	--
A316/0460-3	2.50±0.03	4.83±0.08	2.54±0.05	4.22±0.28	--	--	2400	--
A316/0665-1	4.97±0.26	7.32±0.14	8.64±0.10	6.88±0.14	--	--	2900	--
A316/0665-2	6.80±0.04	6.60±0.36	7.48±0.07	8.24±0.24	--	--	3100	--
A316/0665-3	8.86±0.27	10.57±0.29	8.43±0.18	12.66±0.72	--	--	6400	--
A338/0124-1	8.58±0.05	12.12±0.37	10.76±0.33	10.54±0.14	--	--	3800	--
A338/0124-2	9.10±0.26	12.07±0.12	11.78±0.17	12.86±0.39	--	--	4000	--
A338/0124-3	8.84±0.24	9.49±0.15	11.79±0.44	11.31±0.10	--	--	6600	--
A338/0136-1	--	--	--	17.84±0.08	--	--	6500*	--
A338/0136-2	--	--	--	12.65±0.38	--	--	4800*	--
A338/0136-3	--	--	--	12.84±0.30	--	--	8600*	--
A230/0734	11.55±0.58	0.43±0.02	3.24±0.29	14.90±0.89	3.93±0.20	5.78±0.18	3900	2900
A334/0677	8.44±0.00	5.60±0.27	6.33±0.07	12.84±0.15	5.50±0.06	7.54±0.08	7500	4500
A254/0031	6.97±0.03	9.76±0.49	10.38±0.32	9.51±0.10	7.52±0.12	9.82±0.48	7400	7000
A306/0156	12.57±0.00	14.76±0.02	11.03±0.12	16.06±0.44	--	--	12200	--
A306/0192	--	--	--	8.18±0.19	--	--	7500*	--

*Total surface area for whole biscuit based on powder sample data

TABLE 5. SPECIFIC SURFACE AREA FOR MOD SAMPLES

Biscuit Number	Bulk Strips*	Powder Sample	Percent Difference
219/0199-1-A	1.5	7.71 ±0.24	80.5
219/0199-1-B	4.1	8.00 ±0.24	48.8
219/0199-2-A	3.2	4.64±0.12	31.0
219/0199-2-B	5.2	5.88±0.38	11.6
A87/0131-1-A	3.4 (3.6)	7.42 ±0.23	54.2
A87/0131-1-B	8.4	9.64 ±0.40	12.9
A87/0131-2-A	2.4 (2.5)	3.80 ±0.12	36.8
A87/0131-2-B	2.5	3.58 ±0.23	30.2
A87/0228-1-B	0.3	0.65 ±0.01	53.8
A87/0228-2-A	1.8 (1.1)	2.45 ±0.08	26.5
A87/0228-2-B	1.9	1.43 ±0.03	32.9
A87/0345-1-A	3.0 (2.0)	2.60 ±0.14	-15.4
A87/0345-1-B	1.3	4.01 ±0.20	67.6
A87/0345-2-A	1.6 (1.2)	3.27 ±0.14	51.1
A87/0345-2-B	1.2	4.46 ±0.11	73.1
A87/0479-1-A	1.3 (4.1)	5.31 ±0.20	75.5
A87/0479-1-B	3.6	6.50 ±0.35	44.6
A87/0479-2-A	3.3 (3.3)	2.62±0.02	-26.0
A87/0479-2-B	2.8	3.77±0.10	25.7

* - value in parenthesis for front face sample
219/0199 from Work Assignment No. 9, EPA Contract 68-03-3192
A87/0131 from Work Assignment No. 31, EPA Contract 68-03-3162
A87/0228 from Work Assignment No. 21, EPA Contract 68-03-3162
A87/0345 from Work Assignment No. 21, EPA Contract 68-03-3162
A87/0479 from Work Assignment No. 26, EPA Contract 68-03-3162

TABLE 6. ALUMINA CRYSTAL STRUCTURE AND OTHER CRYSTALLINE STRUCTURE FOUND

Biscuit Number	Front Face, UR1	Middle Outer Edge, UR2	Rear Face, UR3
A249/0486-1	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2
A249/0486-2	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2
A249/0486-3-A	mostly gamma/delta alumina with CeO_2 and possible $Ni\ Al_2\ O_4$	mostly gamma/delta alumina with CeO_2 and possible $Ni\ Al_2\ O_4$	mostly gamma/delta alumina with CeO_2 and possible $Ni\ Al_2\ O_4$
A249/0486-3-B	mostly gamma/delta alumina		
A280/0004L-A	mostly theta alumina with CeO_2 or ZnS and possible $AlPO_4$	mostly theta alumina with $Ce0_2$	mostly theta alumina with CeO_2
A280/0004L-B	mostly theta alumina		
A280/0006L-A	mostly theta alumina with CeO_2 or ZnS	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2
A280/0006L-B	mostly gamma alumina		
A317/0196-A	mostly gamma/theta alumina with CeO_2 or ZnS, possible $AlPO_4$	mostly gamma/theta alumina with CeO_2	mostly gamma/theta alumina with CeO_2
A317/0196-B	mostly intermediate alumina with CeO_2		
A317/1115-A	mostly gamma/theta alumina with CeO_2 and $(Al, Fe)\ (PO_3)_3$	mostly gamma/theta alumina with CeO_2	mostly gamma/theta alumina with CeO_2
A317/1115-B	mostly gamma/theta alumina with CeO_2		
A317/1151-A	mostly gamma/theta alumina with CeO_2 and $AlPO_4$	mostly gamma/theta alumina with CeO_2	mostly gamma/theta alumina with CeO_2
A317/1151-B	mostly gamma/theta alumina with CeO_2		

TABLE 6. (CONT'D) ALUMINA CRYSTAL STRUCTURE AND OTHER CRYSTALLINE STRUCTURE FOUND

Biscuit Number	Front Face, UR1	Middle Outer Edge, UR2	Rear Face, UR3
A337/0151-A	mostly alpha with some gamma/ theta alumina and CeO_2	mostly alpha with some gamma/ theta alumina and CeO_2	mostly alpha with some gamma/ theta alumina and CeO_2
A337/0151-B	mostly alpha with some gamma/ theta alumina and CeO_2		
A337/0227-A	mostly alpha with some gamma/ theta alumina and CeO_2	mostly alpha with some gamma/ theta alumina and CeO_2	mostly alpha with some gamma/ theta alumina and CeO_2
A337/0227-B	mostly alpha with some gamma/ theta alumina and CeO_2		
A279/0002L-A	mostly gamma alumina with NiO and CeO_2 or ZnS, possible $NiAl_2O_4$, metallic Ni, and $AlPO_4$	mostly gamma alumina with NiO and CeO_2, possible $NiAl_2O_4$ $NiAl_2O_4$	mostly gamma alumina with NiO and CeO_2, possible $NiAl_2O_4$ and metallic nickel
A279/0002L-B	mostly gamma alumina with CeO_2		
A279/0003L-A	mostly gamma alumina with NiO and CeO_2 or ZnS, possible $NiAl_2O_4$ and $AlPO_4$	mostly gamma alumina with NiO CeO_2, possible $NiAl_2O_4$	mostly gamma alumina with NiO and CeO_2, possible $NiAl_2O_4$
A279/0003L-B	mostly gamma alumina with CeO_2		
A279/0004L-A	mostly theta with some alpha alumina, possible NiO	mostly alpha with trace of theta alumina, possible NiO, metallic Ni and $AlPO_4$	mostly alpha with possible trace of theta alumina, possible NiO, metallic Ni, and $AlPO_4$
A279/0004L-B	mostly alpha with trace of theta alumina and CeO_2		
A316/0460-1	50% alpha and 50% theta alumina with CeO_2 or ZnS, and NiO	50% alpha and 50% theta alumina with CeO_2 and NiO	50% alpha and 50% theta alumina with CeO_2 and NiO

TABLE 6. (CONT'D) ALUMINA CRYSTAL STRUCTURE AND OTHER CRYSTALLINE STRUCTURE FOUND

Biscuit Number	Front Face, UR1	Middle Outer Edge, UR2	Rear Face, UR3
A316/0460-2	mostly alpha alumina with CeO_2 or ZnS and NiO, possible trace of theta alumina	50% alpha and 50% theta alumina with CeO_2 and NiO	50% alpha and 50% theta alumina with CeO_2 and NiO
A316/0460-3	mostly theta alumina with CeO_2 or ZnS	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2
A316/0665-1	mostly alpha alumina with CeO_2 and $NiAl_2O_4$, possible trace of $Zn(PO_3)_2$	mostly alpha alumina with CeO_2 and $NiAl_2O_4$ possible trace of $Zn(PO_3)_2$	mostly alpha alumina with CeO_2 and $NiAl_2O_4$,
A316/0665-2	mostly alpha alumina with CeO_2 and $NiAl_2O_4$, possible $AlPO_4$ and $Zn(PO_3)_2$	mostly alpha alumina with CeO_2 and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and $NiAl_2O_4$, possible $Zn(PO_3)_2$
A316/0665-3	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2
A338/0124-1	mostly alpha alumina with possible trace of theta alumina, NiO and $NiAl_2O_4$	mostly alpha alumina with possible trace of theta alumina, NiO, and $NiAl_2O_4$	mostly alpha alumina with possible trace of theta alumina, NiO, and $NiAl_2O_4$
A338/0124-2	mostly alpha alumina with possible trace of theta alumina, NiO and $NiAl_2O_4$	mostly alpha alumina with possible trace of theta alumina, NiO, and $NiAl_2O_4$	mostly alpha alumina with possible trace of theta alumina, NiO, and $NiAl_2O_4$
A338/0124-3	mostly theta alumina with CeO_2 and possible trace of $NiAl_2O_4$	mostly theta alumina with CeO_2 and possible trace of $NiAl_2O_4$	mostly theta alumina with CeO_2 and possible trace of $NiAl_2O_4$
A338/0136-1	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$
A338/0136-2	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$

TABLE 6. (CONT'D) ALUMINA CRYSTAL STRUCTURE AND OTHER CRYSTALLINE STRUCTURE FOUND

Biscuit Number	Front Face, UR1	Middle Outer Edge, UR2	Rear Face, UR3
A338/0136-3	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$	mostly alpha alumina with CeO_2 and NiO, possible trace of theta alumina and $NiAl_2O_4$
A334/0677-A	no alumina, mostly $PbSO_4$	intermediate alumina, mostly $PbSO_4$	intermediate alumina, mostly $PbSO_4$
A334/0677-B	intermediate alumina, mostly $PbSO_4$		
A254/0031-A	mostly gamma/theta alumina with CeO_2 or ZnS	mostly gamma/theta alumina with CeO_2, possible trace of alpha alumina	mostly gamma/theta alumina with CeO_2, possible trace of alpha alumina
A254/0031-B	mostly gamma/theta alumina with CeO_2 and possible trace of alpha alumina		
A254/0275-A	mostly gamma/theta alumina with CeO_2 or ZnS and possible trace of alpha alumina	mostly gamma/theta alumina with CeO_2, possible trace of alpha alumina	mostly gamma/theta alumina with CeO_2, possible trace of alpha alumina
A254/0275-B	mostly gamma/theta alumina with CeO_2 and possible trace of alpha alumina		
A306/0156	mostly gamma alumina with CeO_2 or ZnS	mostly gamma alumina with CeO_2	mostly gamma alumina with CeO_2
A306/0192	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2	mostly theta alumina with CeO_2

utilized protons to "knock" electrons from the inner orbital shells. The electron removal causes the element to fluoresce X-rays at characteristic wavelengths. These fluoresced X-rays are detected, and they represent the quantity of each element present in the sample.

The elements of concern were phosphorus (P), sulfur (S), calcium (Ca), manganese (Mn), zinc (Zn), lead (Pb), platinum (Pt), palladium (Pd), rhodium (Rh), and nickel (Ni). The elements P, S, Ca, Mn, Zn, and Pb are poisons or contaminants. They are derived from engine wear, dirt deposits, oil, fuel, and other sources. The noble metals are Pt, Pd, and Rh, and they perform the function of "cleaning up" the exhaust. Nickel was found in some converters, and is reportedly present to enhance the catalytic activity. Aluminum (Al), silicon (Si), and magnesium (Mg) are major constituents of the support material, and were not quantitatively determined. The minor constituents such as sodium (Na), potassium (K), titanium (Ti), iron (Fe), cerium (Ce), and barium (Ba) were also not quantified. The elements Na, K, and Ti are present in small amounts from the clays used to make the cordierite ceramic. Titanium is also probably present in the converters as a whitening agent for the ceramic substrate. Cerium was added to inhibit the conversion of gamma-alumina with a higher surface area to alpha alumina with a lower surface area at the elevated temperatures experienced within the converters, and also to increase the catalytic activity of the converter when present in concentrations of one percent or more. Iron was probably from the engine, as a wear product, the exhaust system due to rust, or as an impurity in the ceramic substrate. Barium was also found in some of the samples.

The samples were prepared by grinding the entire pieces to a coarse powder (approximately 50 mesh). Approximately 10 grams of the coarse powder were taken and ground in its entirety to a very fine powder (400 mesh). The analysis was conducted by Dr. Sene Bauman, Element Analysis Corporation. Matrix corrections and data analysis were performed at Elemental Analysis Corporation and reviewed by SwRI.

The weight percentages of each element are included in Table 7. Where the concentration of an element was at the detection limit of the analytical procedure, the word "trace" was used, and an asterisk (*) was used to identify those elements with concentrations below the detection limit. Table 7 also includes the other elements found in each sample which were not quantified.

H. Scanning Electron Microscopy

Samples from the front face of each converter and a sample from the rear face of one converter for each engine family were examined by SEM. Each sample was mounted on an aluminum stud and coated with a thin layer of carbon, followed by a thin layer of gold. The purpose of this coating is to ground the sample and reduce the effects of surface charging which decrease the surface resolution. A spectrum and the surface topography was recorded for each sample at 2500X and a voltage of 24 KeV. The twelve converters from Work Assignment No. 8 and several samples with silicon-to-aluminum ratios greater than 2 were also evaluated at a voltage of 30 KeV. The surface concentrations for silicon, phosphorus, sulfur, lead, calcium, manganese, and zinc from the spectra were normalized to the aluminum concentration. The results are presented in Table 8. The actual spectra and the representation of the surface are included in Appendix D.

TABLE 7. ELEMENTAL ANALYSIS OF NOBLE METALS AND POISONS BY PIXE

Biscuit Number	Sample Location	Weight Percent of Element										
		P	S	Ca	Mn	Ni	Zn	Rh	Pd	Pt	Pb	Others
A221/0198-A	LL1	1.33±0.05	0.17±0.03	0.12±0.01	0.01±0.002	0.01±0 0004	0.24±0.001	0.01±0.003	*	0.09±0.01	0.45±0.003	Na,Mg,Al,K,Ti,Fe,Ce
	LL2	0.16±0.05	0.15±0.02	0.06±0.01	trace	trace	0.02±0.0002	0.01±0.002	*	0.07±0.002	0.04±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	*	0.24±0.02	0.09±0.02	*	0.01±0.0003	0.04±0.0004	0.01±0.003	*	0.10±0.003	0.02±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A249/0486-1	LL1	0.60±0.04	0.06±0.03	0.09±0.01	0.03±0.002	0.01±0.0004	0.13±0.0005	0.01±0 005	*	0.15±0.005	0.20±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.10±0.04	*	0.07±0.01	0.01±0.001	trace	0.02±0.0002	0.02±0.002	*	0.15±0.003	0.07±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	trace	*	0.06±0.02	trace	trace	0.01±0.0002	0.02±0.003	*	0.14±0.002	0.03±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A249/0486-2	LL1	0.99±0.04	0.10±0.03	0.11±0.01	0.06±0.003	0.03±0.0004	0.26±0.001	0.03±0.005	*	0.22±0.01	0.67±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.53±0.04	0.06±0.02	0.09±0.01	0.02±0.003	0 01±0.0004	0.08±0.0004	0.09±0.005	*	0.59±0.005	0.21±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.13±0.04	0.08±0.02	0.07±0.01	trace	0.01±0.0003	0.02±0.0003	0.03±0.004	*	0.24±0.003	0.05±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A249/0486-3-A	LL1	0.20±0.04	0.57±0.03	0.13±0.01	0.01±0.003	0.01±0.0004	0.10±0.0005	0 06±0.005	*	0.36±0.005	0.32±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	*	0.32±0.02	0.10±0.01	0.01±0 002	0.01±0.0003	0.03±0.0003	0.05±0.003	*	0.31±0.003	0.07±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	*	0.32±0.02	0.14±0.01	0.01±0.002	0.01±0.0003	0.03±0.0003	0.05±0.003	*	0.33±0.003	0.04±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A249/0486-3-B	LL	*	0 28±0.02	0 08±0.01	0.01±0 001	trace	0.01±0.0002	*	0.49±0.0005	*	0.01±0.001	Na,Mg,Al,Si,K,Ti,Fe
A280/0004L-A	LL1	1 55±0.05	0.09±0.04	0 22±0.02	0.02±0 003	0.01±0.0005	0.43±0.001	0.01±0.004	*	0.10±0.01	0.68±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.23±0.05	0.04±0.02	0.08±0.01	0.01±0.001	trace	0.05±0.0003	0.01±0.002	*	0.08±0.003	0.05±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.12±0.05	0.09±0.03	0.08±0.02	*	trace	0.04±0.0003	0.01±0.003	*	0.14±0.003	0.03±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A280/0004L-B	LL	0.07±0 05	0.12±0.02	0 08±0.01	0.01±0.0005	trace	0.05±0.0003	*	0.17±0.005	*	0.14±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A280/0006L-A	LL1	2.03±0.04	0.24±0.04	0.20±0.02	0.03±0.004	0.02±0.0005	0.52±0.001	0.01±0.005	*	0.14±0.01	0.50±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.29±0.05	0.07±0.02	0.05±0 01	0.01±0.001	0 01±0.0002	0.04±0.0003	0.01±0.002	*	0.06±0.003	0.04±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.10±0.05	0.16±0.02	0 06±0.02	*	trace	0.04±0.0004	0.01±0.003	*	0.08±0.003	0.02±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A280/0006L-B	LL	0.09±0.05	0.18±0.03	0.08±0.01	0.01±0.001	trace	0.05±0.0002	*	0.17±0 003	trace	0.14±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A317/0196-A	LL1	1.22±0.05	0.17±0.03	0.26±0.01	0.04±0.003	0.01±0.0004	0.44±0.001	0.02±0 005	*	0.12±0.01	0.50±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.26±0.05	0.10±0.03	0.09±0.01	0 01±0.001	0.01±0.0002	0 02±0.0002	0 01±0.001	*	0.04±0.002	0.06±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.23±0.05	0.21±0.03	0.10±0.01	0.01±0.002	0.01±0.0003	0.05±0.0004	0 01±0.003	*	0.11±0.003	0.09±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A317/0196-B	LL	0.15±0 05	0.20±0.04	0.10±0.02	trace	trace	0.03±0.0003	0.01±0.003	*	0.10±0.002	0.05±0.002	Na,Mg,Al,Si,Ti,Fe,Ba,Ce
A317/1115-A	LL1	1.80±0.04	0.20±0.03	0.20±0 01	0.18±0.003	0.02±0.0004	0.82±0.01	0.01±0.004	*	0.16±0.01	0.71±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	1.09±0.04	0.18±0.03	0.11±0 02	0.08±0.004	0.01±0.0004	0.19±0.001	0.03±0.005	*	0.17±0.01	0.28±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.25±0.04	0.13±0.02	0.08±0.01	0.03±0.002	trace	0.06±0.0003	0.02±0 003	*	0 12±0.003	0.12±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A317/1115-B	LL	0.10±0.05	0.09±0.03	0.06±0 01	0.01±0.002	trace	0.02±0.0002	0.01±0.002	*	0.06±0.002	0.06±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A317/1151-A	LL1	1.29±0.04	0.17±0.02	0.11±0.01	0.02±0.003	0.01±0 0004	0.37±0.001	0.01±0 004	trace	0.10±0.01	0.31±0 003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	2.41±0.03	0.39±0.03	0 11±0.02	0 02±0.003	0.01±0.0004	0.29±0.001	0.05±0 004	trace	0.28±0.01	0.31±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.32±0.04	0 24±0.02	0.08±0.01	*	0.01±0.0003	0 03±0.0004	0 01±0 003	*	0.10±0.003	0 04±0.002	Na,Mg,Al,Si,K,Ti,Fe
A317/1151-B	LL	0.21±0.05	0 02±0.03	0.08±0.01	trace	trace	0.03±0 0003	0 01±0 002	*	0.08±0.002	0.04±0.001	Na,Mg,Al,Si,Ti,Fe,Ce
A337/0151-A	LL1	0 07±0.05	0.31±0.02	0.05±0.01	*	0.01±0.0003	0 01±0.0002	0 01±0.002	*	0 08±0.002	0.01±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.20±0.04	0 66±0.02	0.06±0 02	*	0.02±0.0004	0.05±0.0005	0.03±0.004	*	0 21±0.004	0.07±0 002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.30±0.03	0 47±0.02	0 08±0 02	0 01±0.003	0 01±0.0003	0.09±0.0004	0 02±0 002	*	0 13±0.004	0.09±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A337/0151-B	LL	0.07±0 05	0 45±0.03	0 05±0 02	*	0 01±0 0003	0 01±0.0002	0.01±0 003	*	0 09±0.002	0.01±0.001	Na,Mg,Al,Si,Ti,Fe,Ba,Ce

TABLE 7 (CONT'D). ELEMENTAL ANALYSIS OF NOBLE METALS AND POISONS BY PIXE

Biscuit Number	Sample Location	Weight Percent of Element										
		P	S	Ca	Mn	Ni	Zn	Rh	Pd	Pt	Pb	Others
A337/0227-A	LL1	0.36±0.04	0.36±0.02	0.06±0.01	trace	0.01±0.0003	0.08±0.0004	0.02±0.003	*	0.13±0.003	0.08±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.17±0.04	0.34±0.02	0.04±0.01	*	0.01±0.0003	0.02±0.0003	0.02±0.003	*	0.12±0.002	0.03±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.09±0.05	0.31±0.02	0.04±0 02	*	0.01±0.0003	0.01±0.0002	0.02±0.002	*	0.12±0.002	0.02±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A337/0227-B	LL	0.07±0.05	0.31±0.03	0 05±0.02	*	0 01±0.0002	0.01±0.0002	0.02±0.002	*	0.10±0.002	0.01±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A279/0002L-A	LL1	1.56±0.05	0.46±0.03	0.08±0.01	0.11±0.003	1.74±0.001	0.30±0.001	0.02±0.005	*	0.09±0.01	0.29±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.42±0.04	0.24±0.02	0.05±0 01	0.02±0.002	1.28±0.001	0.04±0.001	0.01±0.003	trace	0.08±0.004	0.05±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.21±0.04	0.33±0.02	0.05±0.01	0.02±0.003	2.01±0.001	0.03±0.001	0.02±0.01	*	0.10±0.005	0.05±0.0003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A279/0002L-B	LL	0.11±0.04	0.21±0.02	0.04±0.01	0.02±0.001	0.02±0.0002	0.03±0.0002	*	0.05±0.002	0.07±0.002	0.02±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A279/0003L-A	LL1	1.40±0.05	0.27±0.03	0.11±0 01	0.36±0.003	1.18±0.001	0.26±0.001	0 02±0.004	*	0.08±0.01	0.50±0.005	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	1.01±0.03	0.79±0.02	0.07±0 01	0.23±0.01	4.83±0.002	0.14±0.003	0.05±0.01	0.02±0.004	0.24±0.01	0.23±0.005	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.24±0.05	0.43±0.03	0 06±0.01	0.06±0 003	1.96±0.001	0.03±0.001	0.02±0.01	*	0.12±0.005	0.18±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A279/0003L-B	LL	0.10±0.04	0.21±0.03	0.07±0.01	0.06±0.002	0.03±0.0003	0.04±0.0003	*	0.07±0.003	0.10±0.003	0.09±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A279/0004L-A	LL1	0 96±0.05	0.29±0.03	0.06±0.01	0.03±0.002	1.21±0.001	0.17±0.001	0.02±0.005	*	0.08±0.01	0.43±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.25±0.04	0.13±0.02	0.03±0.01	0.01±0.003	1 80±0.001	0.01±0.001	0.02±0.004	*	0.09±0.003	0.03±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.15±0 04	0.25±0.02	0.02±0.01	trace	1 61±0.001	0.01±0.001	0 02±0.004	*	0.09±0.003	0.01±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A279/0004L-B	LL	*	0.08±0.02	0.04±0 01	trace	0.02±0.0002	0.02±0.0002	*	0.03±0.002	0.04±0.003	0.03±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A316/0460-1	LL1	1.00±0.05	0.18±0.03	0.09±0.01	0.02±0.003	1.69±0.001	0.33±0.001	0.02±0.01	*	0.10±0.01	0.42±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.90±0.04	0.28±0.02	0.07±0.01	0.01±0.004	2.30±0.001	0.06±0.001	0.03±0.01	trace	0.11±0.01	0.13±0.005	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.43±0.03	0.27±0.01	0 05±0.01	0.01±0 002	1.27±0.001	0.04±0.001	0.02±0.004	trace	0.10±0.004	0.06±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A316/0460-2	LL1	1.07±0.04	0.15±0.03	0.05±0.01	0.03±0.003	1.56±0.001	0.26±0.001	0.03±0.01	*	0.10±0.01	0.48±0.005	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0 58±0.04	0.20±0.02	0.04±0.01	0.01±0.003	1.80±0 001	0.04±0.001	0.02±0.005	*	0.10±0.005	0.09±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0 21±0.04	0.32±0.02	0.05±0.01	trace	2 14±0 001	0.03±0.001	0.03±0.005	0.01±0.004	0.12±0.005	0.04±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A316/0460-3	LL1	0.56±0.04	0.56±0.03	0.15±0.01	0.03±0.001	0.03±0.0003	0.24±0.0003	*	0.05±0 003	0.08±0.005	0.23±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.18±0.04	0.22±0.02	0 05±0.01	0.01±0.001	0.02±0.0003	0 04±0.0003	*	0.06±0.003	0.09±0.003	0.04±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.04±0.04	0.07±0.03	0 05±0.01	0.01±0.001	0.01±0.0002	0.03±0.0002	*	0.03±0 002	0.05±0.002	0.02±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A316/0665-1	LL1	1.37±0.04	0.10±0.02	0.09±0.01	0.05±0 003	1.54±0 001	0.28±0 001	0.02±0.005	*	0.09±0.01	0.23±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0 71±0.03	0.20±0.02	0.05±0.01	0 02±0.005	4 22±0.002	0.09±0.002	0.03±0.01	0.01±0.003	0.16±0.01	0.03±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.15±0.002	0.16±0.02	0 04±0.01	0 01±0.004	2.33±0.001	0.01±0.002	0.02±0.01	0.01±0.005	0.12±0.01	0.02±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A316/0665-2	LL1	1.26±0.03	0.11±0.02	0 09±0.01	0.07±0.003	1.32±0.001	0.38±0 001	0 02±0 004	*	0.09±0.01	0.36±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.86±0.03	0.17±0.02	0.07±0 01	0.03±0.005	3.49±0 001	0.10±0.002	0.03±0.01	trace	0.15±0.01	0.04±0 003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0 19±0.03	0.16±0.02	0 06±0.01	0.01±0 004	2.38±0.001	0.04±0 001	0 03±0.01	0 01±0.004	0.13±0.005	0.01±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A316/0665-3	LL1	0.39±0 04	0.20±0.02	0.10±0.01	0 03±0.002	0 04±0.0004	0 22±0.001	0 01±0 003	0 05±0 004	0 10±0.01	0.17±0 002	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.18±0.03	0.20±0.02	0 12±0.01	0 01±0.002	0.05±0 0003	0.12±0 0004	*	0 11±0 001	0 21±0 004	0.24±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	*	trace	0.08±0 01	0 01±0 001	0.02±0 0002	0.04±0 0002	*	0.04±0 002	0 07±0.002	0.05±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A338/0124-1	LL1	0 76±0.04	0.11±0.03	0.06±0 01	0 02±0.002	0.93±0.001	0.06±0 001	0.02±0.004	*	0.07±0.005	0.10±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.36±0.04	0.31±0.03	0.04±0.02	*	2.75±0.001	0.02±0 001	0 03±0.01	*	0 14±0.005	0.03±0 003	Na,Mg,Al,Si,Ti,Fe,Ba,Ce
	LL3	0 09±0.05	0.29±0.02	0.03±0.02	*	1 53±0.001	trace	0 02±0 004	*	0 08±0.003	0 01±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce

TABLE 7 (CONT'D). ELEMENTAL ANALYSIS OF NOBLE METALS AND POISONS BY PIXE

Biscuit Number	Sample Location	Weight Percent of Element										
		P	S	Ca	Mn	Ni	Zn	Rh	Pd	Pt	Pb	Others
A338/0124-2	LL1	0 99±0.04	0.21±0.03	0.07±0.02	0.02±0 003	1.40±0.001	0.13±0.001	0.01±0.01	*	0.09±0.01	0.09±0.002	Na,Mg,Al,Si,K,Ti,Fe
	LL2	0 33±0.03	0.36±0.02	0.04±0.02	*	4.02±0.002	0.05±0.002	0.03±0.01	*	0.19±0.01	0.03±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.09±0.04	0.28±0.03	0.04±0.02	*	1.58±0.001	0.02±0.001	0.02±0.005	*	0.08±0.004	0.01±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A338/0124-3	LL1	0.19±0.05	0.29±0.03	0.10±0.02	0.01±0.001	0.07±0.0003	0.06±0.0003	trace	0.03±0.002	0.07±0.003	0.06±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.11±0.05	0.34±0.02	0.06±0.02	*	0.03±0.0003	0.02±0.0003	0.01±0 003	0.06±0.004	0.18±0.003	0.05±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.06±0.03	0.10±0.01	0.03±0.01	trace	0.02±0.002	0.01±0.0002	trace	0.06±0.001	0.11±0.001	0.01±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
A230/0734-A	LL1	1.44±0.04	0.18±0.03	0.16±0.02	0.02±0.002	0.02±0.0004	0.29±0.001	0.01±0 004	0.05±0.003	0.11±0.01	0.39±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.52±0.04	0.09±0.02	0.09±0.01	0.01±0.003	0.01±0.0005	0.06±0.001	0.02±0.005	0.06±0.01	0.14±0.005	0.06±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.12±0.04	0.13±0.02	0.08±0.02	*	0.01±0.0005	0.02±0.0005	0 01±0.004	0.06±0.01	0.13±0.003	0.01±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A230/0734-B	LL	0.14±0.04	0.17±0.02	0.10±0.02	*	0.01±0.0004	0.03±0.0004	0.03±0.001	0.09±0.004	0.20±0.003	0.01±0.002	Na,Mg,Al,Si,Ti,Fe,Ce
A254/0031-A	LL1	2.37±0.05	0.55±0.04	0.17±0.02	0.12±0.01	0.02±0.001	0.49±0.001	0.04±0.01	*	0.31±0.01	1.84±0.01	Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.93±0.04	2.20±0.03	0.08±0.02	*	trace	0 09±0.001	0 05±0.01	*	0.52±0.01	0.55±0.01	Na,Mg,Al,Si,K,Fe,Ba,Ce
	LL3	0.15±0.05	1.54±0.03	0.08±0.02	*	trace	0.04±0.001	0.03±0.01	*	0.32±0.01	0.11±0.003	Na,Mg,Al,Si,K,Fe,Ba,Ce
A254/0031-B	LL	*	0.90±0.04	0.06±0.02	0.21±0.001	trace	0.01±0.0003	0.01±0.003	*	0.15±0.002	0.03±0.01	Na,Mg,Al,Si,K,Ti,Ba,Ce
A254/0275-A	LL1	2.49±0.05	0.78±0.04	0.13±0.02	*	0.01±0.001	0.33±0.001	0.03±0.01	*	0.25±0.01	1.39±0.005	Na,Mg,Al,Si,K,Ti,Ba,Ce
	LL2	0.60±0.05	1.35±0.03	0.08±0.02	*	trace	0.05±0.0005	0.02±0.004	trace	0 26±0.005	0.27±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.13±0.05	1.81±0.03	0.08±0.02	*	trace	0.04±0.0005	0.03±0.005	trace	0.26±0.004	0.09±0.002	Na,Mg,Al,Si,K,Fe,Ba,Ce
A254/0275-B	LL	0.13±0.05	1.87±0.03	0.08±0.02	*	trace	0.02±0.0004	0.03±0.005	*	0.20±0.004	0.05±0.002	Na,Mg,Al,Ti,Fe,Ba,Ce
A306/0156	LL1	1.15±0.04	0.17±0.03	0 10±0.01	0.04±0.002	0.69±0.001	0.27±0.001	0.04±0 004	*	0.19±0.01	0.65±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.41±0.04	0.25±0.03	0.05±0.02	0.01±0.002	1.08±0.001	trace	0 06±0.004	*	0.30±0.004	0.11±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL3	0.13±0.04	0.09±0.03	0.04±0 01	trace	0.56±0.0005	0.02±0 0005	0 03±0.004	*	0.15±0.003	0.04±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A306/0192	LL1	0.72±0.03	0.15±0.03	0.12±0 01	0.03±0.003	0.12±0.0005	0.15±0.001	0.03±0.004	*	0.18±0.01	0.49±0.003	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	0.22±0.04	0.33±0.03	0.13±0.02	*	0.35±0.001	0.03±0.001	0.11±0.01	trace	0.56±0.01	0.12±0.004	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL3	0.10±0 04	0.12±0.02	0.06±0.02	*	0.13±0.0005	0.01±0.0004	0.03±0.005	*	0.17±0.003	0.02±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ce
A338/0136-1	LL1	0.26±0.04	0.27±0.02	0.06±0.01	0 01±0.003	1.74±0.001	0.04±0.001	0.03±0.003	*	0.12±0.005	0.05±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.11±0 04	0.45±0.03	0.03±0.01	*	4.04±0.002	0 01±0.002	0.04±0.01	0 01±0.004	0.22±0.005	0.03±0.003	Na,Mg,Al,Si,Ti,Fe,Ba,Ce
	LL3	0.09±0.04	0.19±0.02	0 04±0.01	*	1.01±0.001	trace	0 01±0.004	*	0.08±0.002	0.01±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A338/0136-2	LL1	0.37±0.03	0.21±0.02	0.05±0.01	0 01±0.02	1.45±0.001	0 06±0.001	0 02±0.003	*	0.10±0.003	0.05±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
	LL2	0.15±0.03	0.41±0.02	0.04±0.02	*	4.02±0.002	0.02±0.02	0.05±0.01	trace	0.21±0.01	0.02±0.004	Na,Mg,Al,Si,Ti,Fe,Ba,Ce
	LL3	0.07±0.03	0.27±0.02	0 04±0.01	*	2.10±0.001	0.01±0.001	0.02±0.004	*	0 12±0 003	0.01±0.002	Na,Mg,Al,Si,K,Ti,Fe,Ba,Ce
A338/0136-3	LL1	0.09±0 04	0.23±0.02	0 07±0.01	0 01±0.001	0.05±0.0002	0.03±0.0003	trace	0.08±0.002	0.15±0.002	0.05±0.001	Na,Mg,Al,Si,K,Ti,Fe,Ce
	LL2	*	0.22±0 03	0 05±0.01	*	0.04±0.0003	0.01±0.0003	*	0.11±0.001	0.22±0.002	0 02±0.001	Na,Mg,Al,Si,Ti,Fe,Ce
	LL3	*	0.04±0 02	0 04±0.01	trace	0.01±0.0002	trace	*	0.02±0 003	0.04±0 001	trace	Na,Mg,Al,Si,K,Ti,Fe,Ce
A334/0677-A	LL1	1 05±0.05	3 96±0.15	0.11±0.02	0.27±0.01	1.76±0.004	0.38±0 003	*	0.07±0.04	0 22±0 03	29.13±0.01	Mg,Al,Si,Ce,Ti,Fe,Ba,Ce
	LL2	0.22±0.04	0 66±0 08	0 05±0.01	0 09±0 004	1.61±0.002	0.07±0.002	0.03±0 02	0.08±0 02	0.15±0.01	14.83±0.01	Na,Mg,Al,Si,Ti,Fe,Ba,Ce
	LL3	0 13±0.03	0 53±0.07	0 06±0.01	0 08±0 004	1 41±0 002	0.05±0 002	0 02±0 02	0 06±0.02	0 15±0 01	12 42±0 02	Na,Mg,Al,Si,Ti,Fe,Ba,Ce
A334/0677-B	LL	0 19±0.05	1.48±0 08	0 08±0.01	0 11±0 001	trace	0.06±0.001	*	0 08±0 01	0 14±0 01	7.38±0.01	Na,Mg,Al,Si,K,Ti,Ce

TABLE 8. SURFACE ATOMIC PERCENT RATIOS OF ELEMENTS NORMALIZED TO ALUMINUM

Biscuit Number	Normalized Atomic Ratios						
	P	S	Ca	Mn	Pb	Si	Zn
A221/0198	1.69	0.19	0.09	0.02	0.19	2.05	0.31
A221/0198**	1.51	--	0.06	0.02	0.18	1.98	0.19
A221/0310	1.28	0.18	0.05	0.03	0.52	2.89	0.44
A221/0310**	1.68	--	0.03	0.03	0.57	2.63	0.42
A249/0486-1	0.81	0.00	0.02	0.03	0.03	0.10	0.07
A249/0486-2	3.03	0.00	0.20	0.29	0.85	3.36	0.83
A249/0486-3	0.58	0.47	0.17	0.00	0.13	0.14	0.09
A280/0004L	2.06	0.00	0.47	0.05	0.38	3.69	0.24
A280/0005L	3.70	0.00	1.11	0.38	0.16	4.21	1.86
A280/0005L**	3.29	--	0.88	0.30	0.09	3.02	1.36
A280/0006L	1.62	0.00	0.21	0.07	0.04	2.59	0.27
A317/0196	8.32	0.00	1.15	0.36	1.25	4.43	6.10
A317/1115	3.08	0.00	0.42	0.39	0.41	3.43	1.56
A317/1151	13.78	--	5.95	0.64	2.59	5.58	11.12
A317/1151*	0.50	0.04	0.09	0.01	0.03	0.08	0.06
A337/0151	0.62	0.04	0.12	0.03	0.15	1.09	0.36
A337/0227	0.58	0.06	0.07	0.02	0.13	0.95	0.29
A337/0227*	0.02	0.03	--	--	0.01	0.02	--
A240/0007	0.92	0.00	0.03	0.04	0.14	0.12	0.22
A240/0007**	0.89	0.00	0.02	0.03	0.12	0.10	0.17
A240/0270	0.97	0.00	0.02	0.06	0.09	0.52	0.28
A240/0270**	0.90	0.00	0.02	0.04	0.08	0.47	0.19
A279/0002L	1.62	0.06	0.14	0.16	0.17	0.31	0.54
A279/0002L*	0.41	0.03	0.02	0.02	0.02	0.02	0.04
A279/0003L	5.67	--	0.54	2.44	0.92	1.06	1.94
A279/0004L	0.20	0.02	0.005	--	--	0.06	--
A316/0460-1	1.03	0.00	0.09	0.04	0.28	2.29	0.44
A316/0460-1**	0.71	0.00	0.06	0.02	0.19	1.75	0.26
A316/0460-2	10.09	0.00	1.14	0.99	4.10	25.68	9.19
A316/0460-2**	9.65	0.00	0.67	0.45	2.98	20.92	5.77
A316/0460-3	0.77	0.59	0.25	0.01	0.06	0.63	0.10
A316/0665-1	1.38	--	0.08	0.09	0.13	0.49	0.44

TABLE 8 (CONT'D). SURFACE ATOMIC PERCENT RATIOS OF ELEMENTS NORMALIZED TO ALUMINUM

Biscuit Number	Normalized Atomic Ratios						
	P	S	Ca	Mn	Pb	Si	Zn
A316/0665-2	4.06	0.00	0.31	0.32	0.52	2.24	1.33
A316/0665-2**	2.62	0.00	0.20	0.18	0.36	1.55	0.89
A316/0665-3	0.41	0.03	0.06	0.00	0.01	0.07	0.07
A338/0124-1	1.01	0.00	0.09	0.06	0.15	1.46	0.48
A338/0124-2	0.80	0.00	0.10	0.07	0.22	1.67	0.26
A338/0124-3	0.06	0.05	0.02	0.01	0.01	0.07	0.02
A338/0136-1	0.38	0.01	0.06	0.01	0.03	0.22	0.06
A338/0136-2	0.41	0.00	0.05	0.01	0.02	0.30	0.07
A338/0136-3	0.07	0.01	0.00	0.00	0.01	0.06	0.01
A220/0400	1.75	0.08	0.08	0.04	0.84	2.26	0.48
A220/0400**	1.72	0.00	0.07	0.04	0.67	1.93	0.36
A230/0649	0.07	0.01	0.01	--	0.01	0.06	0.01
A230/0649**	0.09	0.01	0.01	--	0.01	0.08	0.00
A230/0734	0.79	0.00	0.09	0.01	0.08	0.32	0.17
A230/0734**	0.72	--	0.07	0.01	0.07	0.27	0.16
A246/0092	0.72	0.00	0.03	0.02	0.07	0.13	0.05
A246/0092**	0.71	0.00	0.02	0.02	0.07	0.20	0.06
A246/0092*	0.05	0.05	0.004	--	--	0.09	--
A246/0092**	0.08	0.03	0.00	0.00	0.01	0.13	0.00
A334/0677	8.53	0.00	--	1.52	18.86	0.98	1.57
A334/0677*	0.08	0.00	--	0.03	0.65	0.37	--
A254/0031	16.44	--	3.12	0.40	7.37	0.22	10.39
A254/0031*	0.20	0.05	0.01	0.00	0.02	0.02	0.01
A254/0037	0.19	0.02	0.01	0.02	0.02	0.03	0.02
A254/0037**	0.16	0.01	0.01	0.01	0.01	0.02	0.02
A254/0191	3.45	0.26	0.21	0.26	1.55	1.01	1.66
A254/0191**	3.43	0.26	0.21	0.26	1.53	1.01	1.64
A254/0275	11.99	0.36	1.25	0.00	3.08	0.24	3.63
A306/0156	1.86	0.61	0.63	0.09	0.04	0.23	0.56
A306/0156*	0.12	0.02	0.01	--	0.01	0.05	0.01
A306/0192	2.47	0.00	0.42	0.17	0.61	0.24	0.72

*Rear Face of A biscuit for comparison within each engine family.
**Ratios at 30 keV

I. Oxygen Sensors

In addition to catalyst evaluations, oxygen sensors were also examined in this work assignment. A total of 5 oxygen sensors were evaluated. A list of oxygen sensors evaluated is presented in Table 9, and a list of evaluations and test parameters is included in Table 10. All "on-engine" tests were compared to a new Ford sensor, which served as a reference.

A leak-down rate chamber was prepared to determine the leakage rate of each of the sensors. The internal volume of the chamber was measured at 3220 ml. A pressure transducer, mounted on one end, was connected to a strip chart recorder. The chamber was pressurized to an internal pressure of 10"Hg, and the leakage rate was determined after 15 minutes. The leakage rate for each sensor is reported in Table 11.

Cold "light-off" times for all the oxygen sensors were determined using exhaust gas from an engine mounted on a dynamometer test stand. The sensors initially started at room temperature and were heated by the exhaust gases to approximately 370°C. The times for the sensors to begin to respond and the exhaust temperatures are presented in Table 12.

The response times of all the sensors were determined at 370°C and 590°C. The response times were measured following an instantaneous switch from a rich to a lean air/fuel ratio and again from lean to rich. The response times for each sensor are recorded in Table 13.

The voltage outputs at various air/fuel ratios with an exhaust temperature of 590°C were also determined. These data are presented in Table 14. The air/fuel ratio was slowly changed from rich to lean in a stepwise manner. The voltage output of each sensor was recorded as a function of the air/fuel ratio. These data can be used to determine the air/fuel ratio at which the sensor will send a signal to the fuel system for a change from rich to lean and conversely.

The specific surface area of each sensor tip was determined with the same technique used for the catalyst samples. The results are included in Table 15. One important note is that the results for surface areas of sensor tips using the multipoint technique are about 4 to 6 times greater than with the singlepoint technique which was used in previous work assignments. The cause of the lower single point values is the result of a negative peak which follows the desorption peak. The negative peak is probably due to the larger thermal mass of the sensor tips. The area under the negative peak was not accounted for in the singlepoint analysis in the previous work assignments and resulted in lower reported values. The plots for the BET equation versus the relative pressure for each sensor tip are included in Appendix E.

The exterior surfaces of the oxygen sensor tips were examined with ESCA. This is a quantitative technique capable of determining the concentration of all elements except hydrogen and helium above about 0.1 atom percent in the sample. The depth of penetration is about 100 angstroms into the sample. Typical elements detected are carbon (C), oxygen (O), aluminum (Al), magnesium (Mg), calcium (Ca), silicon (Si), chlorine (Cl), sulfur (S), phosphorous (P), lead (Pb), nitrogen (N), zinc (Zn), sodium (Na), chromium (Cr), and iron (Fe). The sensor tip consists of a yttrium-impregnated zirconium dioxide ceramic with a thin platinum coating

TABLE 9. LIST OF OXYGEN SENSORS FOR EVALUATION

Sensor Number	Make	Engine Family	Comments
A317/0196	Chrysler	ECR2.2V5FAA8	
A317/1151	Chrysler	ECR2.2V5FAA8	ceramic tip broken
A316/0205	Ford	EFM3.8V5HHF7	electrical lead cut
A334/1502	GM	E6G4.1V5NKA7	
A310/0298			

TABLE 10. O_2 SENSOR EVALUATION

1. Leak-Down Check

   a. Prepare leak-down chamber
   b. Attach O_2 sensor
   c. Pressurize with air to 10" Hg
   d. Monitor the leak-down rate on a strip chart recorder

2. Engine Evaluation

   a. Light-Off

      (1) Mount O_2 sensor onto exhaust generator (370°C)
      (2) Warm engine to set temperature and switch exhaust to sensor
      (3) Determine "light-off" time by recording the sensor voltage

   b. Voltage Output

      (1) Monitor voltage output on strip chart as A/F ratio stepwise changes from 14 to 16 at 370°C
      (2) Repeat at another exhaust temperature (590°C)

   c. Repsonse Time

      (1) Measure response time for instananeous shifts in A/F ratio from 14 to 16 and then 16 to 14 (change from 300 millivolts to 600 millivolts) at 370°C.
      (2) Repeat at another exhaust temperature (590°C).

3. Laboratory Analysis

   a. Disassemble
   b. Conduct surface area analysis
   c. Submit for ESCA of exterior metals and poisons

TABLE 11. LEAKAGE RATE FOR OXYGEN SENSORS

Sensor Number	Temperature. °F		Pressure, "Hg		Leakage Rate SCIM*
	Initial	Final	Initial	Final	
A317/0196	78	77	9.70	9.44	0.11
A317/1151	75	75	10.18	0.00	66
A316/0205	77	77	9.91	9.87	0.01
A310/0298	77	77	10.03	9.98	0.02
A334/1502	77	77	10.18	10.15	0.01

*SCIM - Standard cubic inches per minute

TABLE 12. O_2 SENSOR EVALUATION - LIGHT-OFF TIMES AT 370°C

Sensor Number	A/F Ratio	Final Voltage, mV	Temperature, °F		Light-Off Times, Sec.	
			Initial*	Final**	Initial*	Final**
A310/0298	13.62	700	601	702	35	364
A316/0205	13.72	770	554	676	18	236
A317/0196	13.62	353	582	694	25	424
A317/1157	13.62	--[c]	550	--	18	--
A334/1502	13.72	710	558	671	20	218
Reference[a]	13.72	910	550	670	18	211
Reference[b]	13.62	910	572	680	22	205

*Initial temperature is temperature where sensor begins to respond.
Initial time is time when sensor begins to respond.
**Final temperature is temperature where sensor reached 90% of final response.
Final time is time to reach 90% of final response
[a]Test with sensors A316/0205, A317/1157, and A334/1502
[b]Test with sensors A310/0298 and A317/0196
[c]Achieved a maximum voltage of 280 mV and then stopped working at 435 seconds

TABLE 13. O_2 SENSOR EVALUATION - RESPONSE TIME AT 370°C

Sensor Number	Response Time to Maximum Response, sec.				Response Time for 600-200 mV, sec. Voltages				Limiting Voltages, mV	
	Test 1		Test 2		Test 1		Test 2			
	Rich to Lean	Lean to Rich	Rich to Lean	Lean to Rich	Rich to Lean	Lean to Rich	Rich to Lean	Lean to Rich	Rich	Lean
				Response Time at 370°C						
A310/0298	154	72	170	74	24	36	21	38	864	40
A316/0205	4	2	3	1	0.5	1	0.2	0.5	737	72
A317/0196	50	1	45	1	3	0.2	2	0.2	651	115
A317/1157	--	--	--	--	--	--	--	--	--	--
A334/1502	1	2	2	2	0.5	1	0.2	0.8	670	28
Reference 1[a]	13	1	8	1	1	0.2	1	0.2	927	73
Reference 2[b]	17	0.5	15	1	1	0.2	1	0.2	917	29
				Response Time at 590°C						
A310/0298	65	98	69	104	10	48	10	47	602	37
A316/0205	5	2	5	2	0.5	0.5	0.5	0.5	885	42
A317/0196	5	2	5	3	NA	NA	NA	NA	79	12
A317/1157	--	--	--	--	--	--	--	--	--	--
A334/1502	0.8	1	1	2	0.2	1	0.2	1	663	0
Reference 1[a]	18	3	15	2	1	1	1	1	942	70
Reference 2[b]	12	2	12	1	0.2	1	0.2	1	958	60

[a]Test 1 with sensors A316/0205, A317/1157, A334/1502, no response was recorded for A317/1157
[b]Test 2 with sensors A310/0298, A317/0196

TABLE 14. O_2 SENSOR EVALUATION - VOLTAGE OUTPUT VERSUS AIR/FUEL RATIO AT 590°C

A/F Ratio	Voltage Output, mV			
	A310/0298	A317/1157	A317/0196	Reference[a]
14.00	570	150	73	960
14.16	540	130	84	950
14.37	260	125	75	875
14.60	63	108	35	600
14.80	23	68	23	400
15.00	17	68	17	240
15.10	15	72	16	200
15.20	15	74	15	135
15.29	11	75	14	130
15.40	10	70	16	97
15.49	8	67	15	85
15.59	8	62	15	80
15.78	7	90	15	84
15.92	7	75	15	70
16.02	8	60	15	70
15.69	9	40	15	80
14.94	10	--*	20	210
14.70	17	--	23	480
14.49	20	--	6	600
14.29	90	16	80	850
14.07	600	--	78	950

A/F Ratio	Voltage Output, mV		
	AA316/0205	A334/1502	Reference
14.02	900	745	960
13.97	885	620	953
14.12	875	635	945
14.23	870	622	940
14.32	865	615	935
14.39	845	620	933
14.51	800	610	923
14.68	600	600	800
14.57	550	600	680
14.80	160	300	520
14.88	80	170	310
15.04	70	120	210
15.13	60	60	120
15.23	60	40	105
15.34	58	35	90
15.43	57	35	93
15.61	53	35	90
15.51	55	38	90
15.69	50	33	85
15.78	50	32	87
16.04	45	30	80
15.94	46	28	82

*negative voltage

[a]Tests compared to sensors A310/0298, A317/1157, and A317/0196

[b]Tests compared to sensors A316/0205 and A334/1502

TABLE 15. SPECIFIC SURFACE AREA OF OXYGEN SENSORS

Sensor Number	Specific Surface Area, m^2/g	Surface Area, m^2
A317/0196	0.95 ± 0.02	3.9
A317/1151	2.09 ± 0.14	6.8
A316/0205	2.98 ± 0.08	8.2
A334/1502	0.92 ± 0.02	3.9
A310/0298	1.72 ± 0.08	4.8

covered by an exterior spinel coating. The spinel coating is composed of magnesium, aluminum, and oxygen. The exteriors of the sensor tips contained many of the same elements that are found in the catalysts as poisons. No data are available at this time. The results will be compiled and submitted in a subsequent communication.

II. QUALITY ASSURANCE AND CORRELATION

The quality assurance plan for this work assignment is covered under sections 1 and 2D-11D of the Quality Assurance Plan for Contract 68-03-3353 "Emission Characterization and Control Studies for ECTD." This document discusses in detail project organization, responsibility, objectives, procedures, sample custody, control checks, preventive maintenance, and other aspects of the program to assure the accuracy and precision of the results presented in this report. A listing of precision, accuracy, and completeness is presented in Table 16. All measurements are representative of the catalyst properties and conditions being measured.

The Micromeritics Flowsorb II dynamic surface area analyzer was set up to analyze the catalyst samples "in-house." Two NBS Standard Reference Materials and seven standards from Duke Scientific Corporation were used to establish the instrument operating range and linearity, as well as confidence in the analytical procedure. In this work assignment, the surface areas were determined with a multipoint technique. A curve was established for the various gas concentrations to determine the calibration setting for the instrument (Figure 4). The standards were analyzed using this technique, and the results are given in Table 17. A plot of the BET equation versus the relative pressure for the standards was presented in the final report for Work Assignment No. 8. In general, the standards repeated within the published confidence limits for the entire range of standards (0.62 m^2/g to 265 m^2/g).

III. SUMMARY

In summary, a total of 45 catalysts and catalyst samples were examined by whole converter X-ray, X-ray fluorescence, X-ray diffraction, PIXE, BET surface area analysis, and SEM. This letter report is a compilation of all of the data available at the time of submittal, and is intended to serve as the final report of the results for the program. Any data not included with this report will be reported as information becomes available. Blanks were left in the Tables to indicate the absence of data. Every effort has been made to provide a complete report, but insufficient time was provided to complete all of the analyses. We hope that the results from these catalyst and oxygen sensor evaluations will help to answer some of the EPA questions about relationships concerning the condition of these items. Please contact us if there are additional questions, or if we can be of further assistance.

Prepared by:

E. Robert Fanick/CHA

E. Robert Fanick
Research Scientist
Department of Emissions Research

Reviewed by:

Charles T. Hare

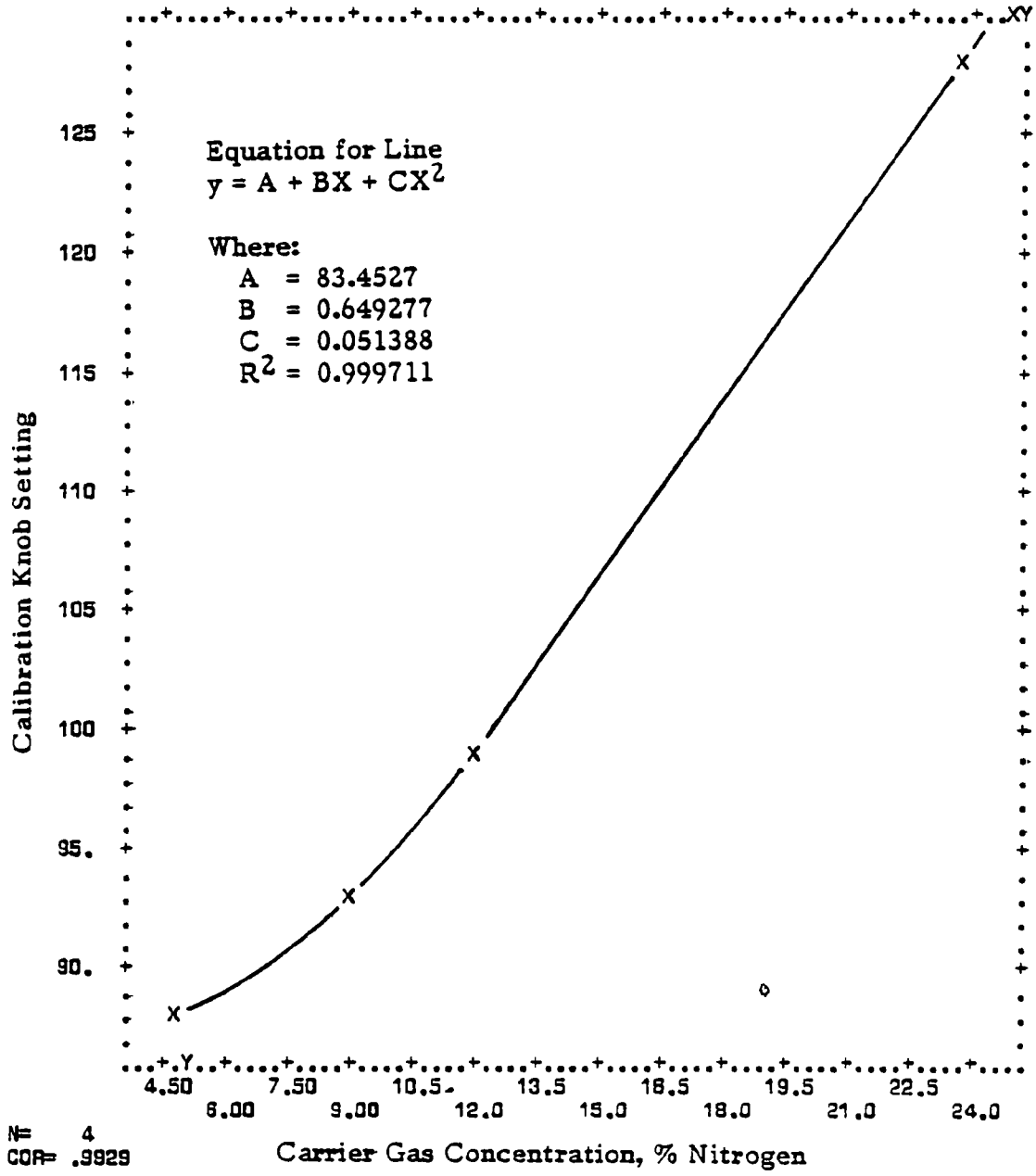
Charles T. Hare
Director
Department of Emissions Research

TABLE 16. PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES

Analytical Procedures	Precision Coeff. of Variation, %	Accuracy	Completeness %
Whole catalyst X-ray	NA[a]	0.02[b] 2-2T[c]	95
X-ray fluorescence	1-3	±15%	95
X-ray diffraction	5	±5%	95
BET surface area	7	±3%	95
PIXE	±5	±5%	95

[a]NA = not applicable
[b]geometric unsharpness
[c]sensitivity

PAGE 4 CONVERTER SURFACE AREA ANALYSIS



N= 4
COR= .9929

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	12.425	8.1288	X= .45073*Y-33.549	1.3976
Y	102.00	17.907	Y= 2.1874*X+ 74.822	6.7824

VARIABLE 1 P/PO VERSUS VARIABLE 2 X/V SYMBOL=X

FIGURE 4. CALIBRATION KNOB SETTING FOR BET INSTRUMENT

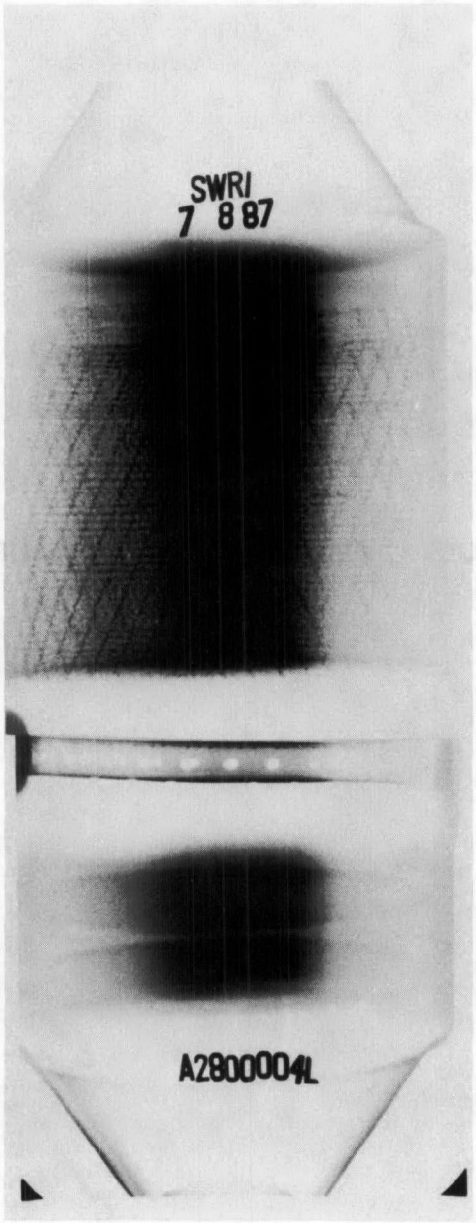
TABLE 17. QUALITY ASSURANCE OF SURFACE AREA STANDARDS

Standard Composition	Standard Surface Area, m^2/g	Measured Surface Area, m^2/g	Percent Difference
Zinc oxide	0.62±0.04	0.61	-1.6
Alpha alumina	0.78 NBS	0.73	-6.4
Alumina	1.39±0.12	1.38	-0.7
Alumina	3.04±0.25	3.21	5.6
Titanium dioxide	7.05±0.7	6.97	-1.1
Alumina	14.0±0.6	14.00	0.0
Graphitized Carbon Black	71.3 NBS	73.13	2.6
Alumina	81.4±6.2	82.37	1.2
Alumina	265±11	220.5	-16.8
		Average	-1.9±6.5

APPENDIX A

WHOLE CATALYST X-RAY RADIOGRAPHS

INLET



OUTLET

Figure A-1. X-Ray Radiograph of A280/0004L

INLET

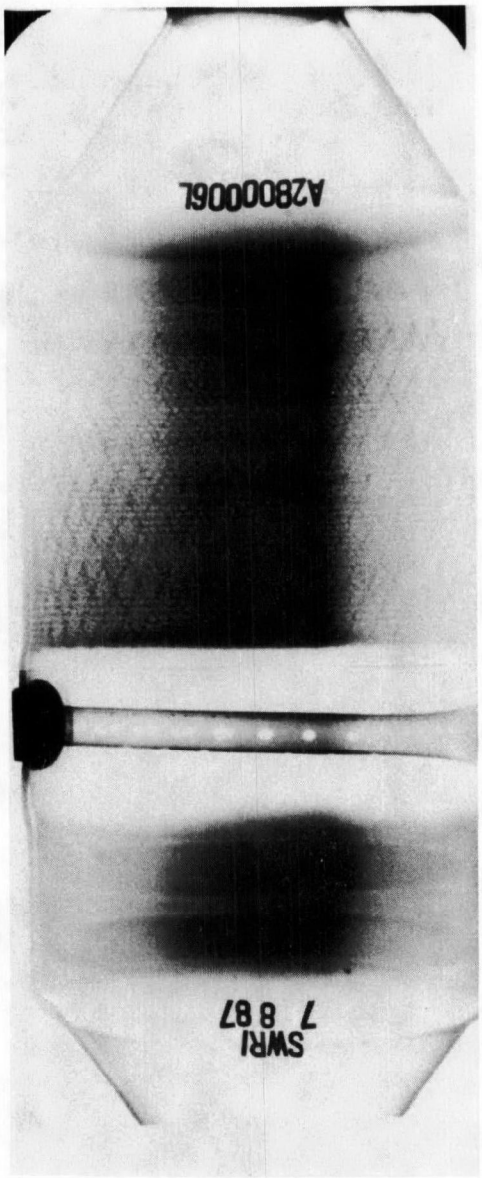


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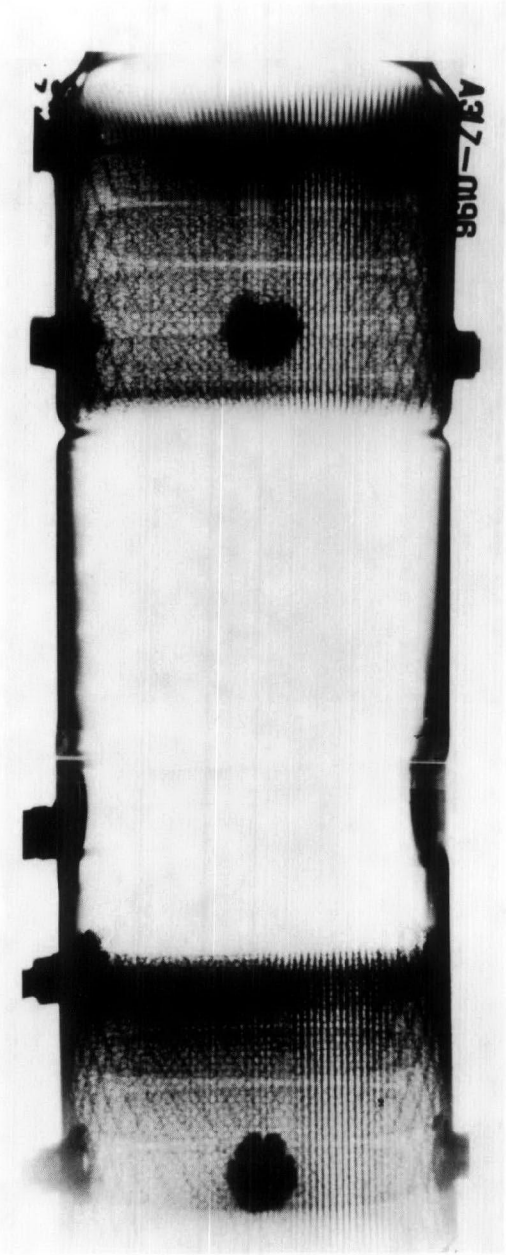
Figure A-2. X-Ray Radiograph of A280/0006L

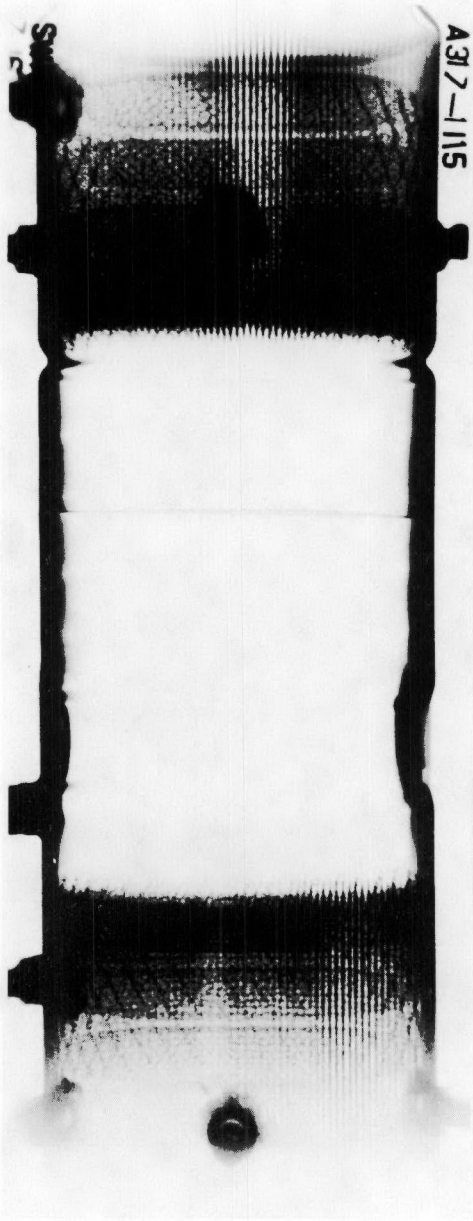
INLET



OUTLET

Figure A-3. X-Ray Radiograph of A317/0196

INLET



OUTLET

Figure A-4. X-Ray Radiograph of A317/1115

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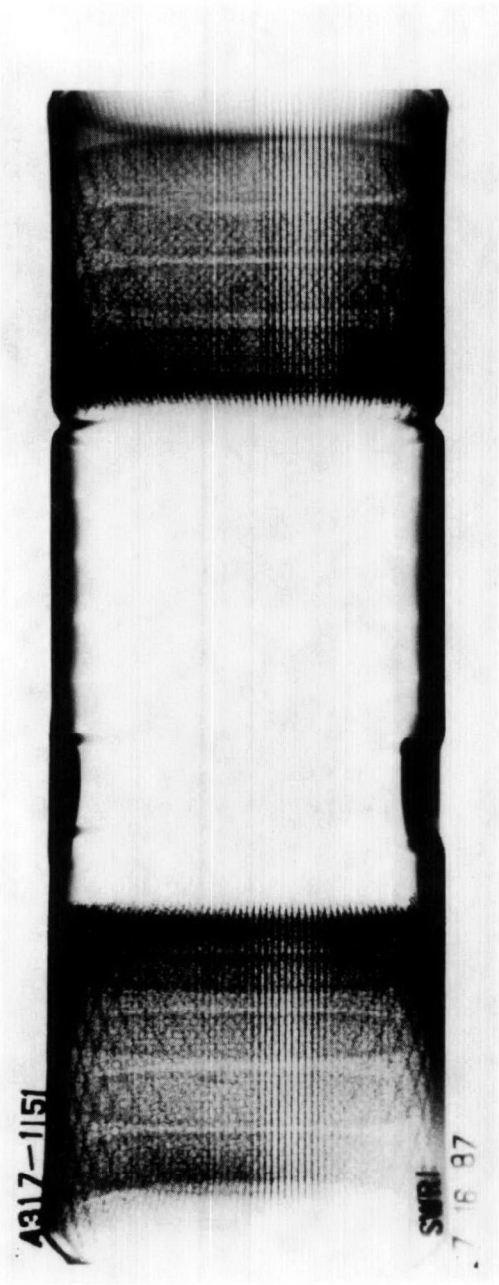

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Figure A-5. X-Ray Radiograph of A317/1151

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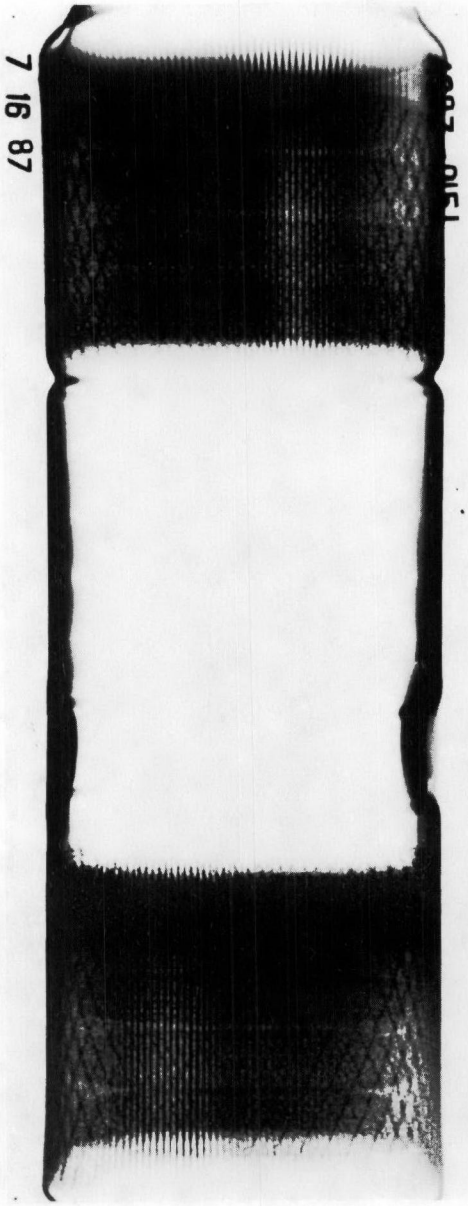

OUTLET

Figure A-6. X-Ray Radiograph of A337/0151

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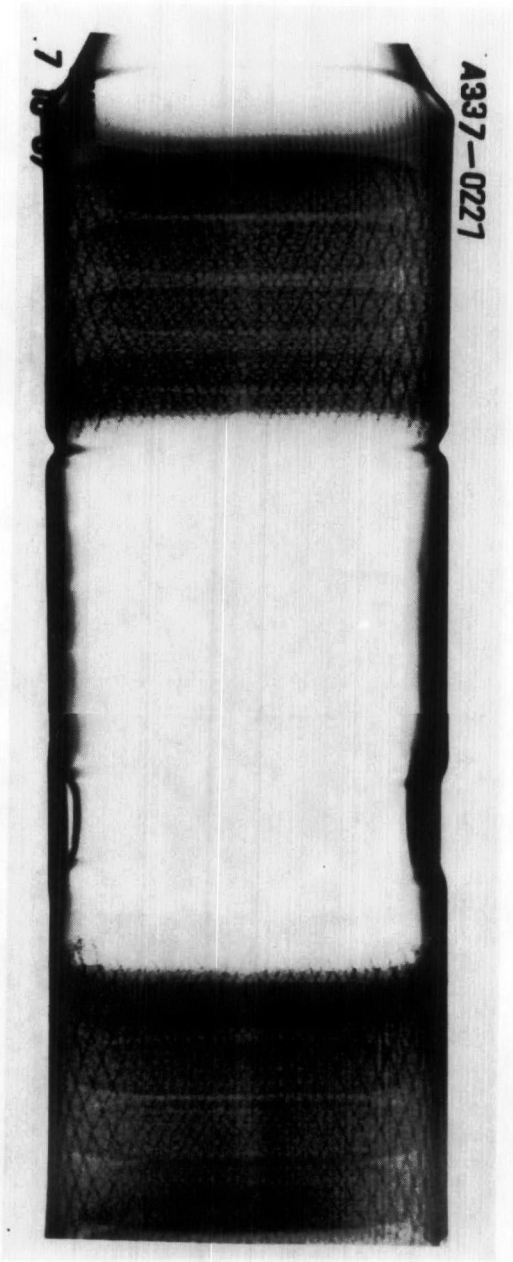

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Figure A-7. X-Ray Radiograph of A337/0227

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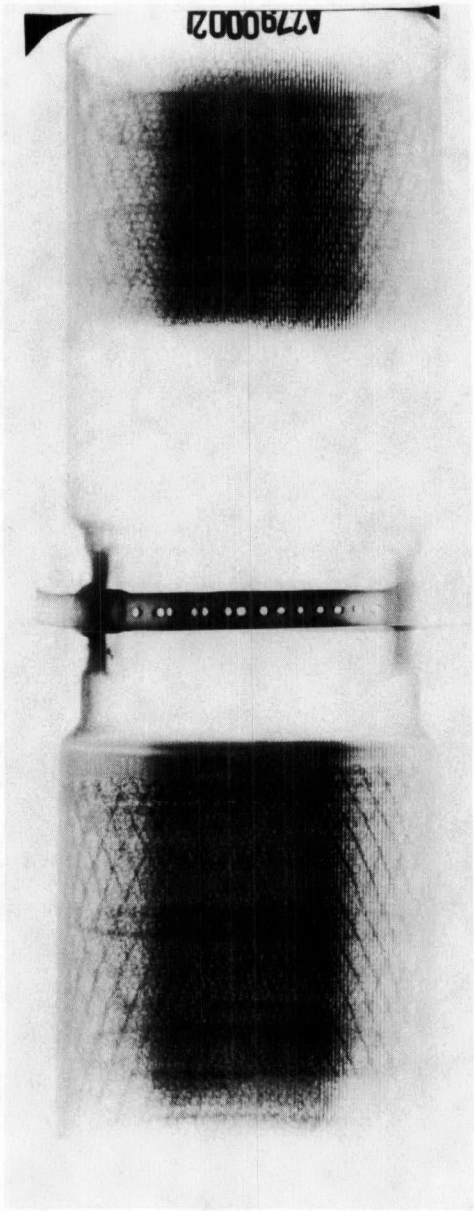

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Figure A-8. X-Ray Radiograph of A279/0002L

INLET

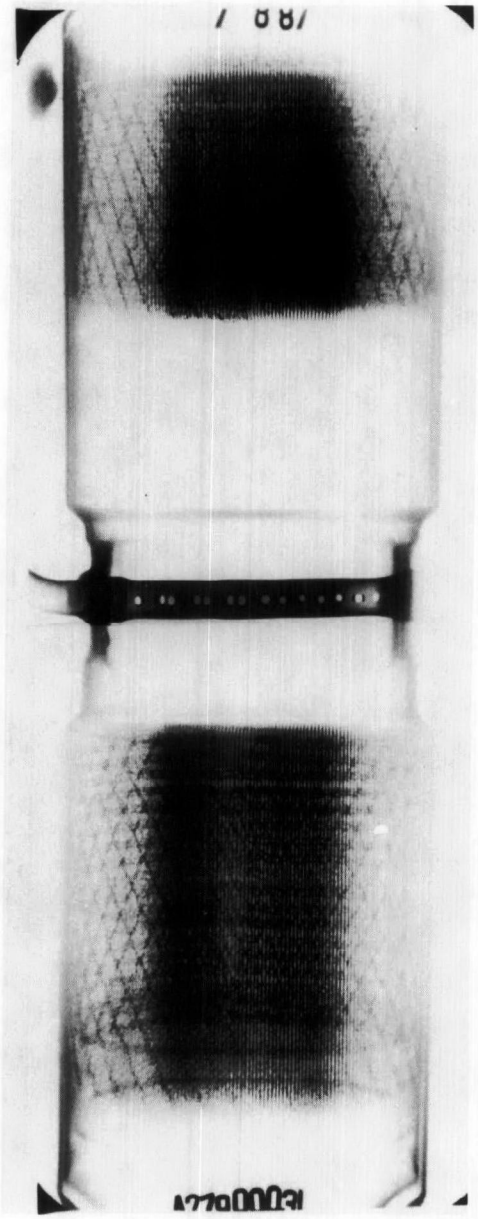

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Figure A-9. X-Ray Radiograph of A279/0003L

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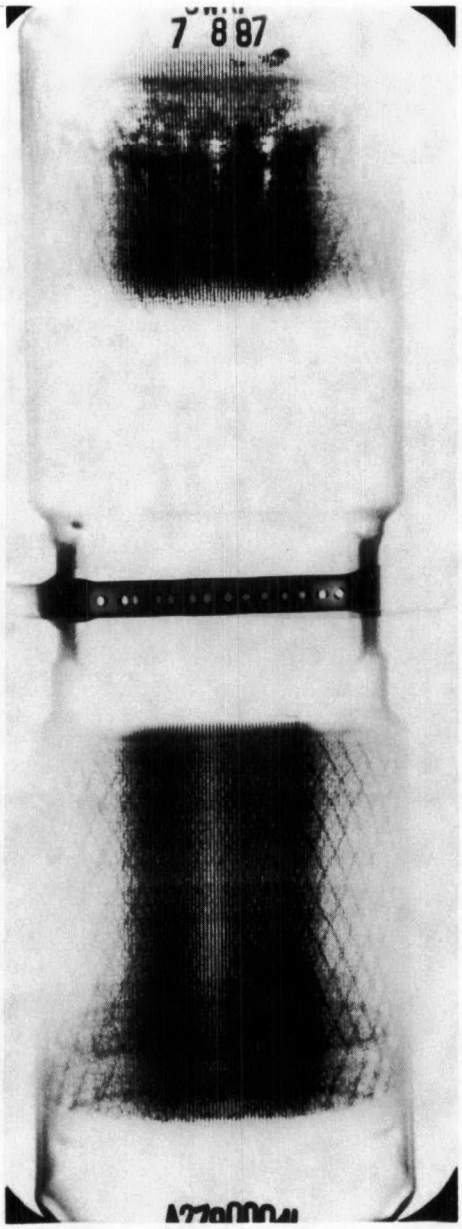


OUTLET

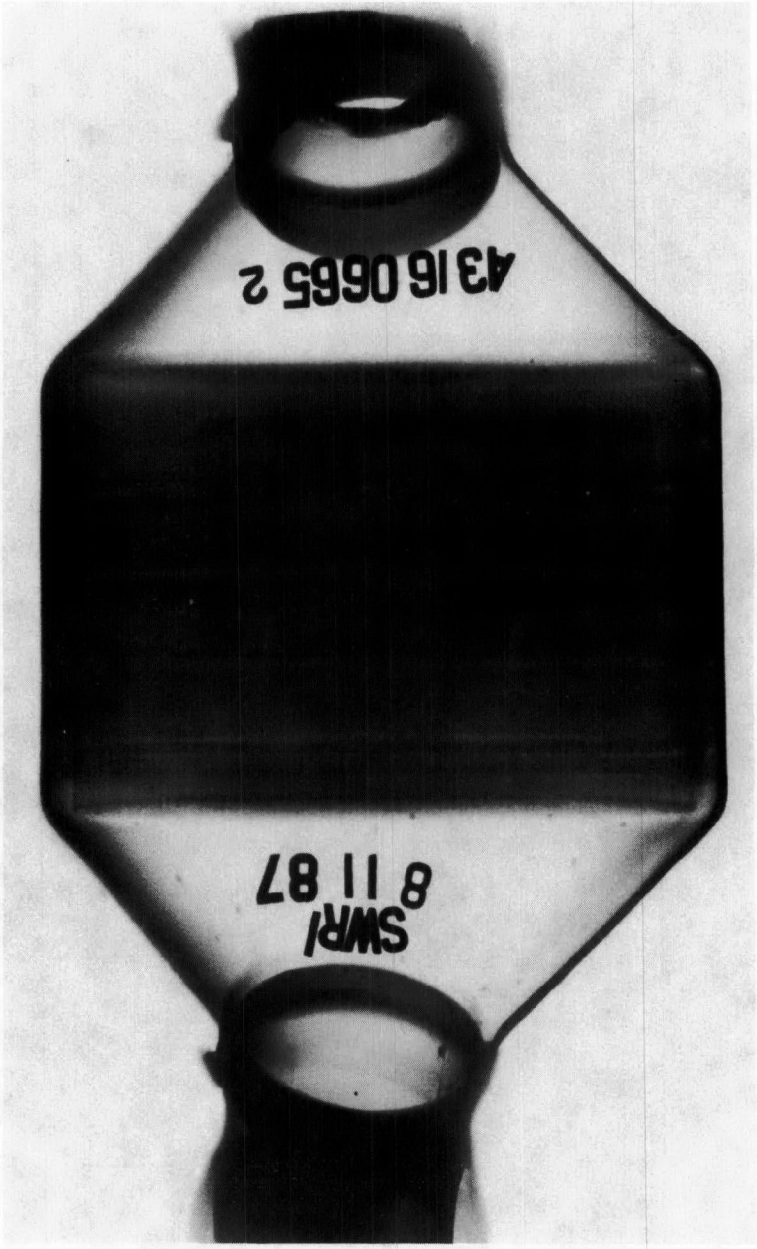
Figure A-10. X-Ray Radiograph of A279/0004L

INLET

OUTLET

Figure A-11. X-Ray Radiograph of A316/0665-1

INLET



OUTLET

Figure A-12. X-Ray Radiograph of A316/0665-2

INLET

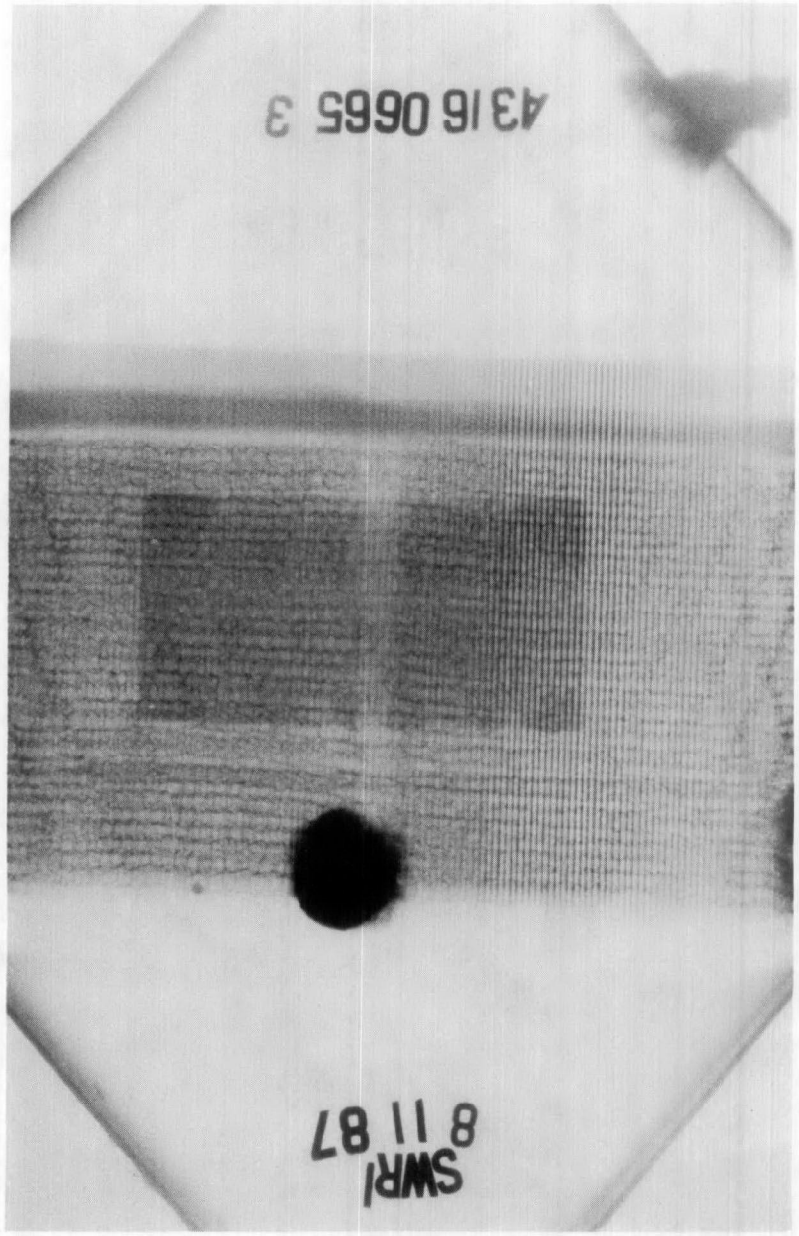


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Figure A-13. X-Ray Radiograph of A316/0665-3

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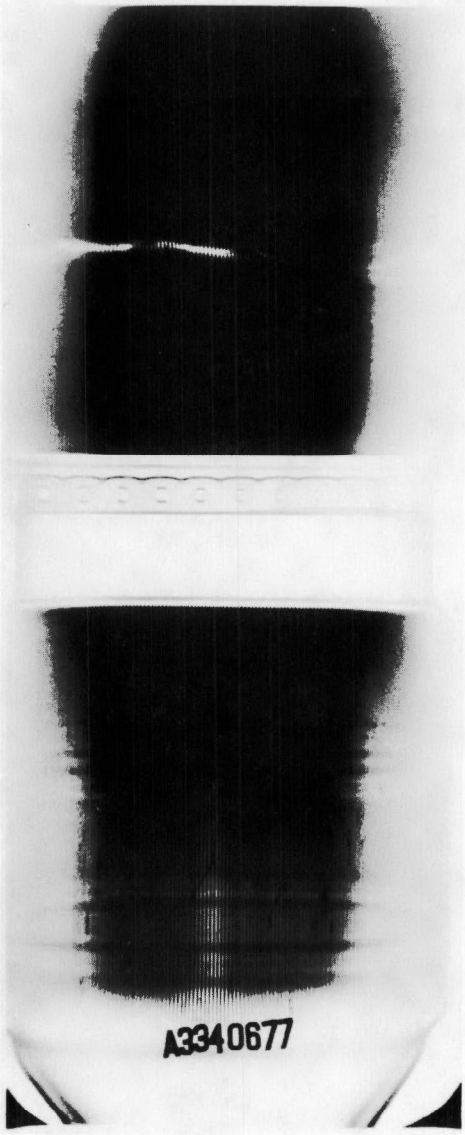
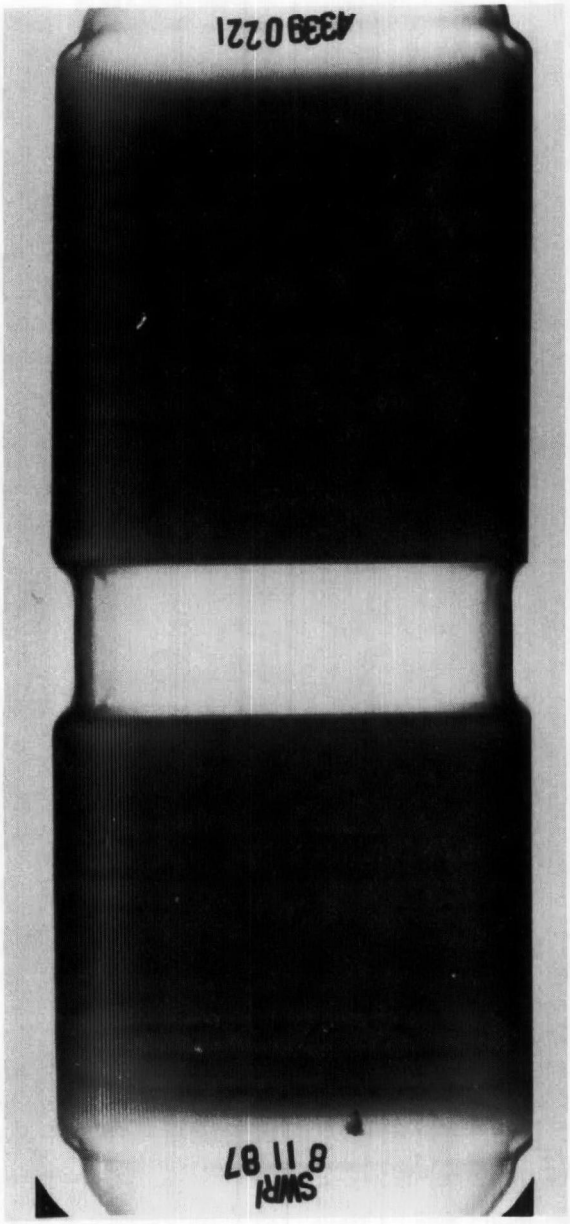


OUTLET

Figure A-14. X-Ray Radiograph of A334/0677

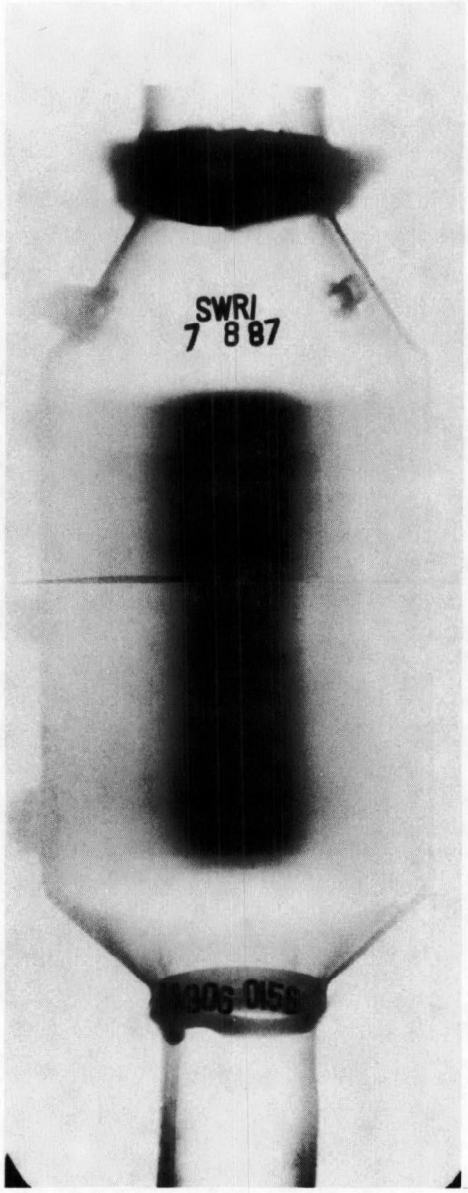
INLET



OUTLET

Figure A-15 X-Ray Radiograph of A339/0221

INLET



OUTLET

Figure A-16. X-Ray Radiograph of A306/0156

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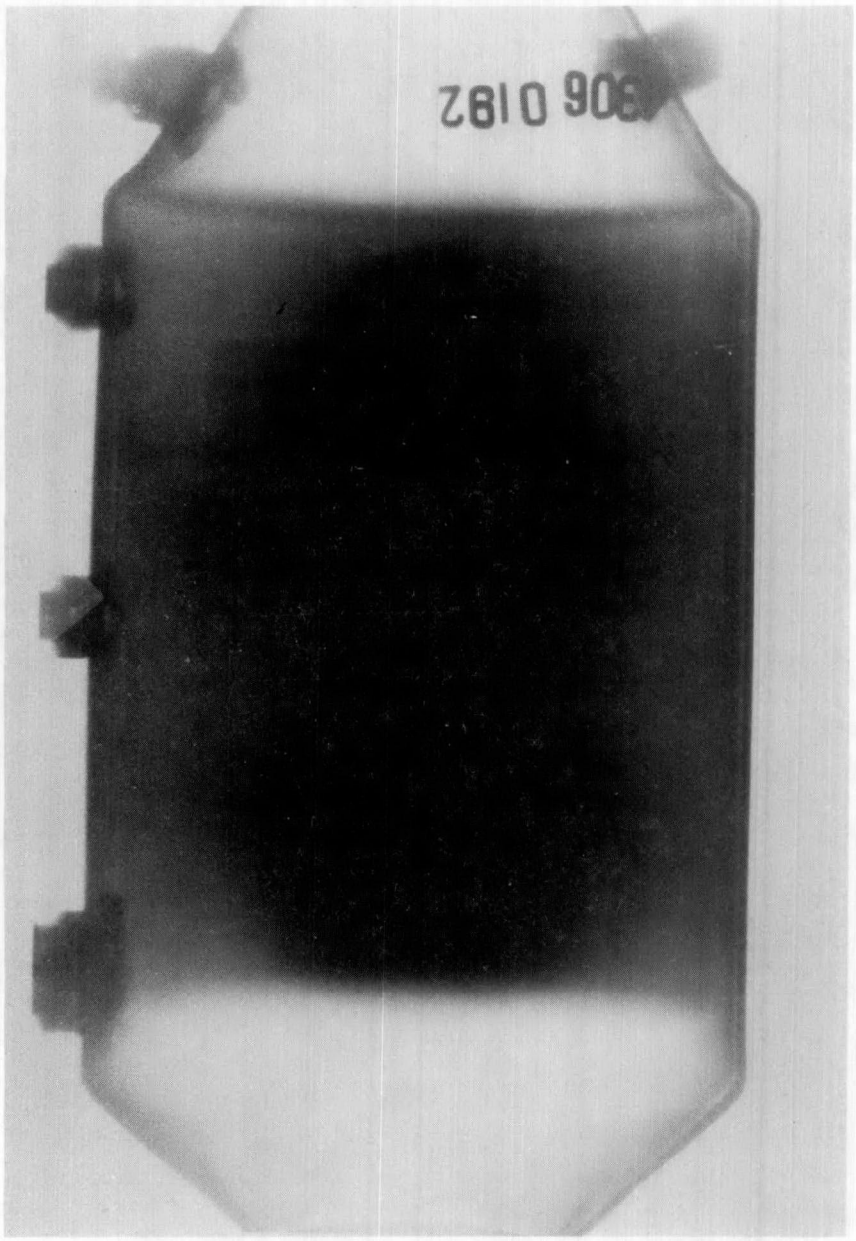

OUTLET

Figure A-17. X-Ray Radiograph of A306/0192

APPENDIX B

BET EQUATION VERSUS RELATIVE PRESSURE FOR CATALYST SAMPLES

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/13/87

SAMPLE I.D.: A221/0198-A LL-1
SAMPLE WEIGHT: 24.7300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	37.33	1.51	0.0490	0.03416
8.860	40.51	1.64	0.0869	0.05809
12.100	43.22	1.75	0.1187	0.07704

BET SURFACE AREA: 7.02 +/- 0.12 m^2/g
SLOPE: 0.6164 +/- 0.0102
INTERCEPT: 0.0041 +/- 0.0009
C: 150.47
Vm: 1.61 cm^3/g
CORRELATION COEFFICIENT 0.9999

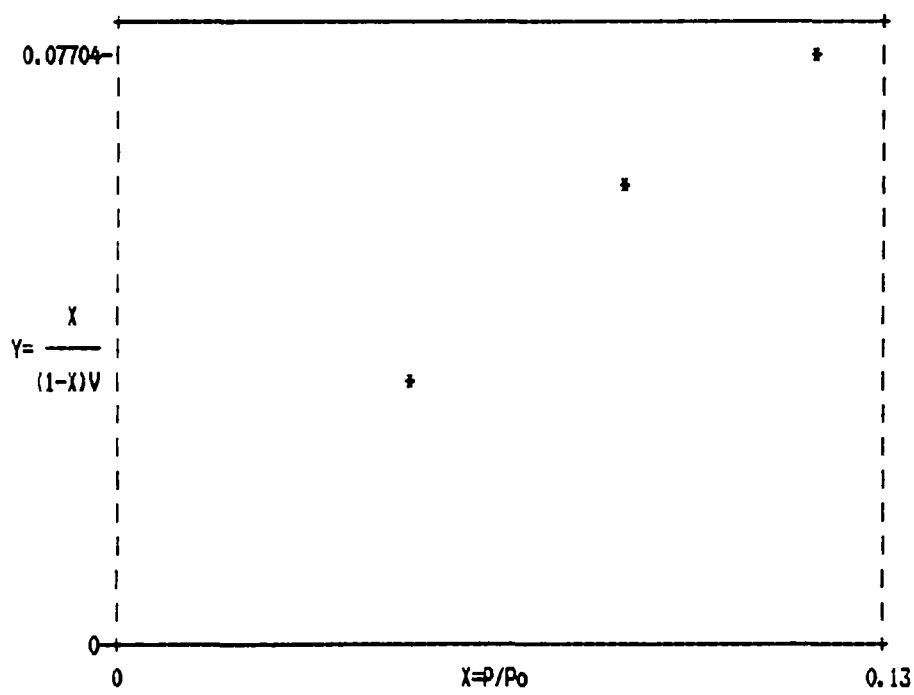

Figure B-1. Plot of BET equation versus relative pressure for Converter A221/0198-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/22/87

SAMPLE I.D.: A221/0198-A LL-2
SAMPLE WEIGHT: 26.3200 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	26.83	1.02	0.0490	0.05058
8.860	33.10	1.26	0.0869	0.07566
12.100	33.22	1.26	0.1187	0.10667

BET SURFACE AREA: 5.37 +/- 0.60 m^2/g
SLOPE: 0.8011 +/- 0.0895
INTERCEPT: 0.0097 +/- 0.0080
C: 83.93
Vm: 1.23 cm^3/g
CORRELATION COEFFICIENT 0.9938

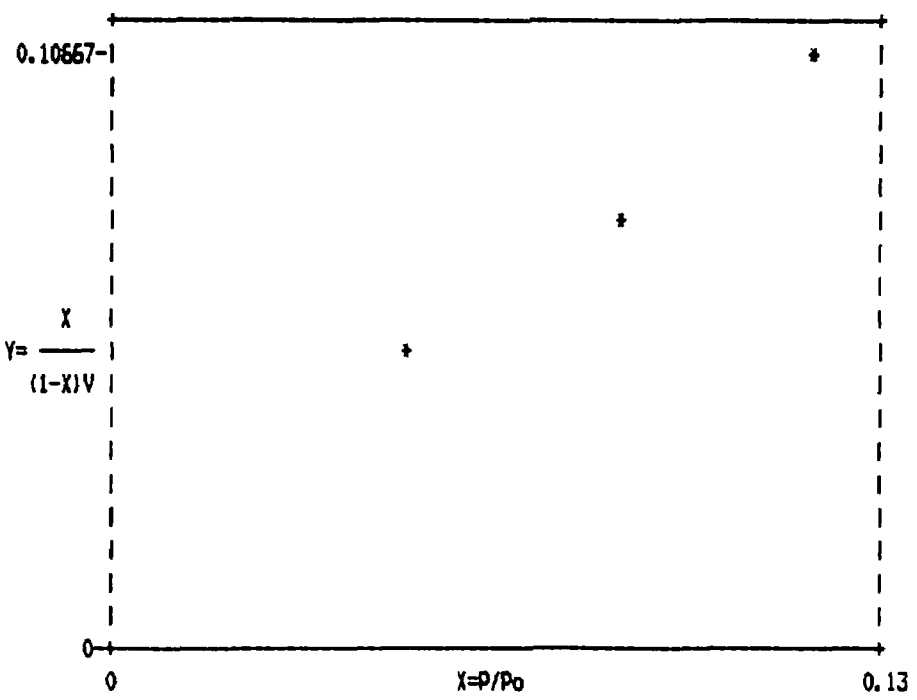

Figure B-2. Plot of BET equation versus relative pressure for Converter A221/0198-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/20/87

SAMPLE I.D.: A221/0198-A LL-3
SAMPLE WEIGHT: 24.4600 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	32.93	1.35	0.0490	0.03830
8.860	36.89	1.51	0.0869	0.06309
12.100	38.39	1.57	0.1187	0.08578

BET SURFACE AREA: 6.35 +/- 0.16 m^2/g
SLOPE: 0.6811 +/- 0.0169
INTERCEPT: 0.0046 +/- 0.0015
C: 149.34
Vm: 1.46 cm^3/g
CORRELATION COEFFICIENT 0.9997

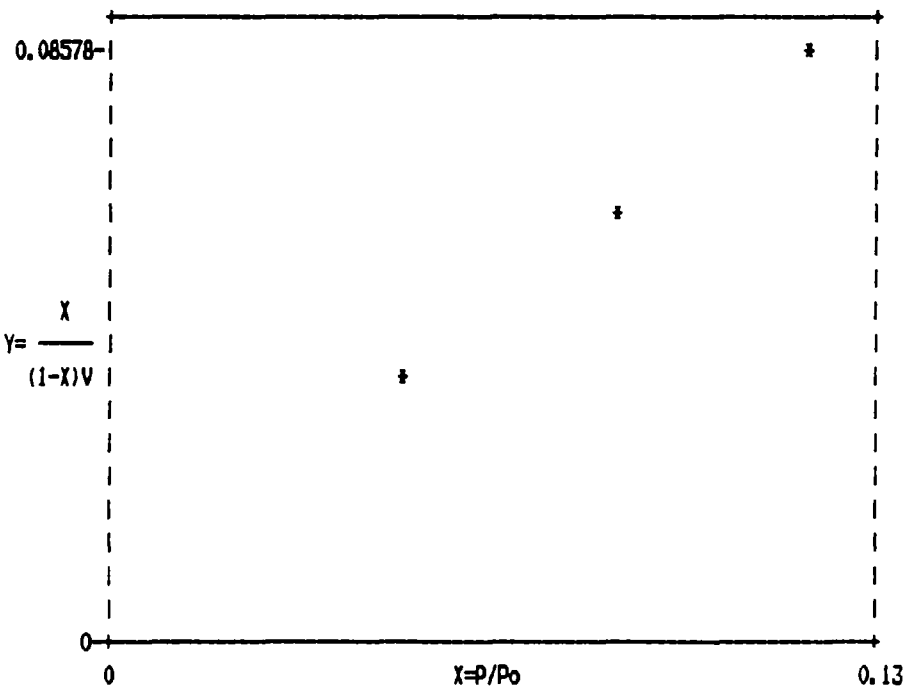

Figure B-3. Plot of BET equation versus relative pressure for Converter A221/0198-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/29/87

SAMPLE I.D.: A221/0198-A LL-1
SAMPLE WEIGHT: 1.3603 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.06	1.51	0.0490	0.03405
8.860	2.32	1.71	0.0869	0.05579
12.100	2.49	1.83	0.1187	0.07355
22.000	3.35	2.46	0.2157	0.11170

BET SURFACE AREA: 9.20 +/- 0.66 m^2/g
SLOPE: 0.4581 +/- 0.0337
INTERCEPT: 0.0149 +/- 0.0045
C: 31.71
Vm: 2.11 cm^3/g
CORRELATION COEFFICIENT 0.9946

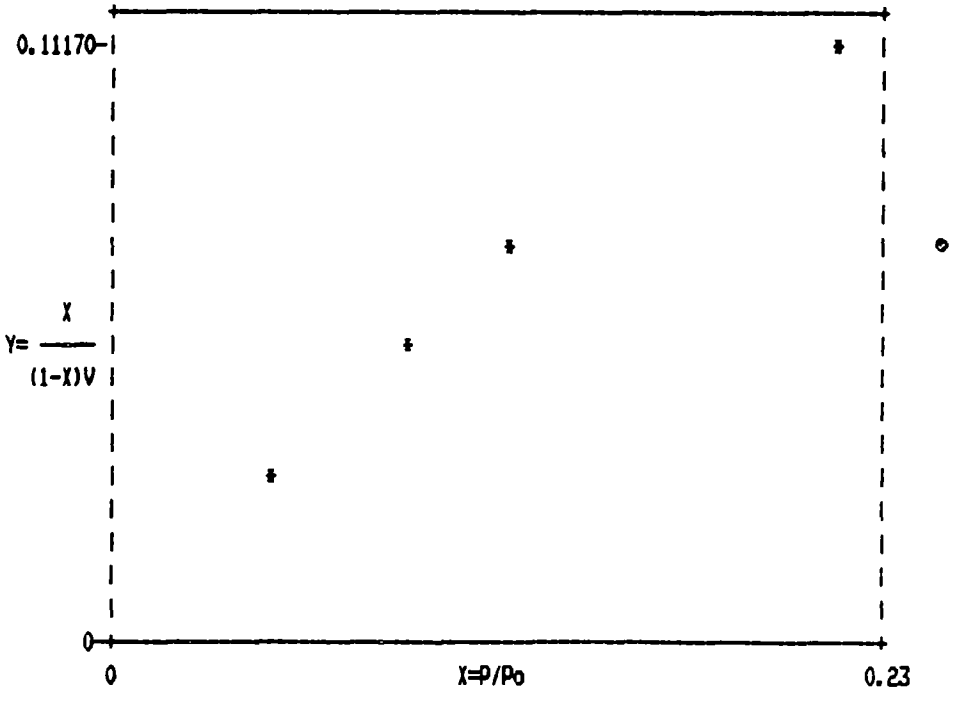

Figure B-4. Plot of BET equation versus relative pressure for Converter A221/0198-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/23/87

SAMPLE I.D.: A221/0198-B UR-1
SAMPLE WEIGHT: 24.3600 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	34.19	1.40	0.0490	0.03674
8.860	36.53	1.50	0.0869	0.06345
12.100	39.39	1.62	0.1187	0.08326

BET SURFACE AREA: 6.46 +/- 0.23 m^2/g
SLOPE: 0.6694 +/- 0.0235
INTERCEPT: 0.0043 +/- 0.0021
C: 155.05
Vm: 1.48 cm^3/g
CORRELATION COEFFICIENT 0.9994

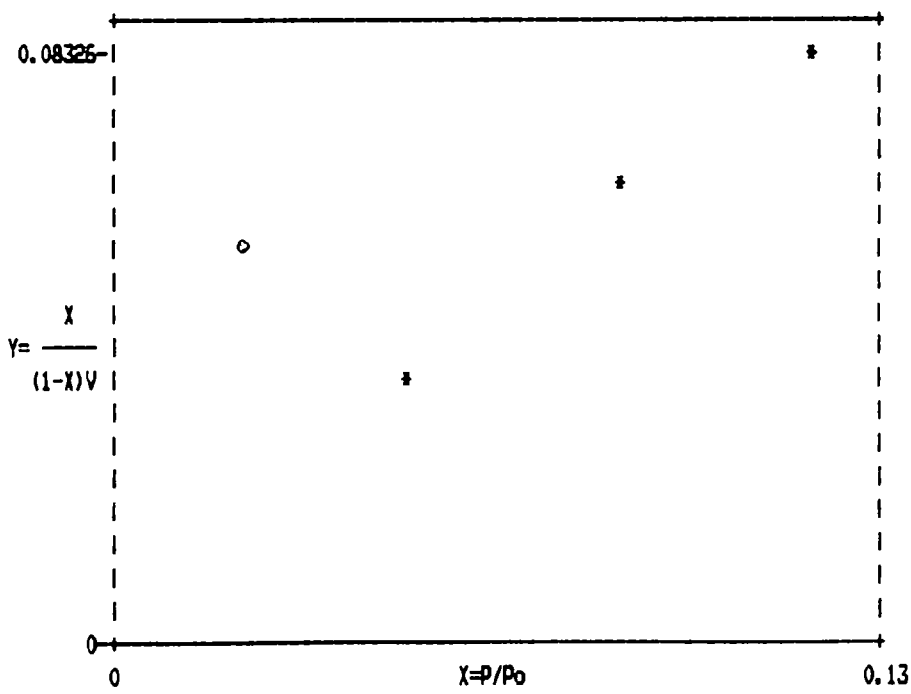

Figure B-5. Plot of BET equation versus relative pressure for Converter A221/0198-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/21/87

SAMPLE I.D.: A221/0198-B (UR-2 1/2 REAR FACE) ADSORBATE: Nitrogen
SAMPLE WEIGHT: 23.0200 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	23.79	1.03	0.0490	0.04989
8.860	27.59	1.20	0.0869	0.07939
14.900	31.17	1.35	0.1461	0.12638

BET SURFACE AREA: 5.45 +/- 0.03 m^2/g
SLOPE: 0.7883 +/- 0.0038
INTERCEPT: 0.0111 +/- 0.0004
C: 71.95
Vm: 1.25 cm^3/g
CORRELATION COEFFICIENT 1.0000

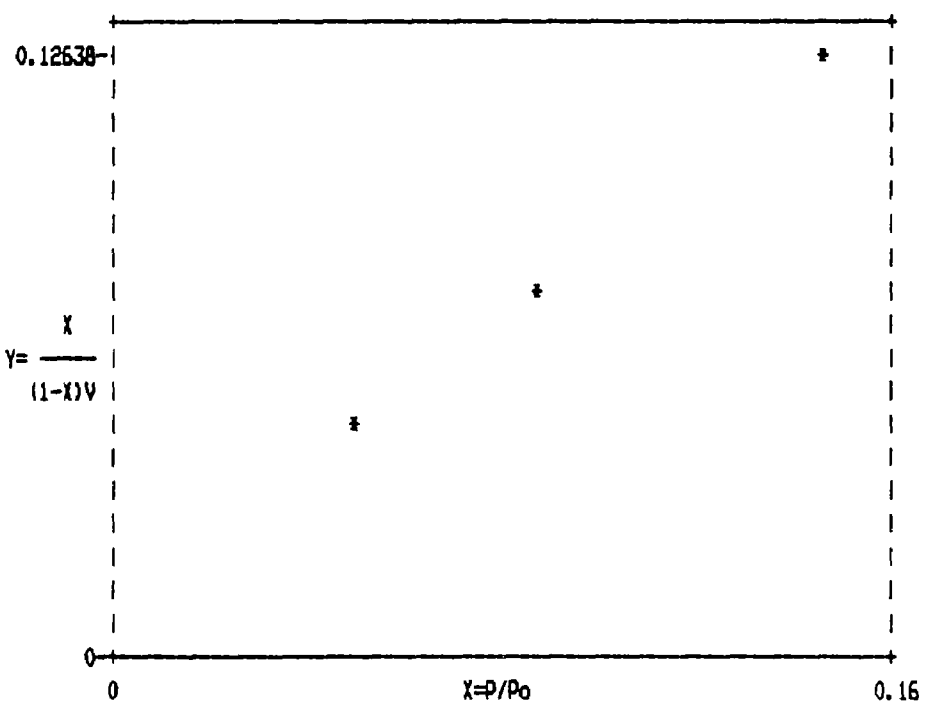

Figure B-6. Plot of BET equation versus relative pressure for Converter A221/0198-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/27/87

SAMPLE I.D.: A249/0486-1-A LL-1
SAMPLE WEIGHT: 19.5300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	35.21	1.80	0.0490	0.02860
8.860	37.57	1.92	0.0869	0.04946
12.100	41.89	2.14	0.1187	0.06277

BET SURFACE AREA: 8.74 +/- 0.67 m^2/g
SLOPE: 0.4927 +/- 0.0378
INTERCEPT: 0.0051 +/- 0.0034
C: 96.92
Vm: 2.01 cm^3/g
CORRELATION COEFFICIENT 0.9971

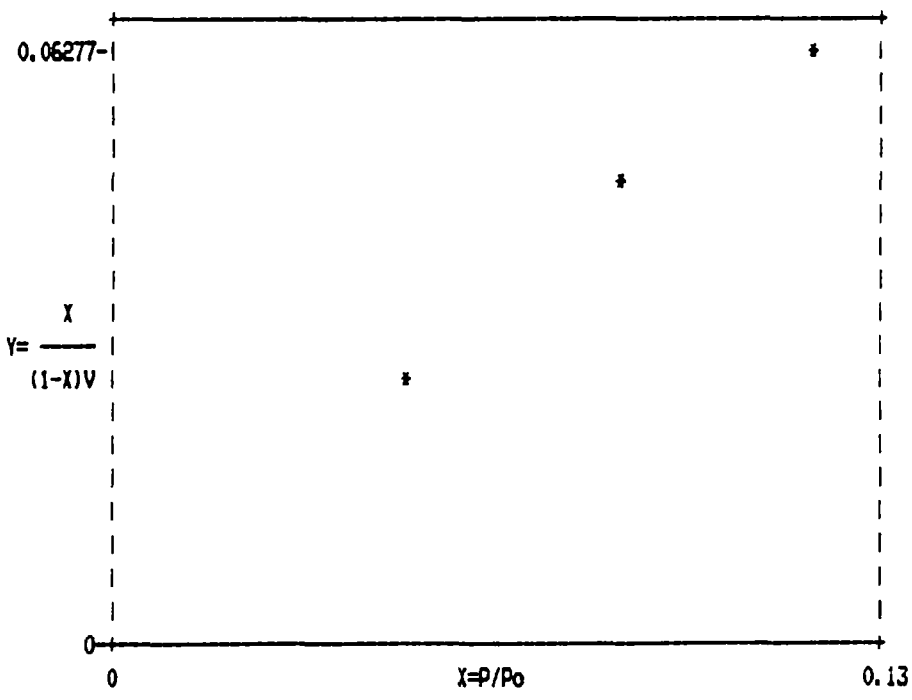

Figure B-7. Plot of BET equation versus relative pressure for Converter A249/0486-1-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/3/87

SAMPLE I.D.: A249/0486-1-A LL-2
SAMPLE WEIGHT: 17.3400 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	22.13	1.28	0.0490	0.04040
8.860	24.25	1.40	0.0869	0.06804
12.100	24.96	1.44	0.1187	0.09353

BET SURFACE AREA: 5.69 +/- 0.15 m^2/g
SLOPE: 0.7621 +/- 0.0206
INTERCEPT: 0.0027 +/- 0.0018
C: 287.86
Vm: 1.31 cm^3/g
CORRELATION COEFFICIENT 0.9996

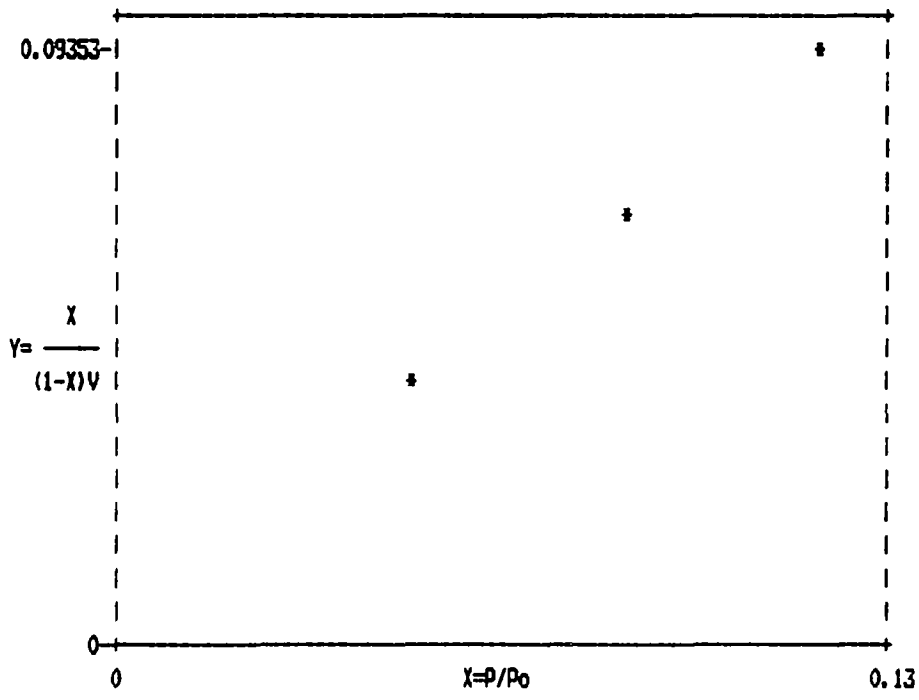

Figure B-8. Plot of BET equation versus relative pressure for Converter A249/0486-1-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/29/87

SAMPLE I.D.: A249/0486-1-A LL-3 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 19.2900 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	30.28	1.57	0.0490	0.03285
8.860	32.53	1.69	0.0869	0.05642
12.100	36.03	1.87	0.1187	0.07208

BET SURFACE AREA: 7.62 +/- 0.50 m^2/g
SLOPE: 0.5654 +/- 0.0372
INTERCEPT: 0.0058 +/- 0.0033
C: 98.36
Vm: 1.75 cm^3/g
CORRELATION COEFFICIENT 0.9978

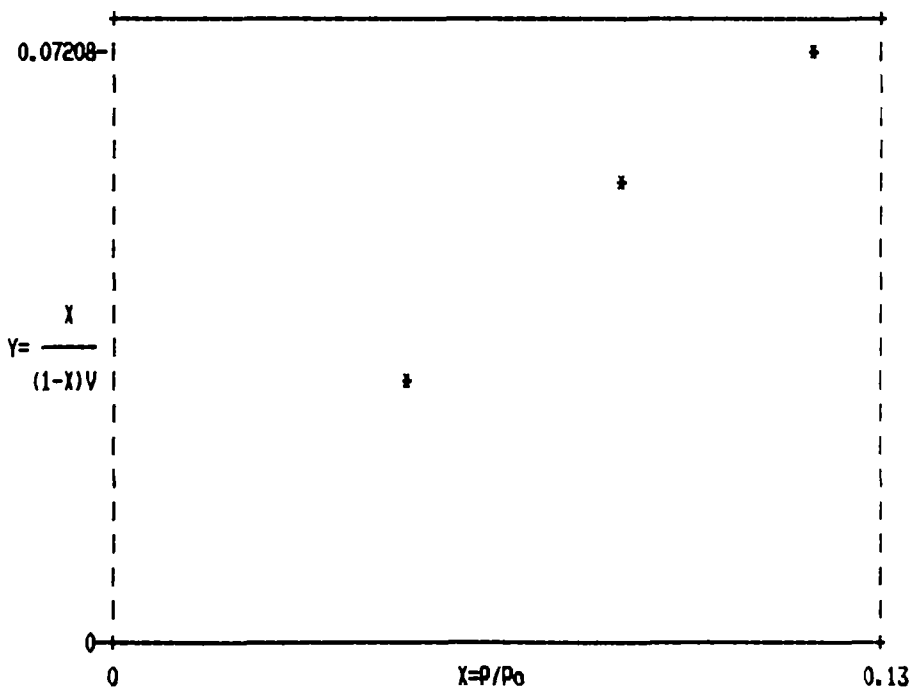

Figure B-9. Plot of BET equation versus relative pressure for Converter A249/0486-1-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/7/87

SAMPLE I.D.: A249/0486-1-A LL-1
SAMPLE WEIGHT: 1.2688 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.58	2.03	0.0490	0.02536
8.860	2.99	2.36	0.0869	0.04038
12.100	3.32	2.62	0.1187	0.05145
22.000	3.95	3.11	0.2157	0.08836

BET SURFACE AREA: 11.35 +/- 0.12 m^2/g
SLOPE: 0.3765 +/- 0.0039
INTERCEPT: 0.0071 +/- 0.0005
C: 53.88
Vm: 2.61 cm^3/g
CORRELATION COEFFICIENT 0.9999

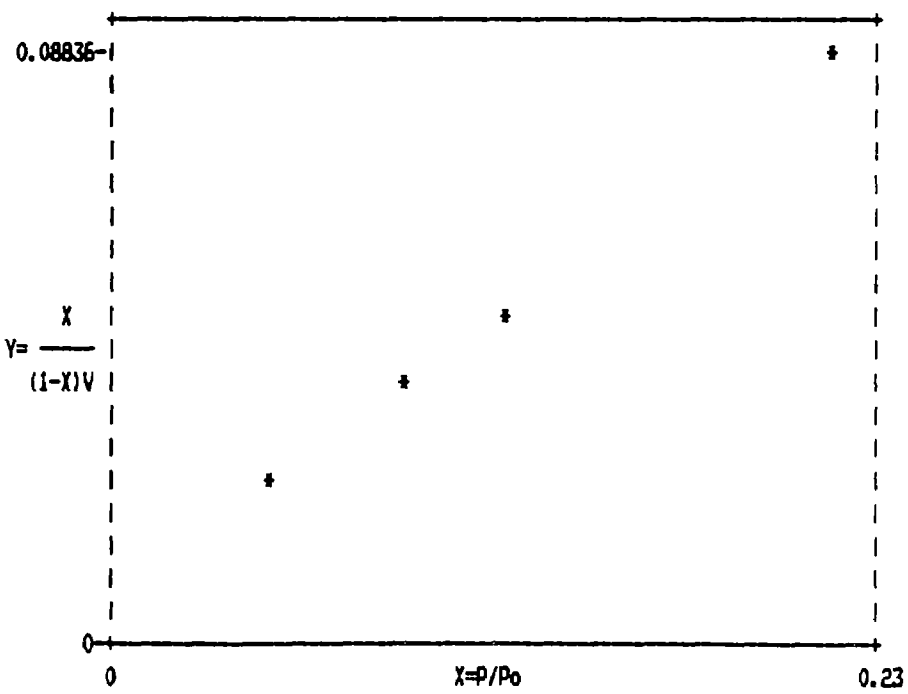

Figure B-10. Plot of BET equation versus relative pressure for Converter A249/0486-1-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/24/87

SAMPLE I.D.: A249/0486-2-A LL-1
SAMPLE WEIGHT: 17.5900 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	26.78	1.52	0.0490	0.03387
8.860	29.06	1.65	0.0869	0.05760
12.100	30.97	1.76	0.1187	0.07647

BET SURFACE AREA: 7.06 +/- 0.11 m^2/g
SLOPE: 0.6123 +/- 0.0094
INTERCEPT: 0.0040 +/- 0.0008
C: 153.51
Vm: 1.62 cm^3/g
CORRELATION COEFFICIENT 0.9999

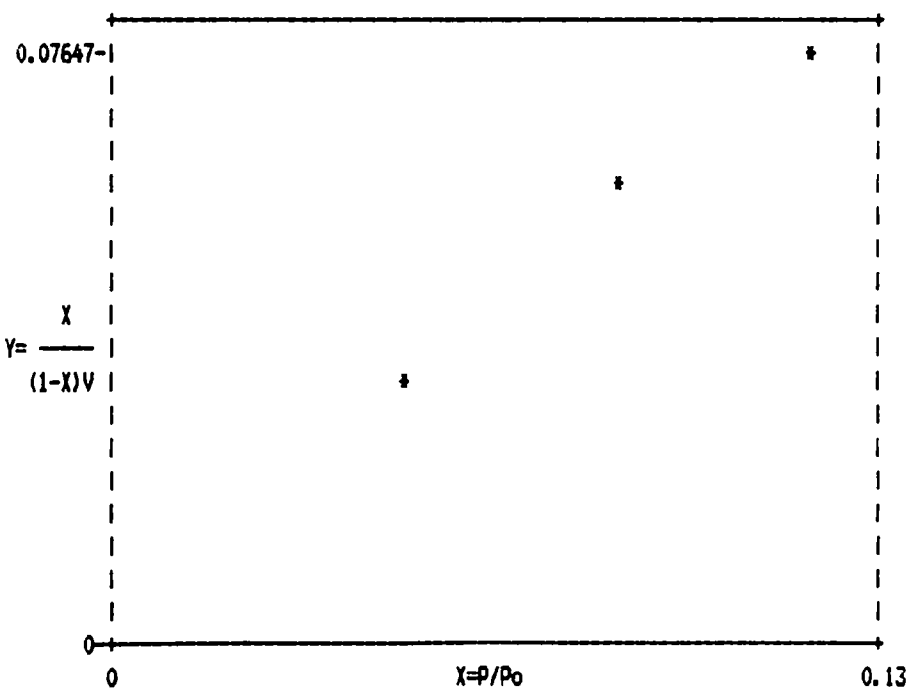

Figure B-11. Plot of BET equation versus relative pressure for Converter A249/0486-2-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/4/87

SAMPLE I.D.: A249/0486-2-A LL-2 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 15.9700 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	15.50	0.97	0.0490	0.05312
8.860	17.40	1.09	0.0869	0.08733
12.100	18.98	1.19	0.1187	0.11328

BET SURFACE AREA: 4.97 +/- 0.14 m^2/g
SLOPE: 0.8653 +/- 0.0248
INTERCEPT: 0.0112 +/- 0.0022
C: 78.58
Vm: 1.14 cm^3/g
CORRELATION COEFFICIENT 0.9996

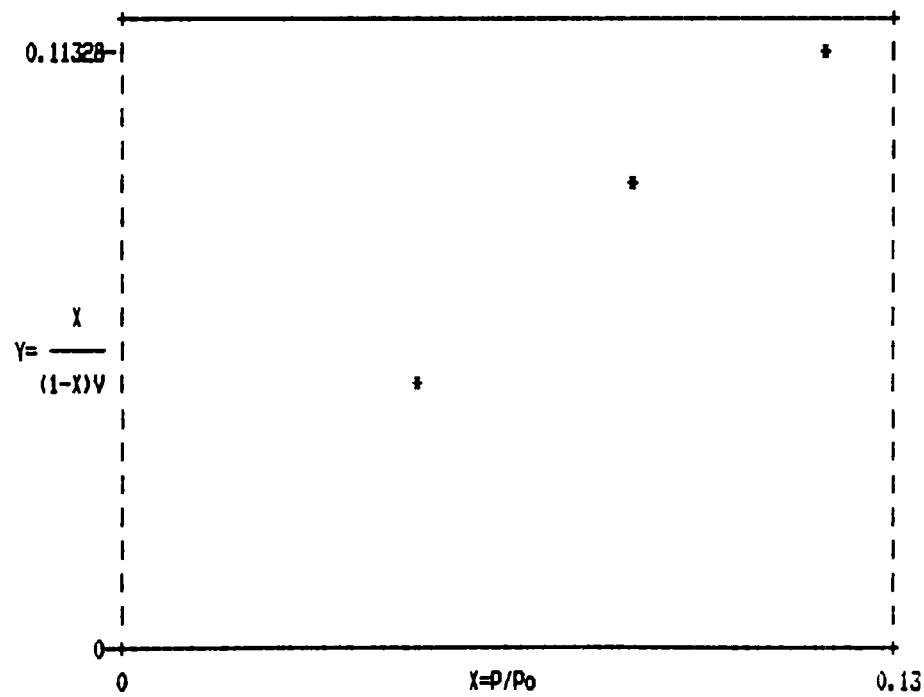

Figure B-12. Plot of BET equation versus relative pressure for Converter A249/0486-2-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/26/87

SAMPLE I.D.: A249/0486-2-A (LL-3)
SAMPLE WEIGHT: 14.7800 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	18.61	1.26	0.0490	0.04095
8.860	19.73	1.33	0.0869	0.07128
14.900	22.98	1.55	0.1461	0.11006

BET SURFACE AREA: 6.09 +/- 0.34 m^2/g
SLOPE: 0.7068 +/- 0.0396
INTERCEPT: 0.0076 +/- 0.0040
C: 93.43
Vm: 1.40 cm^3/g
CORRELATION COEFFICIENT 0.9984

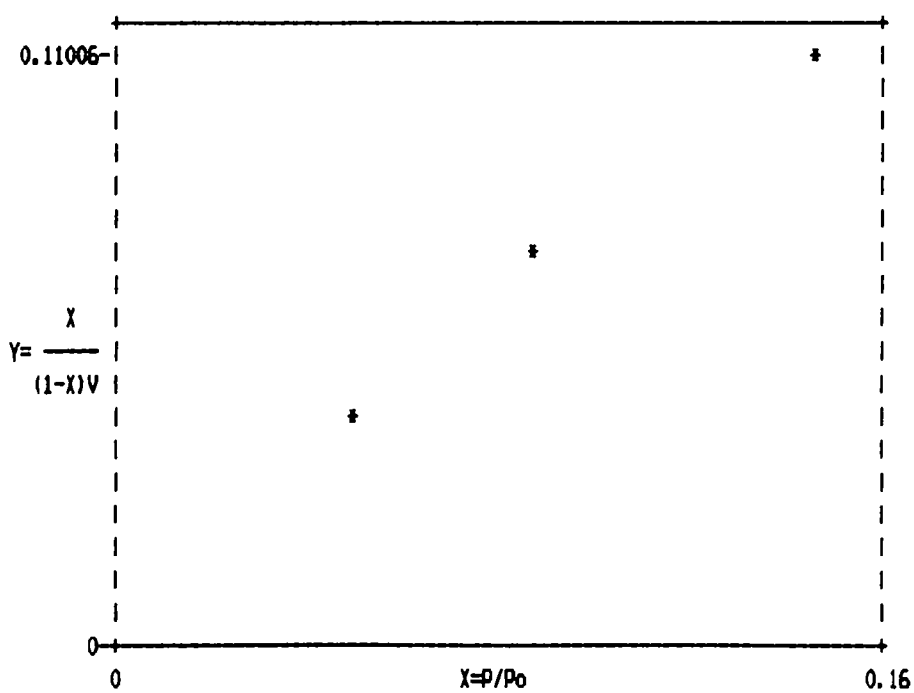

Figure B-13. Plot of BET equation versus relative pressure for Converter A249/0486-2-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A249/0486-2A
SAMPLE WEIGHT: 1.5905 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.28	2.06	0.0490	0.02500
8.860	3.47	2.18	0.0869	0.04361
14.900	4.00	2.51	0.1461	0.06804
22.000	4.52	2.84	0.2157	0.09680

BET SURFACE AREA: 10.07 +/- 0.25 m^2/g
SLOPE: 0.4269 +/- 0.0105
INTERCEPT: 0.0052 +/- 0.0015
C: 82.46
Vm: 2.31 cm^3/g
CORRELATION COEFFICIENT 0.9994

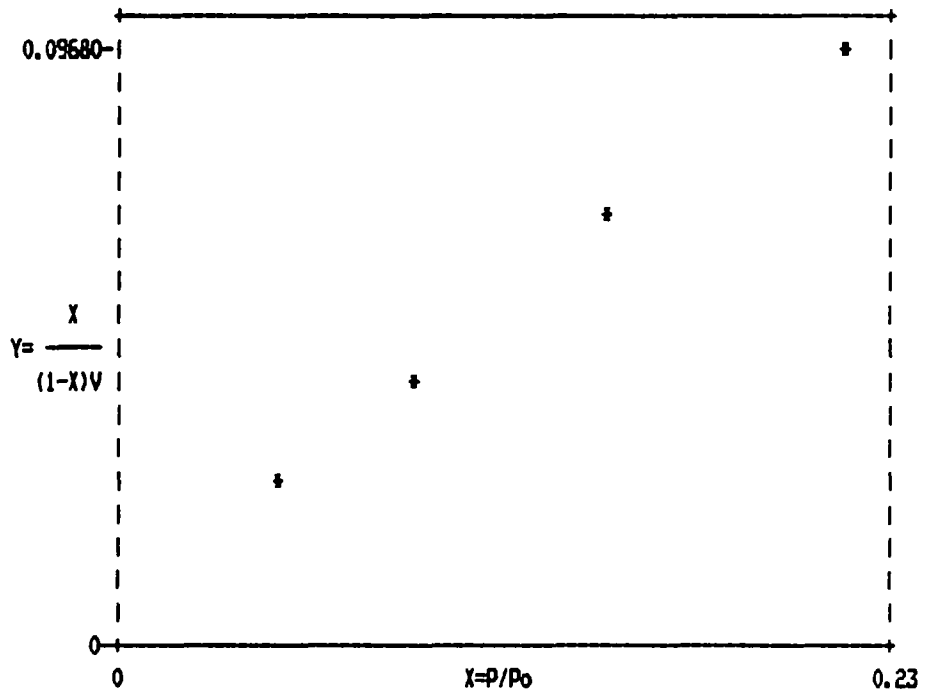

Figure B-14. Plot of BET equation versus relative pressure for Converter A249/0486-2-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/18/87

SAMPLE I.D.: A249/0486-3-A (LL-1)
SAMPLE WEIGHT: 30.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	69.89	2.28	0.0490	0.02265
8.860	78.58	2.56	0.0869	0.03717
14.900	81.57	2.66	0.1461	0.06440

BET SURFACE AREA: 10.04 +/- 0.48 m^2/g
SLOPE: 0.4327 +/- 0.0205
INTERCEPT: 0.0007 +/- 0.0021
C: 593.53
Vm: 2.31 cm^3/g
CORRELATION COEFFICIENT 0.9989

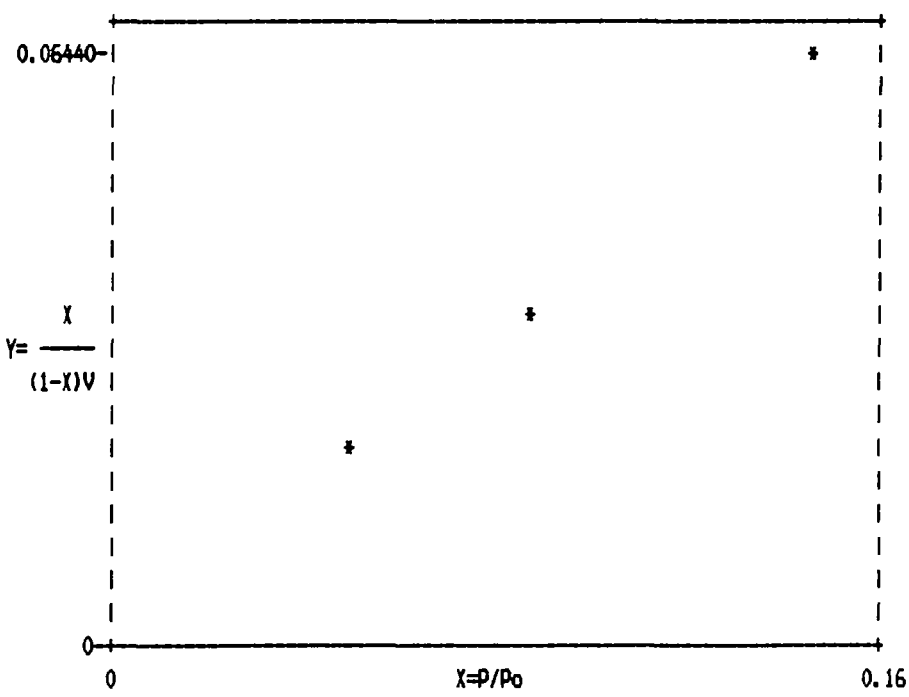

Figure B-15. Plot of BET equation versus relative pressure for Converter A249/0486-3-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/23/87

SAMPLE I.D.: A249/0486-3-A LL-2
SAMPLE WEIGHT: 30.8600 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	53.59	1.74	0.0490	0.02969
8.860	58.03	1.88	0.0869	0.05060
12.100	62.53	2.03	0.1187	0.06644

BET SURFACE AREA: 8.17 +/- 0.24 m^2/g
SLOPE: 0.5286 +/- 0.0154
INTERCEPT: 0.0041 +/- 0.0014
C: 131.45
Vm: 1.88 cm^3/g
CORRELATION COEFFICIENT 0.9996

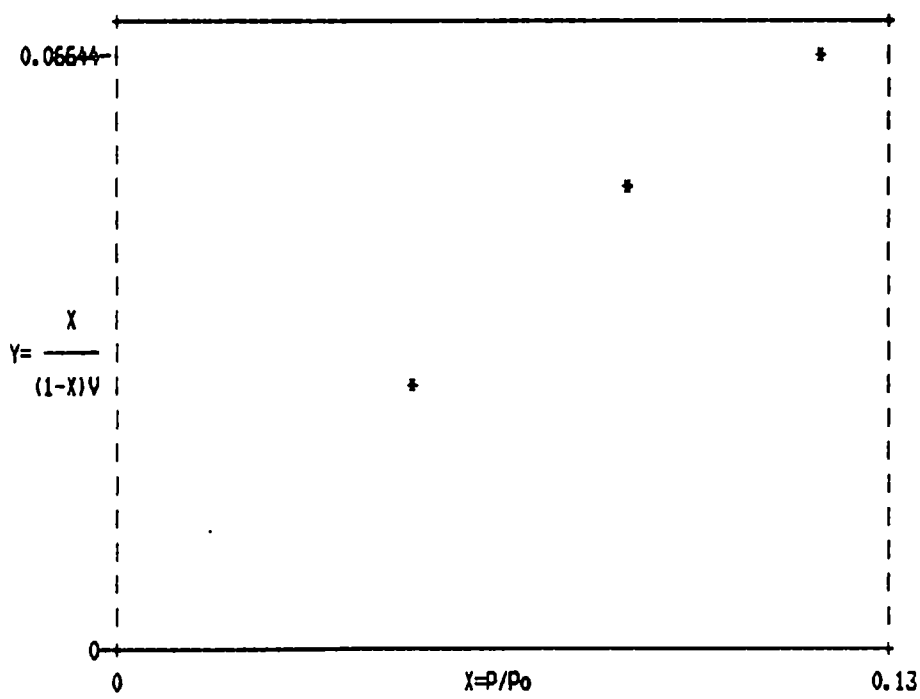

Figure B-16. Plot of BET equation versus relative pressure for Converter A249/0486-3-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/5/87

SAMPLE I.D.: A249/0486-3-A LL-3
SAMPLE WEIGHT: 31.0300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	72.25	2.33	0.0490	0.02214
8.860	75.80	2.44	0.0869	0.03895
12.100	78.13	2.52	0.1187	0.05347

BET SURFACE AREA: 9.68 +/- 0.08 m^2/g
SLOPE: 0.4497 +/- 0.0037
INTERCEPT: 0.0000 +/- 0.0003
C: 18243.18
Vm: 2.22 cm^3/g
CORRELATION COEFFICIENT 1.0000

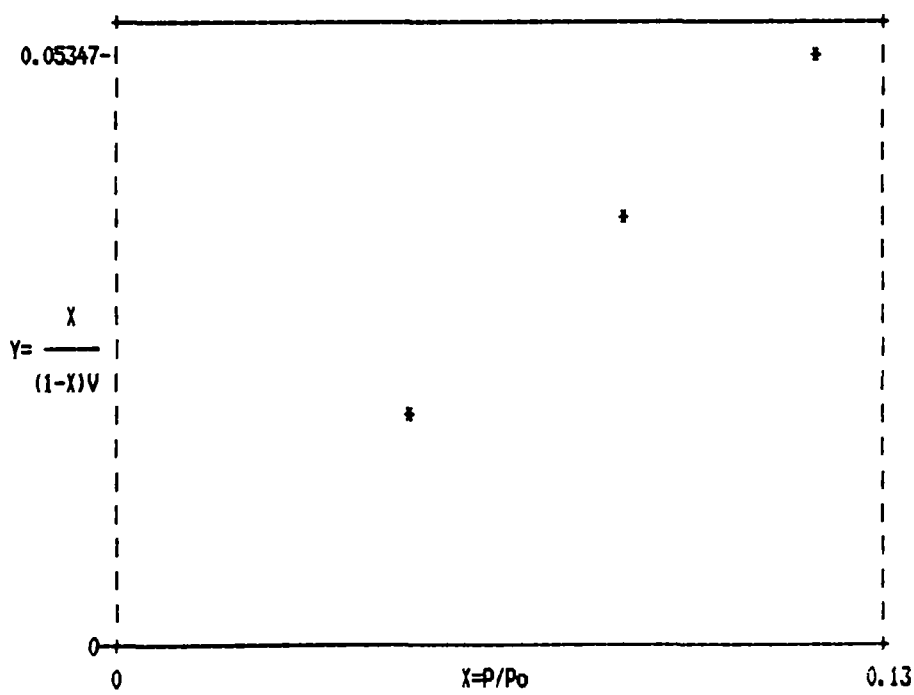

Figure B-17. Plot of BET equation versus relative pressure for Converter A249/0486-3-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/21/87

SAMPLE I.D.: A249/0486-3-A (LL-1)
SAMPLE WEIGHT: 1.7212 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	4.48	2.60	0.0490	0.01981
8.860	4.84	2.81	0.0869	0.03384
14.900	5.39	3.13	0.1461	0.05464
22.000	6.26	3.64	0.2157	0.07564

BET SURFACE AREA: 12.84 +/- 0.42 m^2/g
SLOPE: 0.3348 +/- 0.0110
INTERCEPT: 0.0043 +/- 0.0015
C: 78.65
Vm: 2.95 cm^3/g
CORRELATION COEFFICIENT 0.9989

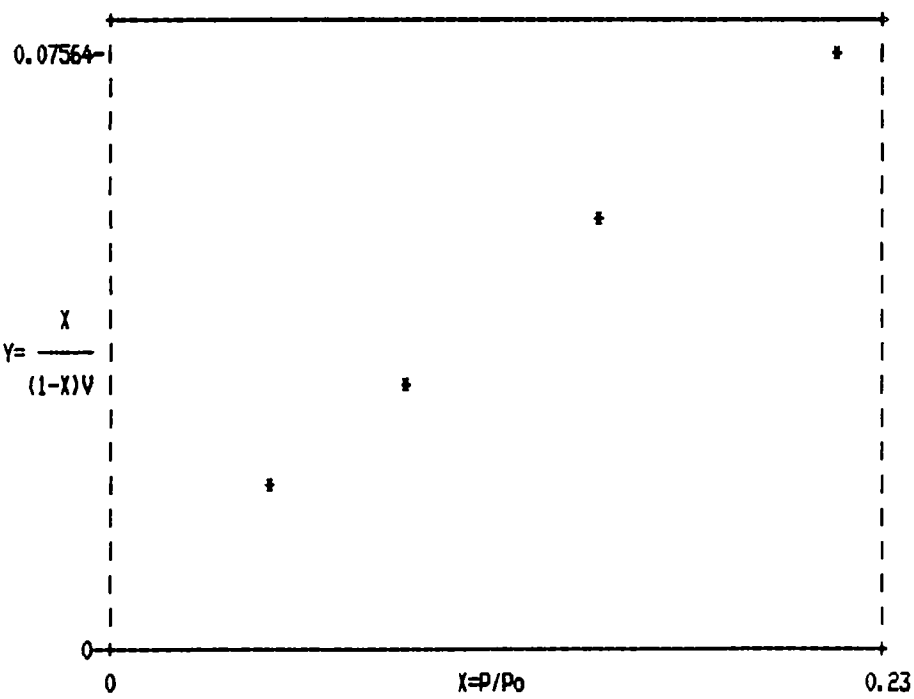

Figure B-18. Plot of BET equation versus relative pressure for Converter A249/0486-3-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/22/87

SAMPLE I.D.: A249/0486-3 UB-1
SAMPLE WEIGHT: 28.6700 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	18.59	0.65	0.0490	0.07952
8.860	20.52	0.72	0.0869	0.13294
14.900	21.48	0.75	0.1461	0.22840

BET SURFACE AREA: 2.82 +/- 0.10 m^2/g
SLOPE: 1.5404 +/- 0.0541
INTERCEPT: 0.0021 +/- 0.0055
C: 721.29
Vm: 0.65 cm^3/g
CORRELATION COEFFICIENT 0.9994

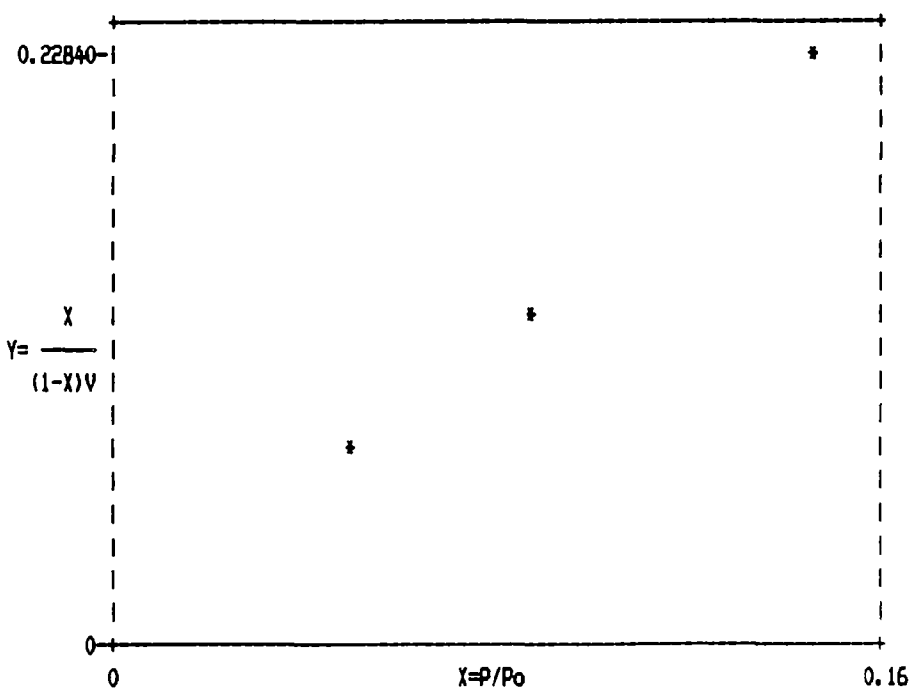

Figure B-19. Plot of BET equation versus relative pressure for Converter A249/0486-3-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/22/87

SAMPLE I.D.: A249/0486-3-B (UR-2) ADSORBATE: Nitrogen
SAMPLE WEIGHT: 29.6200 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	33.09	1.12	0.0490	0.04615
8.860	35.30	1.19	0.0869	0.07984
14.900	37.75	1.27	0.1461	0.13427

BET SURFACE AREA: 4.78 +/- 0.04 m^2/g
SLOPE: 0.9086 +/- 0.0078
INTERCEPT: 0.0013 +/- 0.0008
C: 680.83
Vm: 1.10 cm^3/g
CORRELATION COEFFICIENT 1.0000

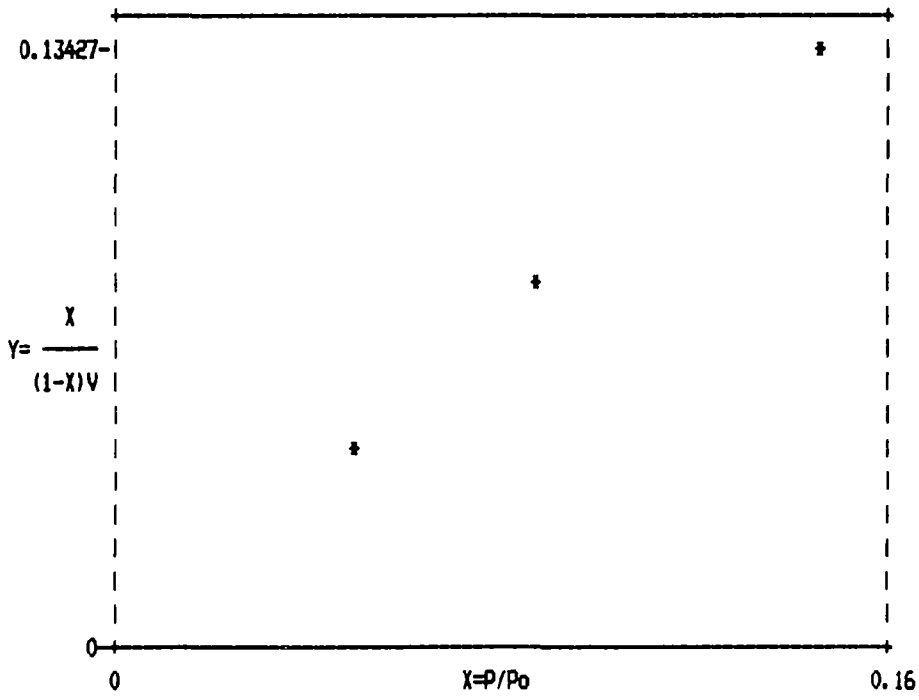

Figure B-20. Plot of BET equation versus relative pressure for Converter A249/0486-3-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/18/87

SAMPLE I.D.: A280/0004 L-A (LL-1)
SAMPLE WEIGHT: 28.6500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	36.85	1.29	0.0490	0.04009
8.100	39.91	1.39	0.0794	0.06194
14.900	44.47	1.55	0.1461	0.11024

BET SURFACE AREA: 5.98 +/- 0.01 m^2/g
SLOPE: 0.7229 +/- 0.0015
INTERCEPT: 0.0046 +/- 0.0002
C: 158.48
Vm: 1.37 cm^3/g
CORRELATION COEFFICIENT 1.0000

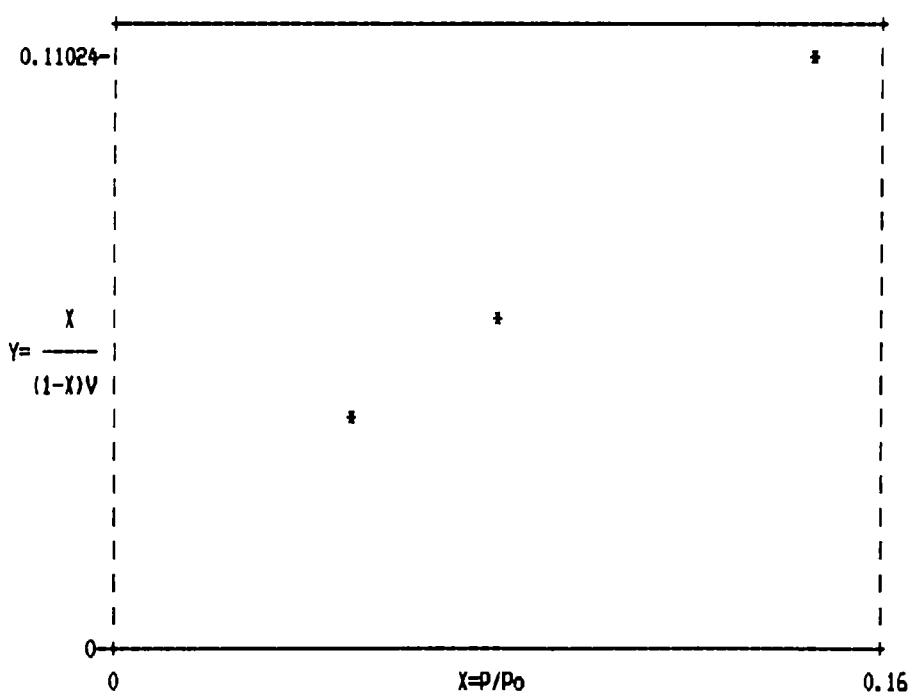

Figure B-21. Plot of BET equation versus relative pressure for Converter A280/0004L-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/10/87

SAMPLE I.D.: A280/0004L-A (LL-2) ADSORBATE: Nitrogen
SAMPLE WEIGHT: 25.0000 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	21.40	0.86	0.0490	0.06023
8.860	22.08	0.88	0.0869	0.10774
12.100	23.21	0.93	0.1187	0.14502

BET SURFACE AREA: 3.57 +/- 0.07 m^2/g
SLOPE: 1.2189 +/- 0.0233
INTERCEPT: 0.0009 +/- 0.0021
C: 1358.39
Vm: 0.82 cm^3/g
CORRELATION COEFFICIENT 0.9998

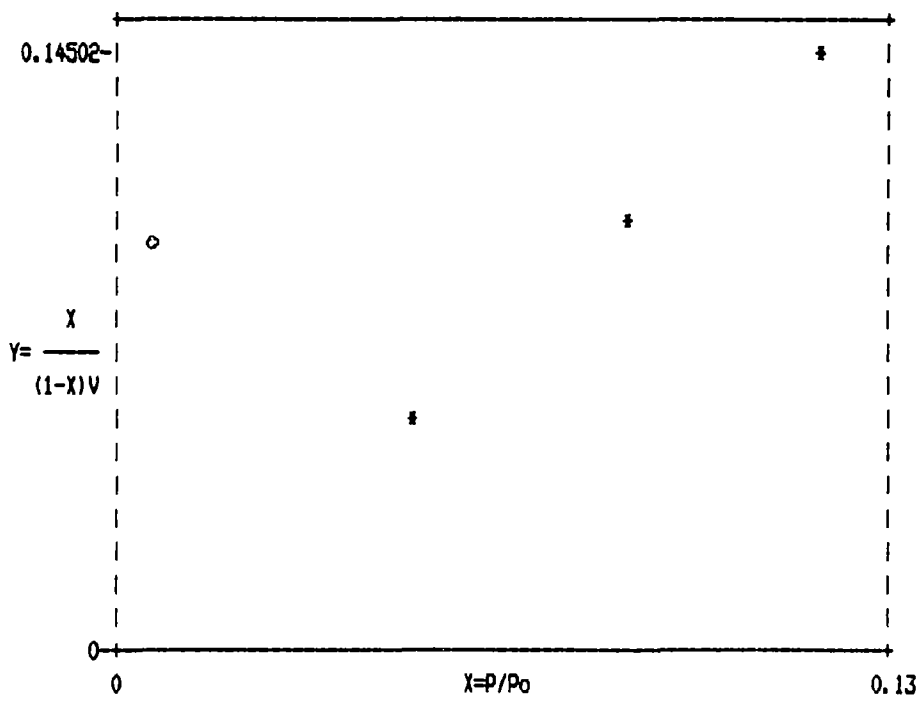

Figure B-22. Plot of BET equation versus relative pressure for Converter A280/0004L-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/19/87

SAMPLE I.D.: A280/0004L-4 LL-3
SAMPLE WEIGHT: 29.4100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	26.98	0.92	0.0490	0.05620
8.860	32.40	1.10	0.0869	0.08637
14.900	34.20	1.16	0.1461	0.14715

BET SURFACE AREA: 4.57 +/- 0.30 m^2/g
SLOPE: 0.9447 +/- 0.0620
INTERCEPT: 0.0078 +/- 0.0063
C: 122.65
Vm: 1.05 cm^3/g
CORRELATION COEFFICIENT 0.9979

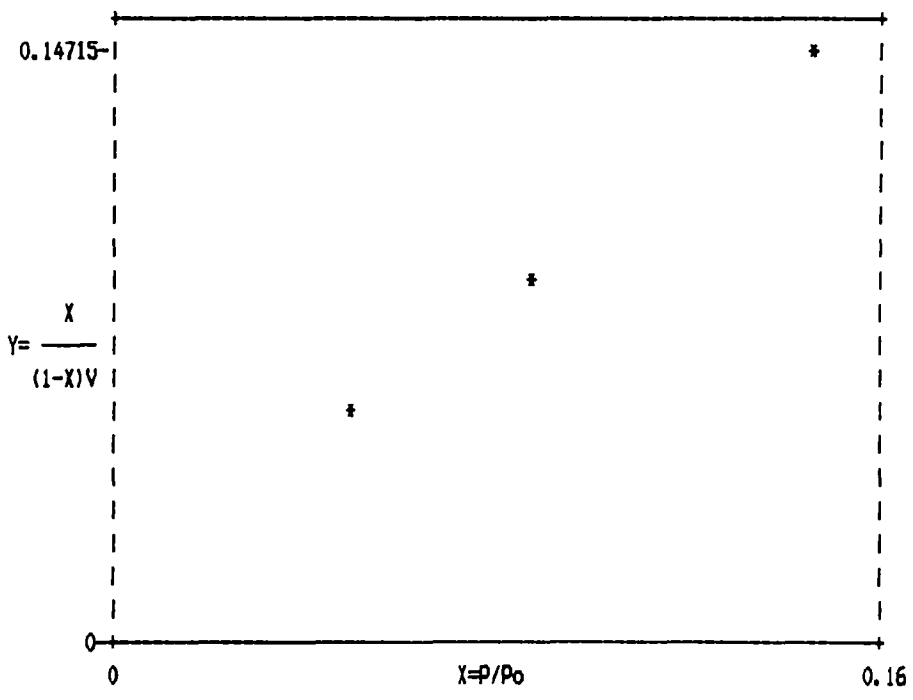

Figure B-23. Plot of BET equation versus relative pressure for Converter A280/0004L-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/20/87

SAMPLE I.D.: A280/0004L-A (LL-1)
SAMPLE WEIGHT: 1.6596 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.34	1.41	0.0490	0.03657
8.860	2.77	1.67	0.0869	0.05701
14.900	3.47	2.09	0.1461	0.08184
22.000	3.92	2.36	0.2157	0.11646

BET SURFACE AREA: 8.95 +/- 0.25 m^2/g
SLOPE: 0.4721 +/- 0.0135
INTERCEPT: 0.0142 +/- 0.0019
C: 34.20
Vm: 2.06 cm^3/g
CORRELATION COEFFICIENT 0.9992

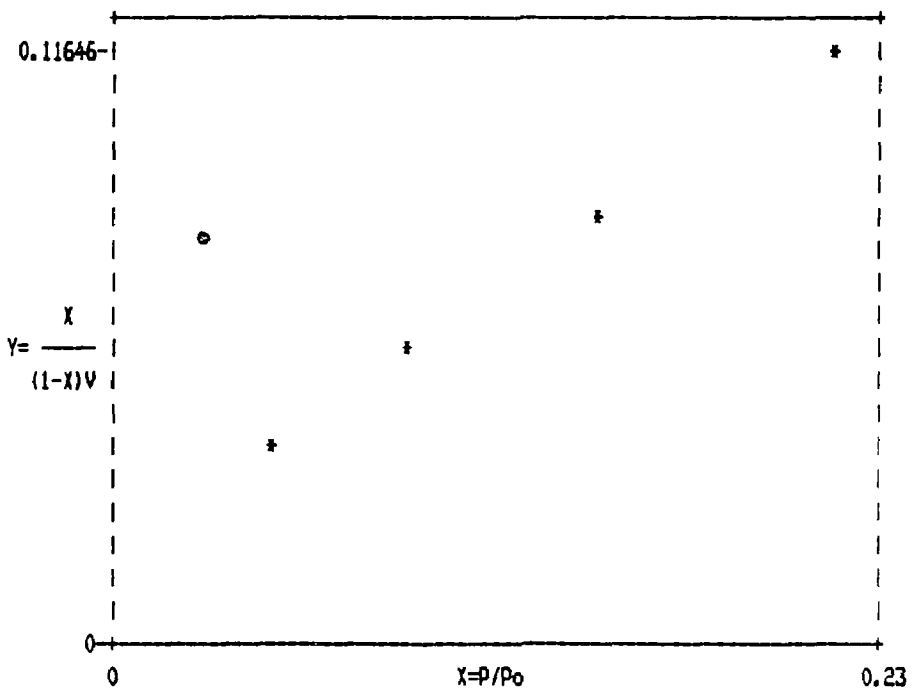

Figure B-24. Plot of BET equation versus relative pressure for Converter A280/0004L-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/20/87

SAMPLE I.D.: A280/0004L-B (UR-1)
SAMPLE WEIGHT: 24.5100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	48.47	1.98	0.0490	0.02607
8.860	51.00	2.08	0.0869	0.04573
14.900	53.33	2.18	0.1461	0.07864

BET SURFACE AREA: 8.03 +/- 0.15 m^2/g
SLOPE: 0.5428 +/- 0.0098
INTERCEPT: -0.0009 +/- 0.0010
C: -617.79
Vm: 1.85 cm^3/g
CORRELATION COEFFICIENT 0.9998

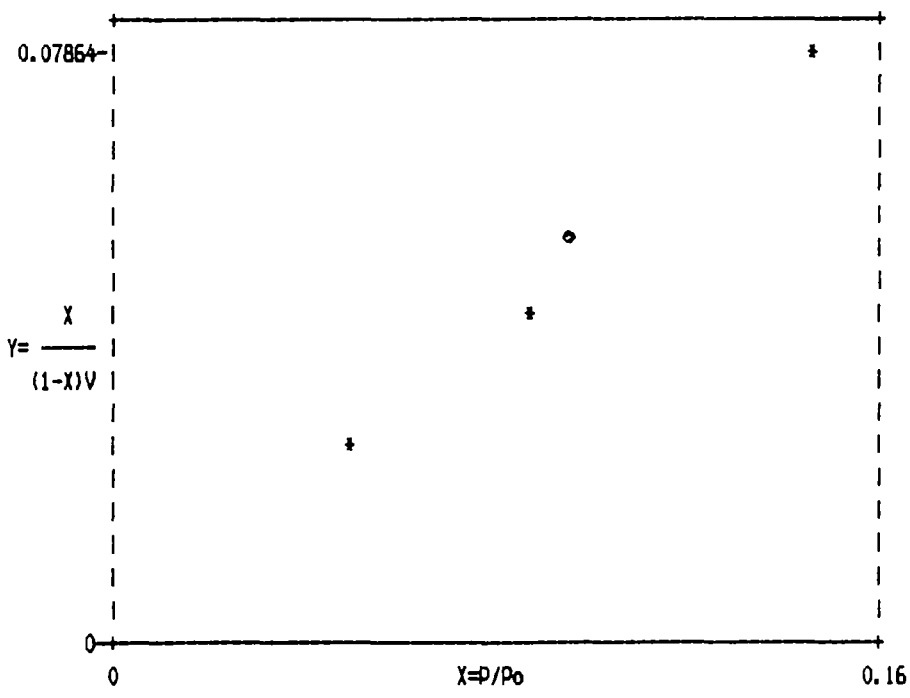

Figure B-25. Plot of BET equation versus relative pressure for Converter A280/0004L-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/19/87

SAMPLE I.D.: A280/0004L-B UR-2
SAMPLE WEIGHT: 24.7700 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	35.63	1.44	0.0490	0.03584
8.860	40.15	1.62	0.0869	0.05870
14.900	42.63	1.72	0.1461	0.09943

BET SURFACE AREA: 6.59 +/- 0.23 m^2/g
SLOPE: 0.6578 +/- 0.0226
INTERCEPT: 0.0028 +/- 0.0023
C: 234.49
Vm: 1.51 cm^3/g
CORRELATION COEFFICIENT 0.9994

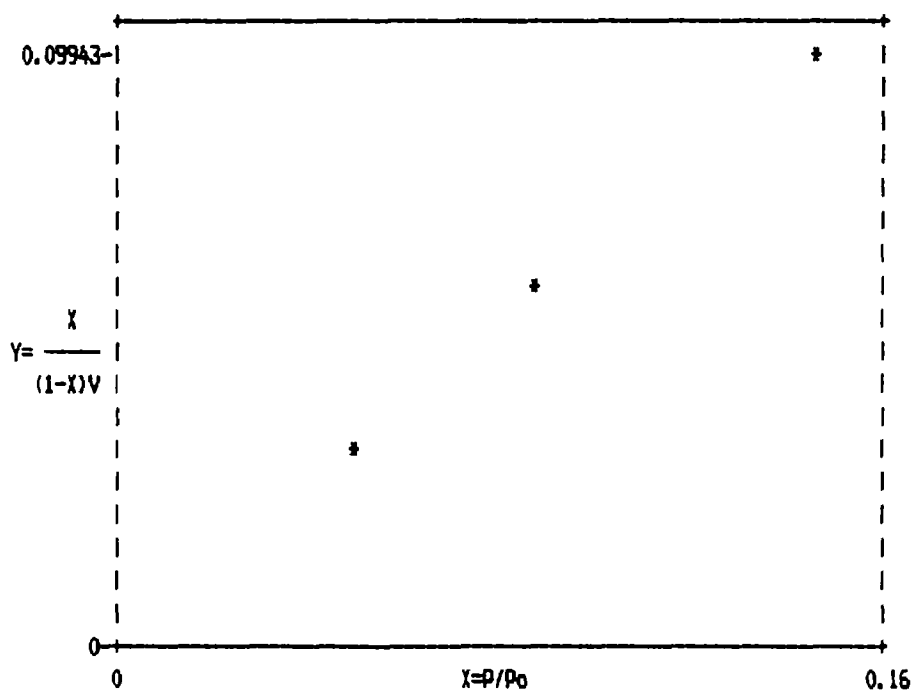

Figure B-26. Plot of BET equation versus relative pressure for Converter A280/0004L-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/11/87

SAMPLE I.D.: A280/0006L-A LL-1
SAMPLE WEIGHT: 29.9800 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	52.87	1.76	0.0490	0.02924
8.860	56.66	1.89	0.0869	0.05035
12.100	58.89	1.96	0.1187	0.06854

BET SURFACE AREA: 7.69 +/- 0.06 m^2/g
SLOPE: 0.5643 +/- 0.0043
INTERCEPT: 0.0015 +/- 0.0004
C: 379.21
Vm: 1.77 cm^3/g
CORRELATION COEFFICIENT 1.0000

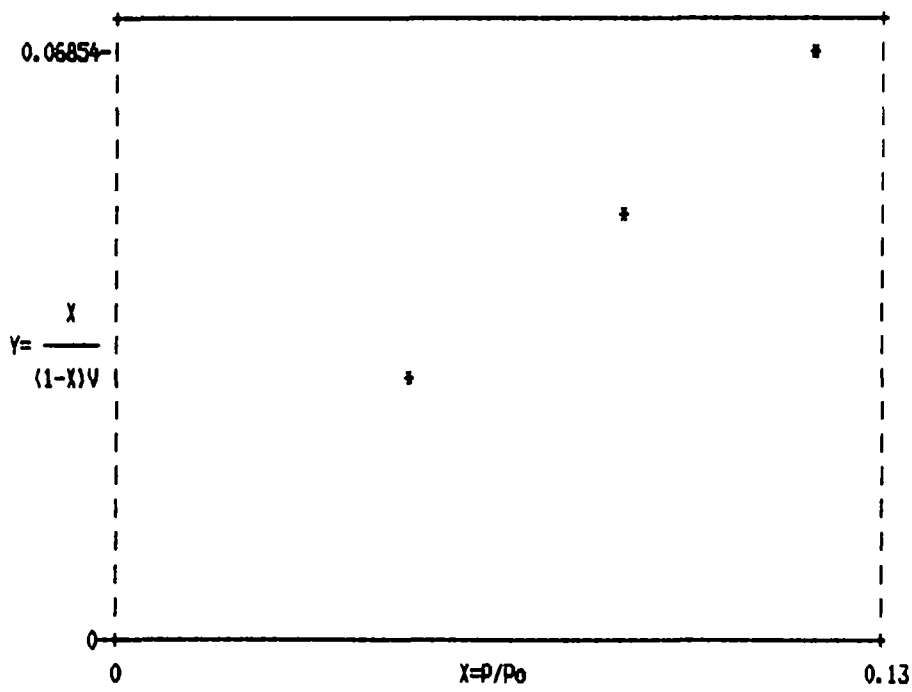

Figure B-27. Plot of BET equation versus relative pressure for Converter A280/0006L-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/5/87

SAMPLE I.D.: A280/0006L-A LL-2
SAMPLE WEIGHT: 27.4400 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	40.25	1.47	0.0490	0.03515
8.860	44.40	1.62	0.0869	0.05881
12.100	49.53	1.81	0.1187	0.07459

BET SURFACE AREA: 7.55 +/- 0.48 m^2/g
SLOPE: 0.5683 +/- 0.0366
INTERCEPT: 0.0080 +/- 0.0033
C: 72.39
Vm: 1.74 cm^3/g
CORRELATION COEFFICIENT 0.9979

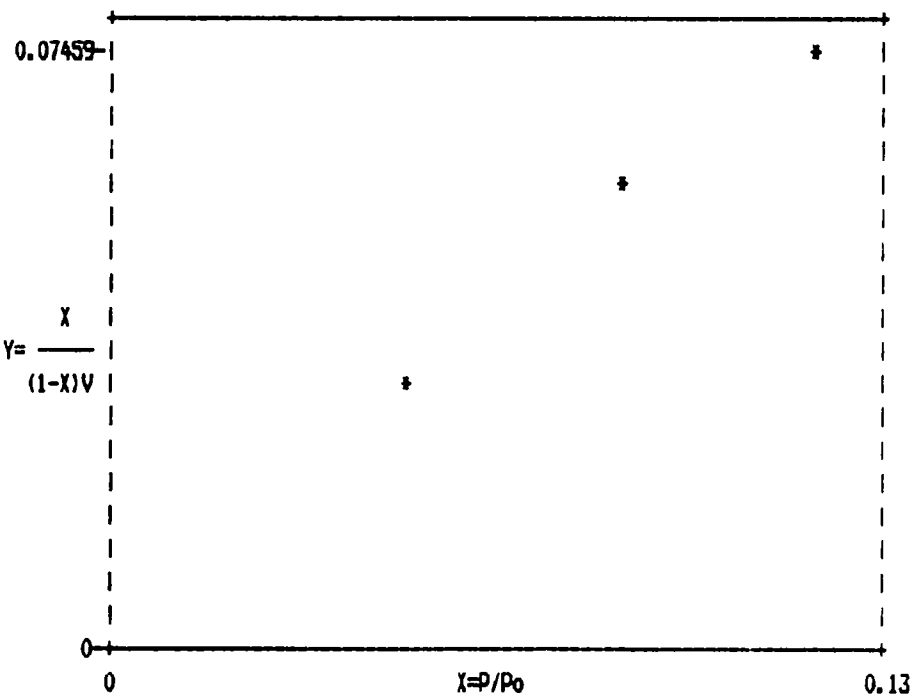

Figure B-28. Plot of BET equation versus relative pressure for Converter A280/0006L-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/10/87

SAMPLE I.D.: A280/0006L-A LL-3
SAMPLE WEIGHT: 30.5500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	48.82	1.60	0.0490	0.03226
8.860	52.77	1.73	0.0869	0.05509
12.100	55.17	1.81	0.1187	0.07455

BET SURFACE AREA: 7.14 +/- 0.03 m^2/g
SLOPE: 0.6072 +/- 0.0027
INTERCEPT: 0.0024 +/- 0.0002
C: 249.79
Vm: 1.64 cm^3/g
CORRELATION COEFFICIENT 1.0000

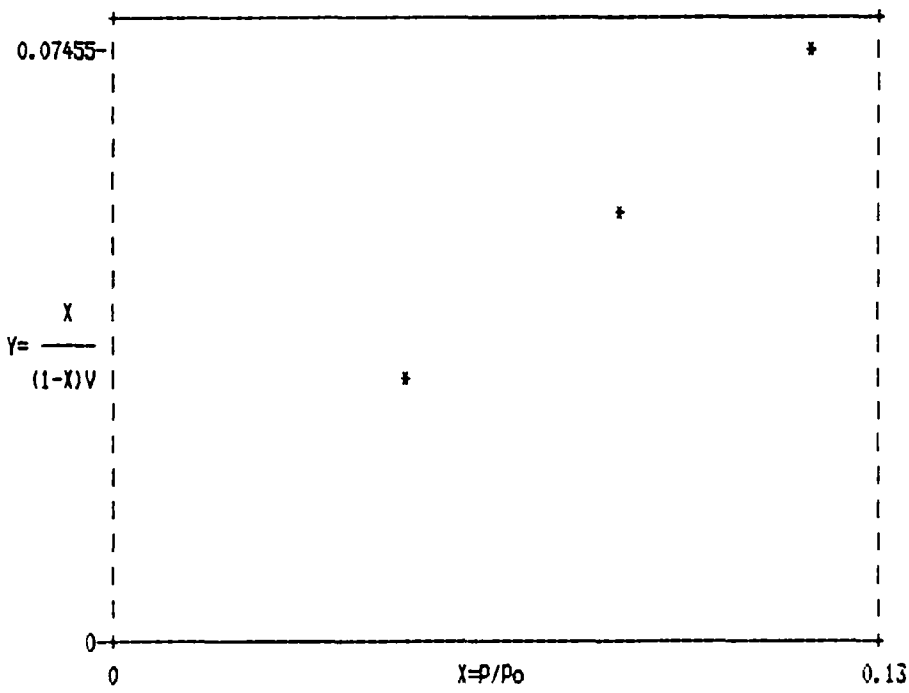

Figure B-29. Plot of BET equation versus relative pressure for Converter A280/0006L-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/12/87

SAMPLE I.D.: A280/0006L-A LL-1 100 MESH
SAMPLE WEIGHT: 1.4995 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.67	1.78	0.0490	0.02896
8.860	2.94	1.96	0.0869	0.04853
12.100	3.23	2.15	0.1187	0.06250
22.000	4.01	2.67	0.2157	0.10287

BET SURFACE AREA: 9.74 +/- 0.33 m^2/g
SLOPE: 0.4379 +/- 0.0152
INTERCEPT: 0.0092 +/- 0.0020
C: 48.48
Vm: 2.24 cm^3/g
CORRELATION COEFFICIENT 0.9988

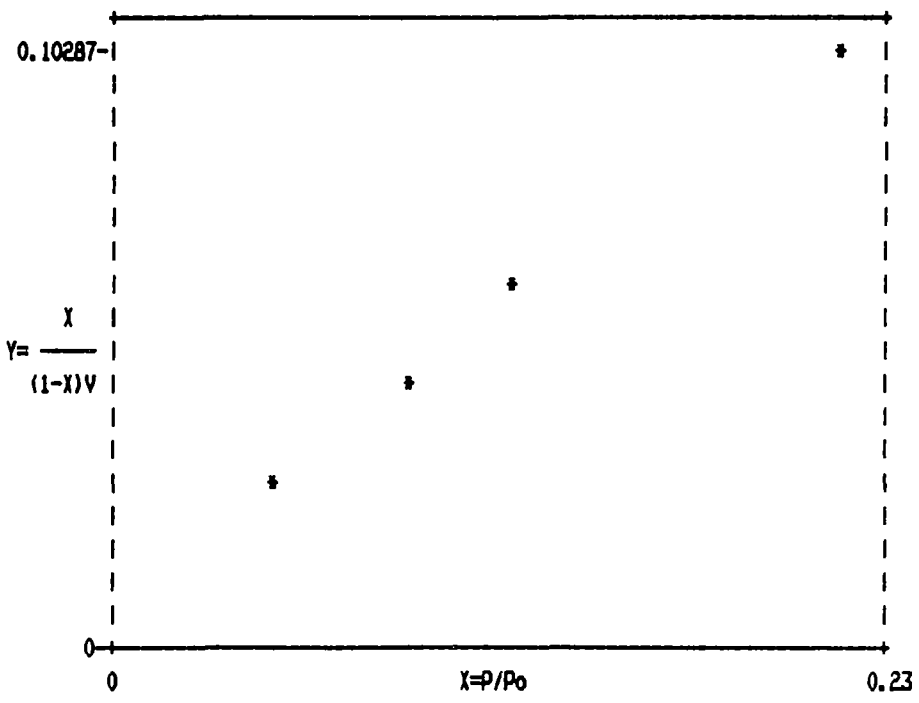

Figure B-30. Plot of BET equation versus relative pressure for Converter A280/0006L-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/21/87

SAMPLE I.D.: A280/0006L-B (UR-1)
SAMPLE WEIGHT: 24.2700 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	27.14	1.12	0.0490	0.04611
8.860	34.31	1.41	0.0869	0.06731
14.900	38.89	1.60	0.1461	0.10679

BET SURFACE AREA: 6.77 +/- 0.30 m^2/g
SLOPE: 0.6287 +/- 0.0288
INTERCEPT: 0.0143 +/- 0.0029
C: 44.98
Vm: 1.56 cm^3/g
CORRELATION COEFFICIENT 0.9990

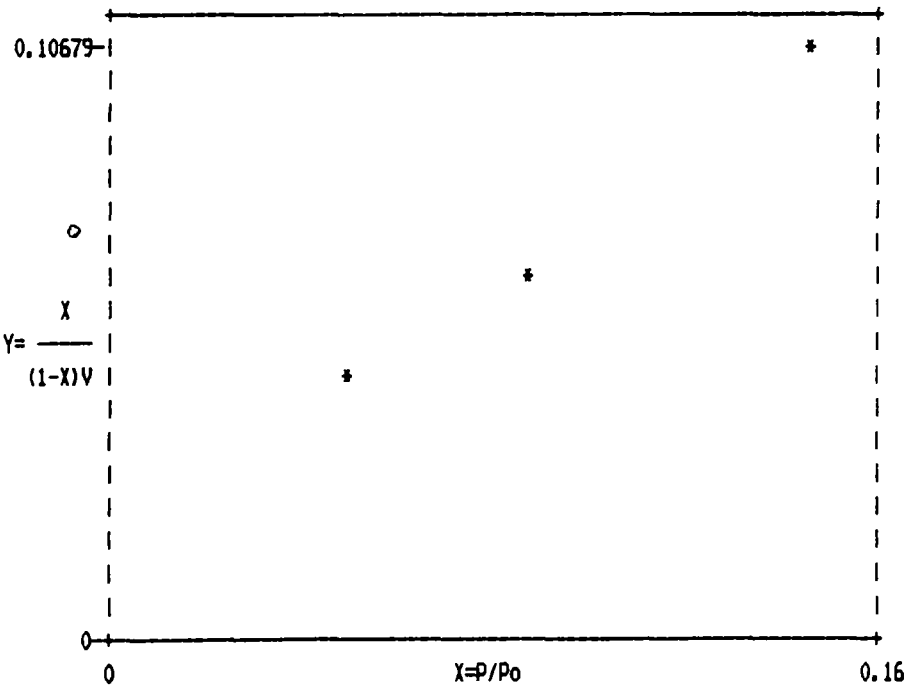

Figure B-31. Plot of BET equation versus relative pressure for Converter A280/0006L-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/21/87

SAMPLE I.D.: A280/0006L-B (UR-2)
SAMPLE WEIGHT: 27.7300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	54.45	1.96	0.0490	0.02626
8.860	57.86	2.09	0.0869	0.04560
14.900	62.72	2.26	0.1461	0.07566

BET SURFACE AREA: 8.54 +/- 0.02 m^2/g
SLOPE: 0.5087 +/- 0.0012
INTERCEPT: 0.0014 +/- 0.0001
C: 377.78
Vm: 1.96 cm^3/g
CORRELATION COEFFICIENT 1.0000

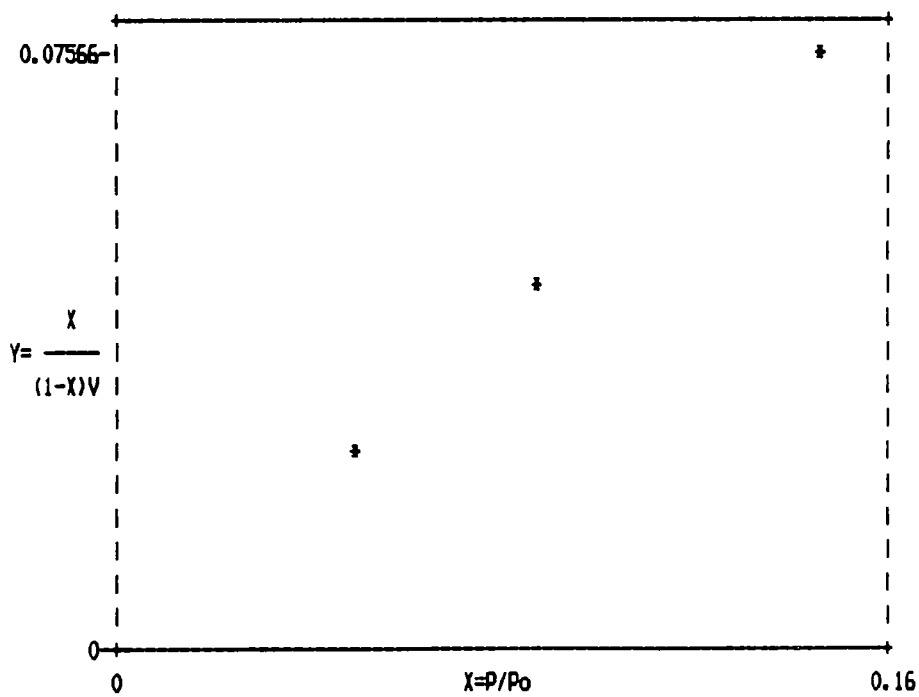

Figure B-32. Plot of BET equation versus relative pressure for Converter A280/0006L-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/17/87

SAMPLE I.D.: A317/0196-A (LL-1)
SAMPLE WEIGHT: 19.0300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	34.84	1.83	0.0490	0.02816
8.860	40.68	2.14	0.0869	0.04451
12.100	44.31	2.33	0.1187	0.05782

BET SURFACE AREA: 10.04 +/- 0.09 m^2/g
SLOPE: 0.4262 +/- 0.0037
INTERCEPT: 0.0073 +/- 0.0003
C: 59.10
Vm: 2.31 cm^3/g
CORRELATION COEFFICIENT 1.0000

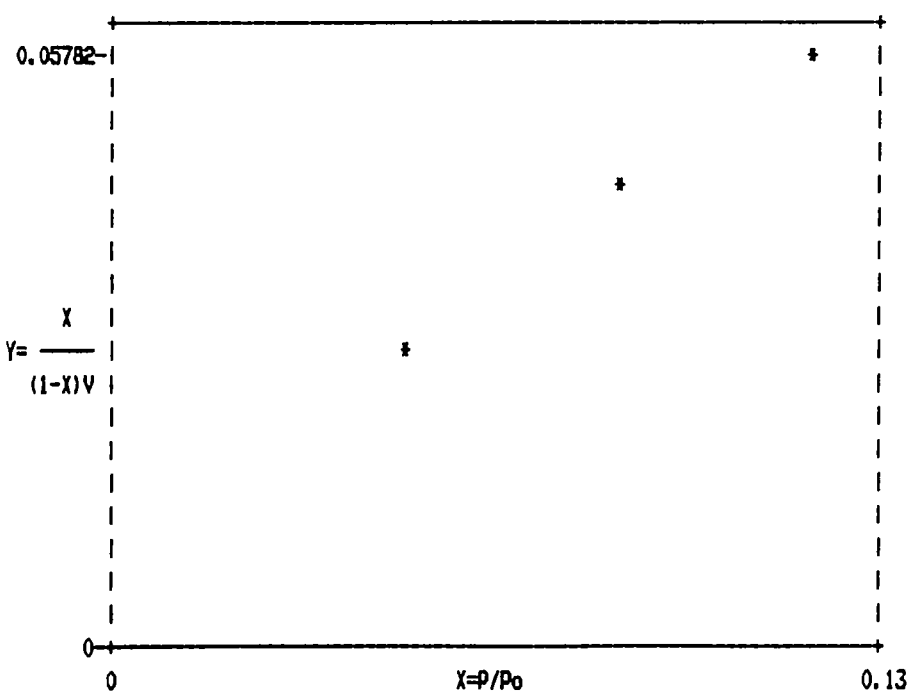

Figure B-33. Plot of BET equation versus relative pressure for Converter A317/0196-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/17/87

SAMPLE I.D.: A317/0196-A LL-2
SAMPLE WEIGHT: 17.4200 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	27.85	1.60	0.0490	0.03225
8.600	30.52	1.75	0.0843	0.05257
12.100	32.66	1.87	0.1187	0.07181

BET SURFACE AREA: 7.60 +/- 0.06 m^2/g
SLOPE: 0.5682 +/- 0.0043
INTERCEPT: 0.0045 +/- 0.0004
C: 127.94
Vm: 1.75 cm^3/g
CORRELATION COEFFICIENT 1.0000

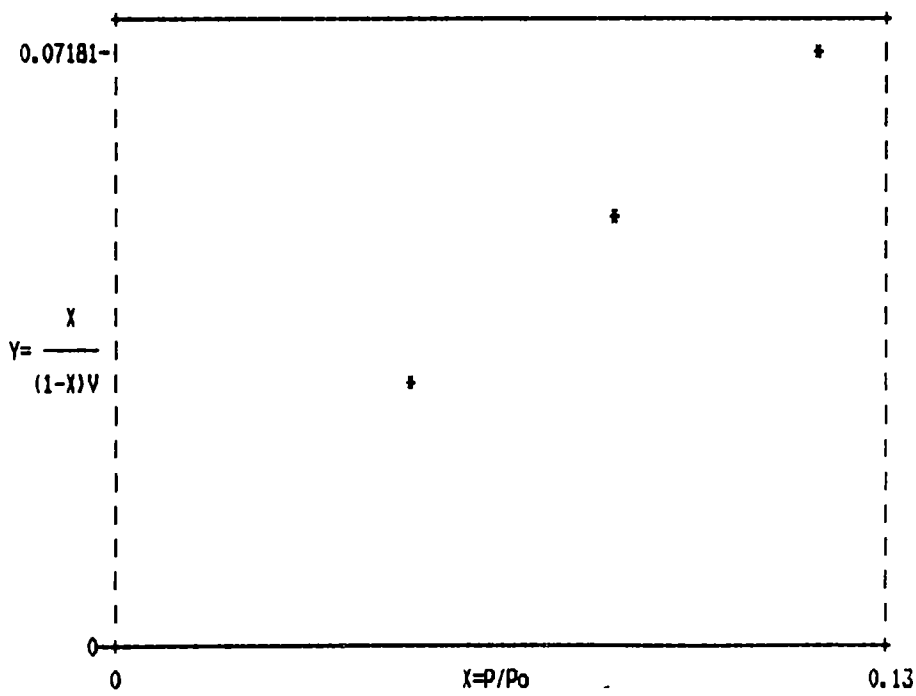

Figure B-34. Plot of BET equation versus relative pressure for Converter A317/0196-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/17/8788898

SAMPLE I.D.: A317/0196-A (LL-3)
SAMPLE WEIGHT: 21.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	46.53	2.22	0.0490	0.02327
8.860	49.45	2.35	0.0869	0.04041
14.900	53.75	2.56	0.1461	0.06686

BET SURFACE AREA: 9.67 +/- 0.04 m^2/g
SLOPE: 0.4487 +/- 0.0017
INTERCEPT: 0.0013 +/- 0.0002
C: 339.51
Vm: 2.22 cm^3/g
CORRELATION COEFFICIENT 1.0000

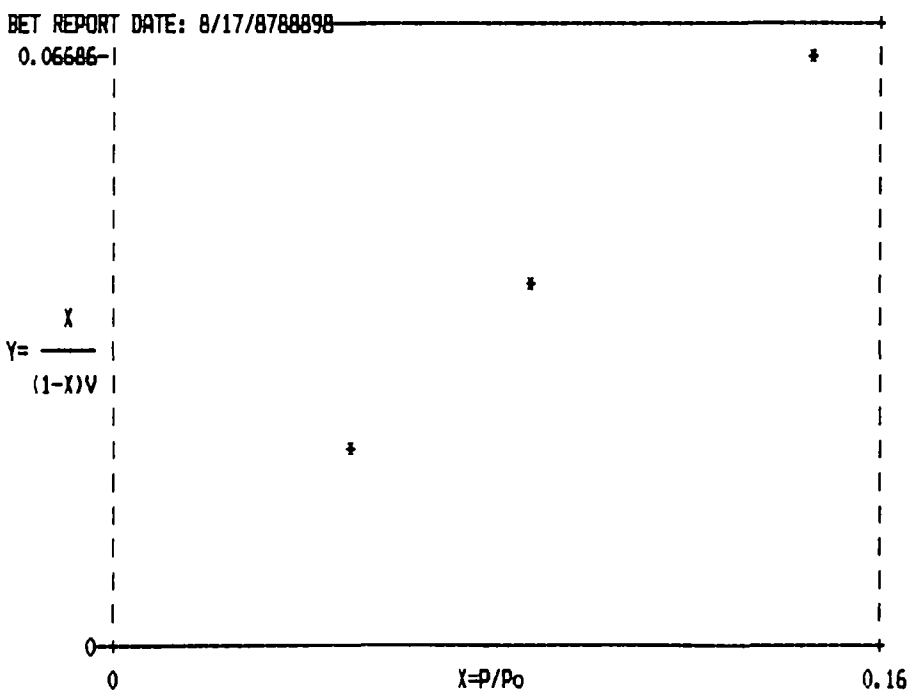

Figure B-35. Plot of BET equation versus relative pressure for Converter A317/0196-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/19/87

SAMPLE I.D.: A317/0169-A (LL-1) 100 MESH
SAMPLE WEIGHT: 1.4337 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.10	2.16	0.0490	0.02385
8.860	3.45	2.41	0.0869	0.03954
14.900	3.95	2.76	0.1461	0.06211
22.000	4.43	3.09	0.2157	0.08903

BET SURFACE AREA: 11.04 +/- 0.11 m^2/g
SLOPE: 0.3893 +/- 0.0039
INTERCEPT: 0.0052 +/- 0.0005
C: 76.06
Vm: 2.53 cm^3/g
CORRELATION COEFFICIENT 0.9999

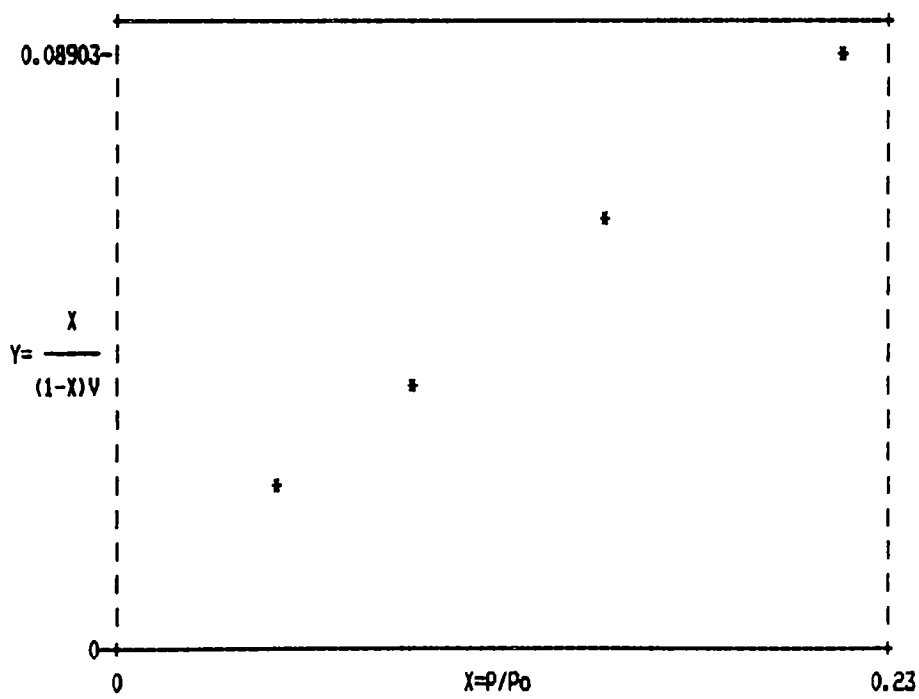

Figure B-36. Plot of BET equation versus relative pressure for Converter A317/0196-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/17/87

SAMPLE I.D.: A317/0196-B (UR-1)
SAMPLE WEIGHT: 14.9100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	38.04	2.55	0.0490	0.02021
8.860	43.80	2.94	0.0869	0.03239
14.900	46.54	3.12	0.1461	0.05482

BET SURFACE AREA: 12.07 +/- 0.52 m^2/g
SLOPE: 0.3585 +/- 0.0154
INTERCEPT: 0.0021 +/- 0.0016
C: 171.14
Vm: 2.77 cm^3/g
CORRELATION COEFFICIENT 0.9991

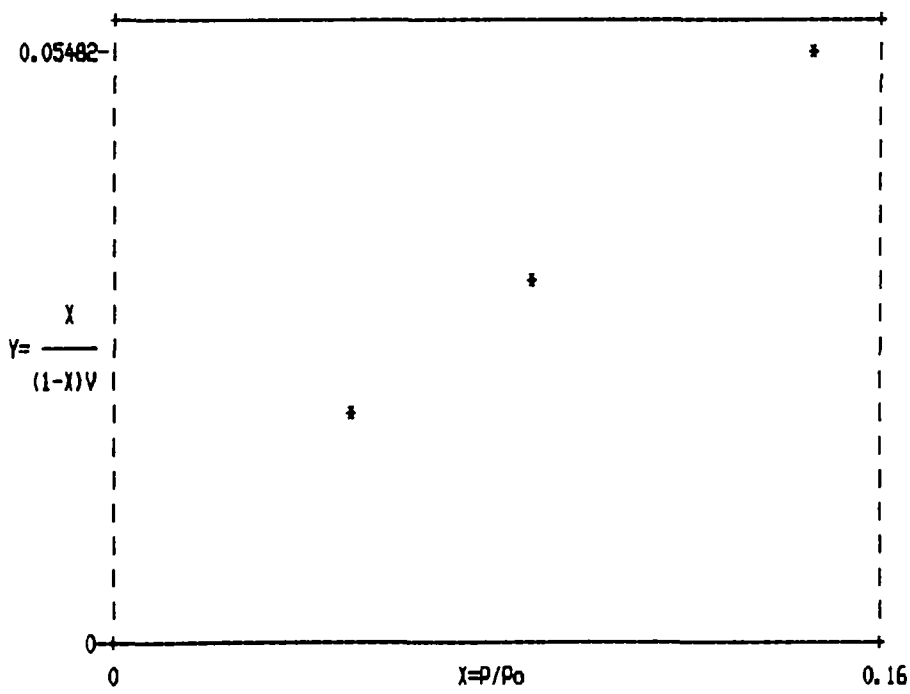

Figure B-37. Plot of BET equation versus relative pressure for Converter A317/0196-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/18/87

SAMPLE I.D.: A317/0196B (UR-2)
SAMPLE WEIGHT: 17.4500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	44.99	2.58	0.0490	0.02000
8.600	48.54	2.78	0.0843	0.03311
14.900	51.82	2.97	0.1461	0.05762

BET SURFACE AREA: 11.18 +/- 0.19 m^2/g
SLOPE: 0.3886 +/- 0.0066
INTERCEPT: 0.0007 +/- 0.0007
C: 548.87
Vm: 2.57 cm^3/g
CORRELATION COEFFICIENT 0.9999

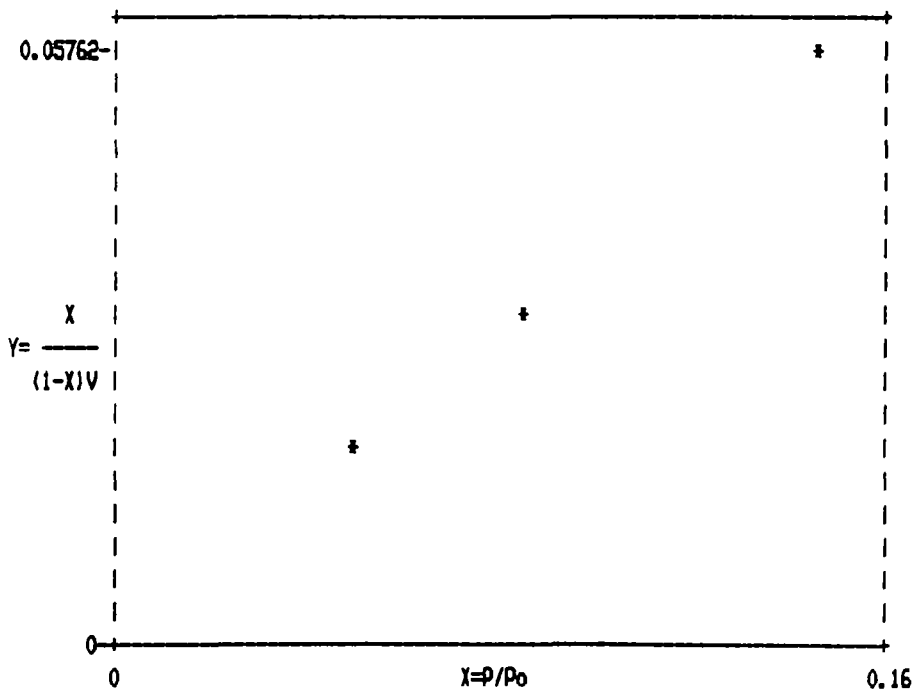

Figure B-38. Plot of BET equation versus relative pressure for Converter A317/0196-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/13/87

SAMPLE I.D.: A317/1115-ALLL-1
SAMPLE WEIGHT: 18.7700 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	49.52	2.64	0.0490	0.01954
8.860	51.08	2.72	0.0869	0.03497
12.100	52.35	2.79	0.1187	0.04827

BET SURFACE AREA: 10.57 +/- 0.08 m^2/g
SLOPE: 0.4125 +/- 0.0032
INTERCEPT: -0.0007 +/- 0.0003
C: -556.17
Vm: 2.43 cm^3/g
CORRELATION COEFFICIENT 1.0000

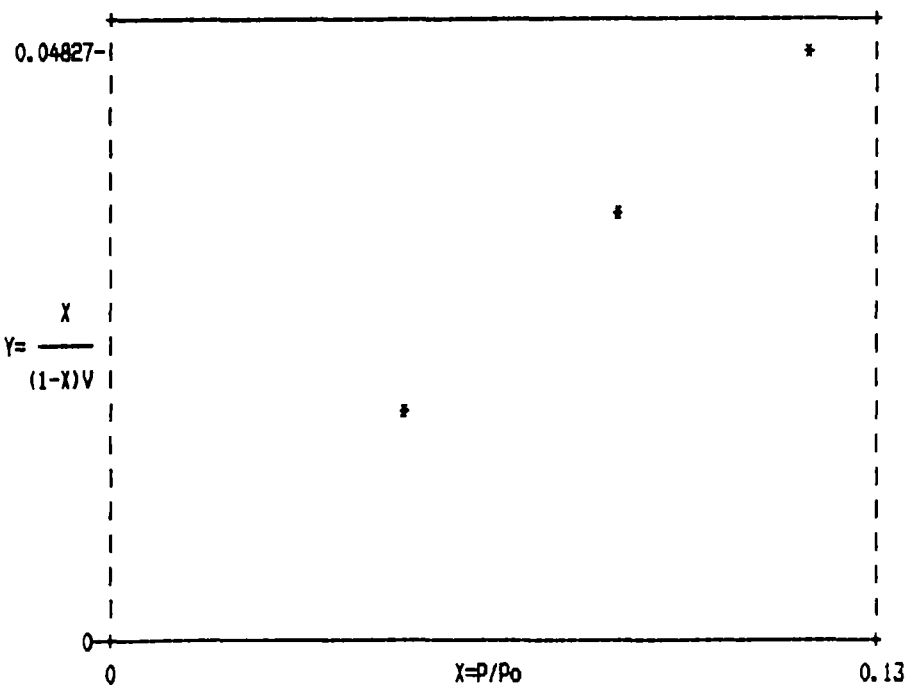

Figure B-39. Plot of BET equation versus relative pressure for Converter A317/1115-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/17/87

SAMPLE I.D.: A317/1115A (LL-2)
SAMPLE WEIGHT: 18.7700 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	40.94	2.18	0.0490	0.02364
8.860	42.79	2.28	0.0869	0.04174
14.900	49.75	2.65	0.1461	0.06456

BET SURFACE AREA: 10.31 +/- 0.62 m^2/g
SLOPE: 0.4183 +/- 0.0251
INTERCEPT: 0.0040 +/- 0.0026
C: 105.94
Vm: 2.37 cm^3/g
CORRELATION COEFFICIENT 0.9982

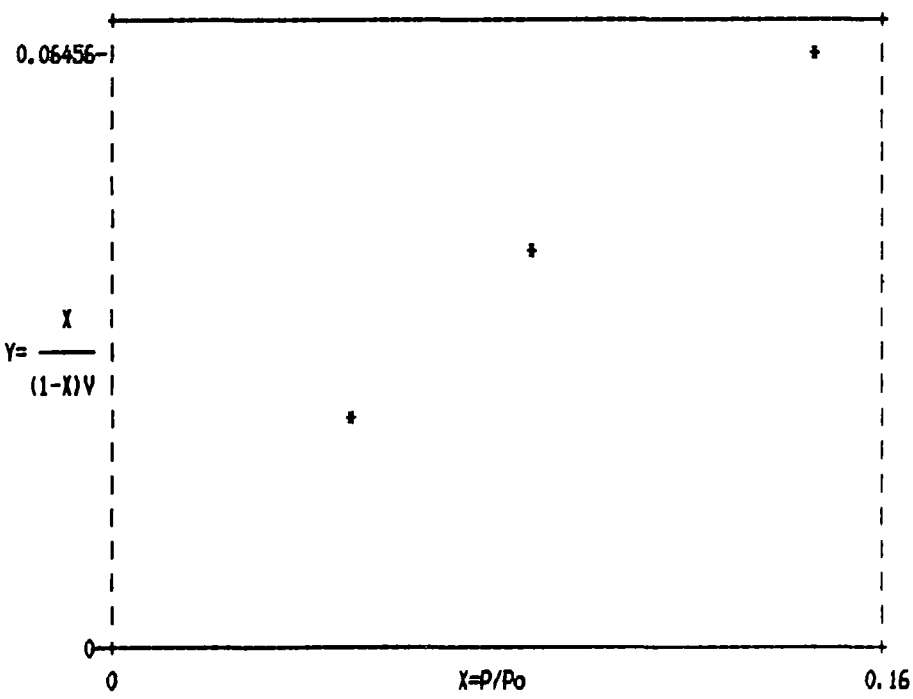

Figure B-40. Plot of BET equation versus relative pressure for Converter A317/1115-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/14/87

SAMPLE I.D.: A317/1115-A (LL-3)
SAMPLE WEIGHT: 19.0400 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	21.25	1.12	0.0490	0.04620
8.860	22.41	1.18	0.0869	0.08084
12.100	23.28	1.22	0.1187	0.11011

BET SURFACE AREA: 4.74 +/- 0.01 m^2/g
SLOPE: 0.9179 +/- 0.0013
INTERCEPT: 0.0012 +/- 0.0001
C: 791.64
Vm: 1.09 cm^3/g
CORRELATION COEFFICIENT 1.0000

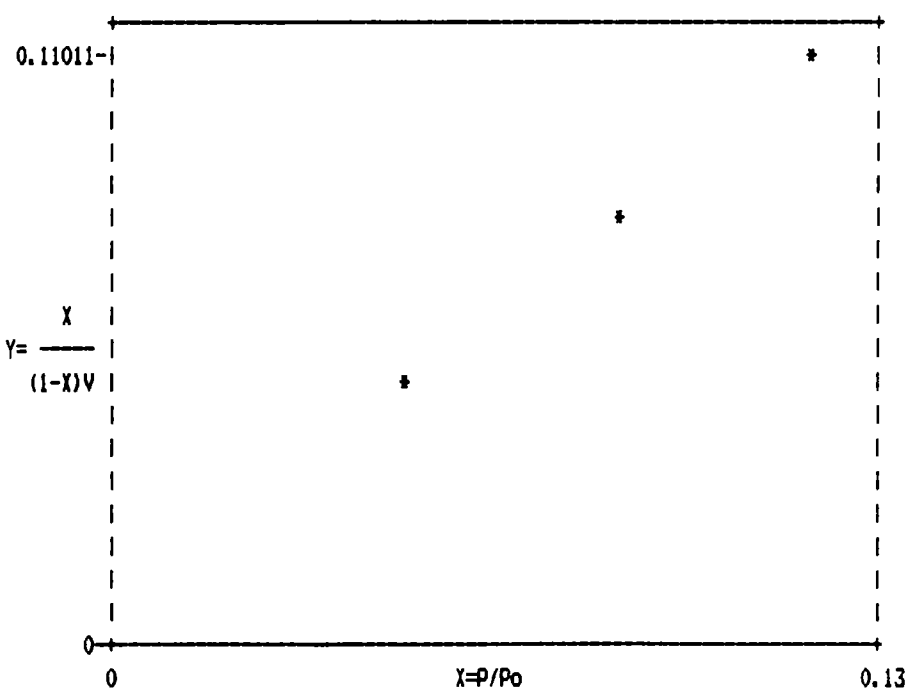

Figure B-41. Plot of BET equation versus relative pressure for Converter A317/1115-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/21/87

SAMPLE I.D.: A317/1115-A (11-1)
SAMPLE WEIGHT: 1.6470 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	4.89	2.97	0.0490	0.01737
8.860	5.43	3.30	0.0869	0.02886
14.900	6.26	3.80	0.1461	0.04502
22.000	6.75	4.10	0.2157	0.06712

BET SURFACE AREA: 14.56 +/- 0.32 m^2/g
SLOPE: 0.2962 +/- 0.0066
INTERCEPT: 0.0027 +/- 0.0009
C: 109.37
Vm: 3.35 cm^3/g
CORRELATION COEFFICIENT 0.9995

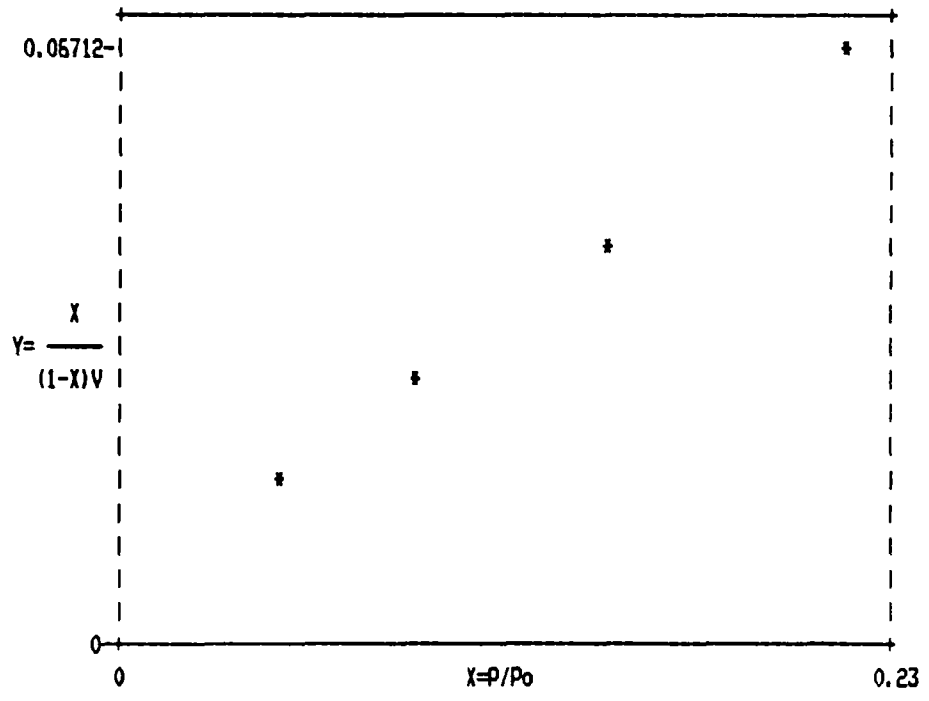

Figure B-42. Plot of BET equation versus relative pressure for Converter A317/1115-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/14/87

SAMPLE I.D.: A317/1115-B (UR-1)
SAMPLE WEIGHT: 16.8100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	39.46	2.35	0.0490	0.02196
8.860	42.65	2.54	0.0869	0.03750
12.100	43.25	2.57	0.1187	0.05233

BET SURFACE AREA: 9.99 +/- 0.37 m^2/g
SLOPE: 0.4353 +/- 0.0160
INTERCEPT: 0.0003 +/- 0.0014
C: 1329.14
Vm: 2.30 cm^3/g
CORRELATION COEFFICIENT 0.9993

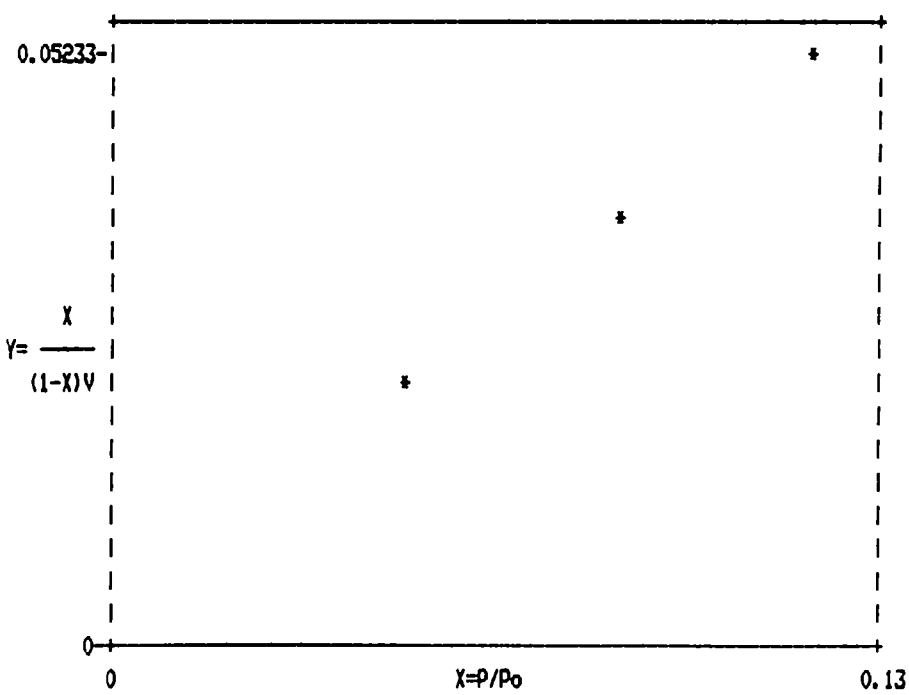

Figure B-43. Plot of BET equation versus relative pressure for Converter A317/1115-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/14/87

SAMPLE I.D.: A317/1115-B (UR-2)
SAMPLE WEIGHT: 18.7400 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	49.83	2.66	0.0490	0.01939
8.860	50.73	2.71	0.0869	0.03515
12.100	54.96	2.93	0.1187	0.04591

BET SURFACE AREA: 11.37 +/- 0.66 m^2/g
SLOPE: 0.3820 +/- 0.0222
INTERCEPT: 0.0011 +/- 0.0020
C: 357.87
Vm: 2.61 cm^3/g
CORRELATION COEFFICIENT 0.9983

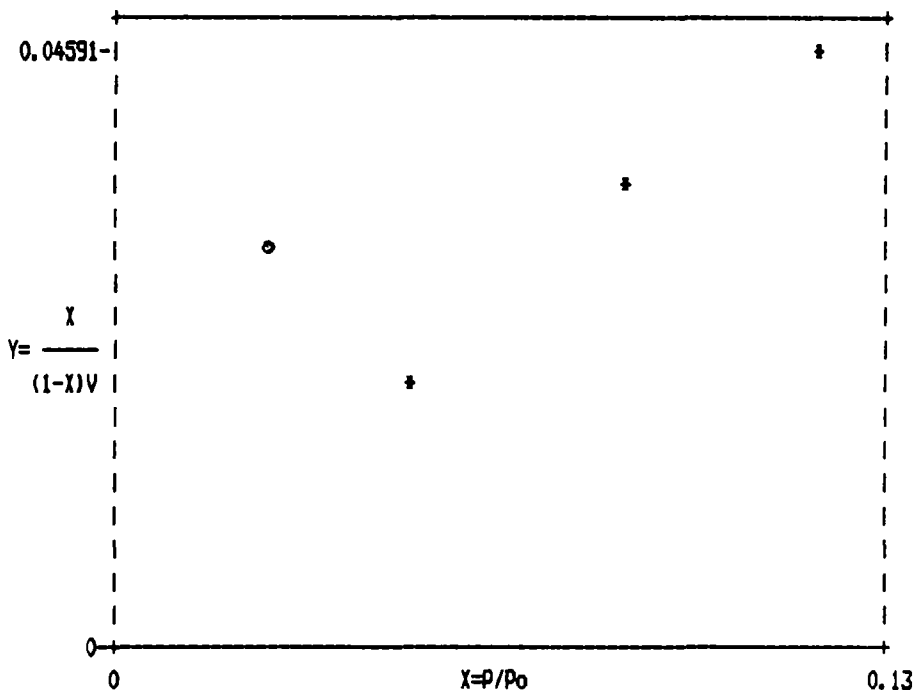

Figure B-44. Plot of BET equation versus relative pressure for Converter A317/1115-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/1/87

SAMPLE I.D.: A337/0151-A LL-1 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 17.3500 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	50.77	2.93	0.0490	0.01762
8.860	55.48	3.20	0.0869	0.02976
14.900	60.14	3.47	0.1461	0.04937

BET SURFACE AREA: 13.24 +/- 0.11 m^2/g
SLOPE: 0.3274 +/- 0.0028
INTERCEPT: 0.0015 +/- 0.0003
C: 223.38
Vm: 3.04 cm^3/g
CORRELATION COEFFICIENT 1.0000

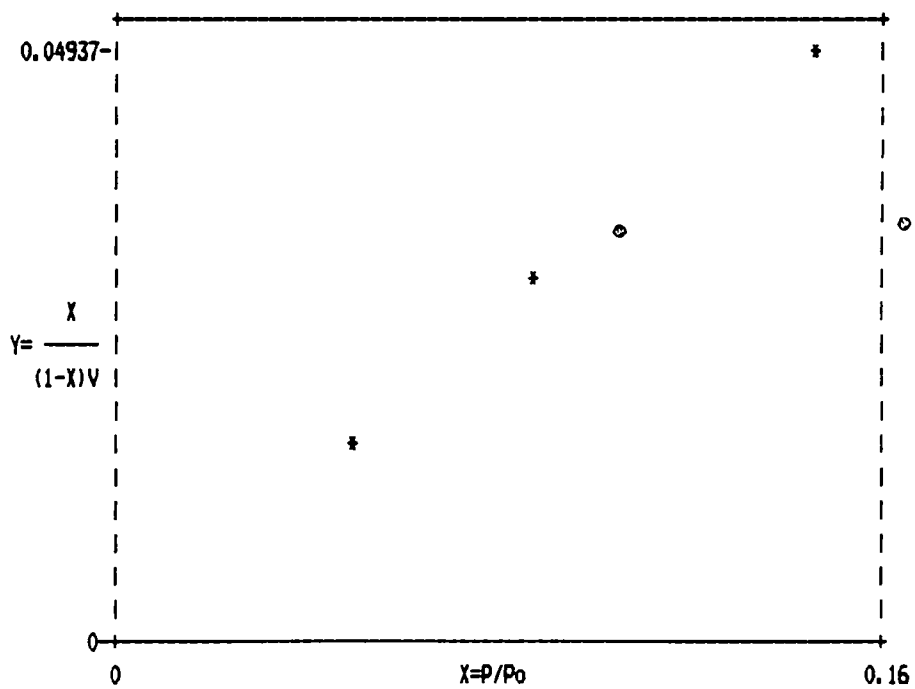

Figure B-45. Plot of BET equation versus relative pressure for Converter A337/0151-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/1/87

SAMPLE I.D.: A337/0151-A (LL-2)
SAMPLE WEIGHT: 23.3000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	46.14	1.98	0.0490	0.02604
8.860	51.72	2.22	0.0869	0.04287
14.900	57.32	2.46	0.1461	0.06956

BET SURFACE AREA: 9.62 +/- 0.04 m^2/g
SLOPE: 0.4485 +/- 0.0017
INTERCEPT: 0.0040 +/- 0.0002
C: 113.38
Vm: 2.21 cm^3/g
CORRELATION COEFFICIENT 1.0000

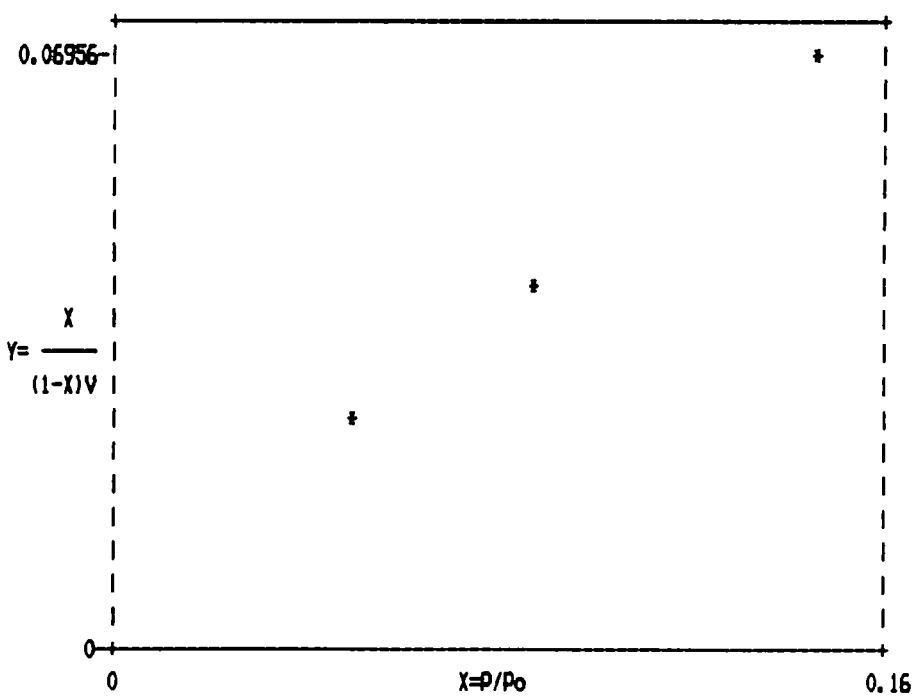

Figure B-46. Plot of BET equation versus relative pressure for Converter A337/0151-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A337-0151-A (LL-3)
SAMPLE WEIGHT: 23.0100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	50.21	2.18	0.0490	0.02363
8.860	56.47	2.45	0.0869	0.03877
14.900	62.80	2.73	0.1461	0.06270

BET SURFACE AREA: 10.71 +/- 0.03 m^2/g
SLOPE: 0.4026 +/- 0.0011
INTERCEPT: 0.0039 +/- 0.0001
C: 105.45
Vm: 2.46 cm^3/g
CORRELATION COEFFICIENT 1.0000

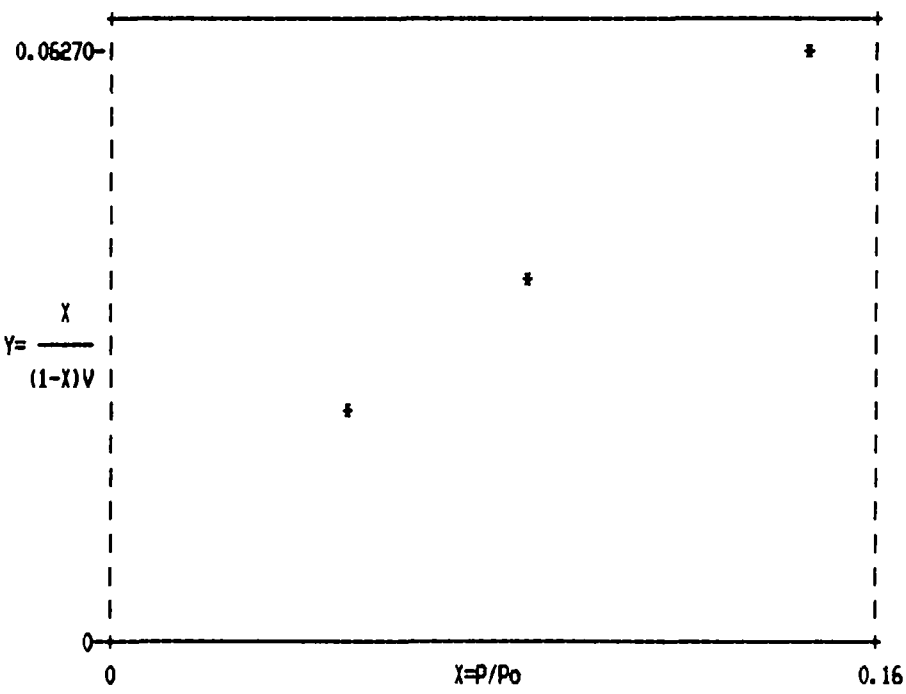

Figure B-47. Plot of BET equation versus relative pressure for Converter A337/0151-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A337/0151-A (LL-1) 100 MESH
SAMPLE WEIGHT: 1.6758 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.40	2.03	0.0490	0.02541
8.860	3.92	2.34	0.0869	0.04068
14.900	4.43	2.64	0.1461	0.06473
22.000	5.05	3.01	0.2157	0.09129

BET SURFACE AREA: 10.83 +/- 0.12 m^2/g
SLOPE: 0.3957 +/- 0.0044
INTERCEPT: 0.0063 +/- 0.0006
C: 63.98
Vm: 2.49 cm^3/g
CORRELATION COEFFICIENT 0.9999

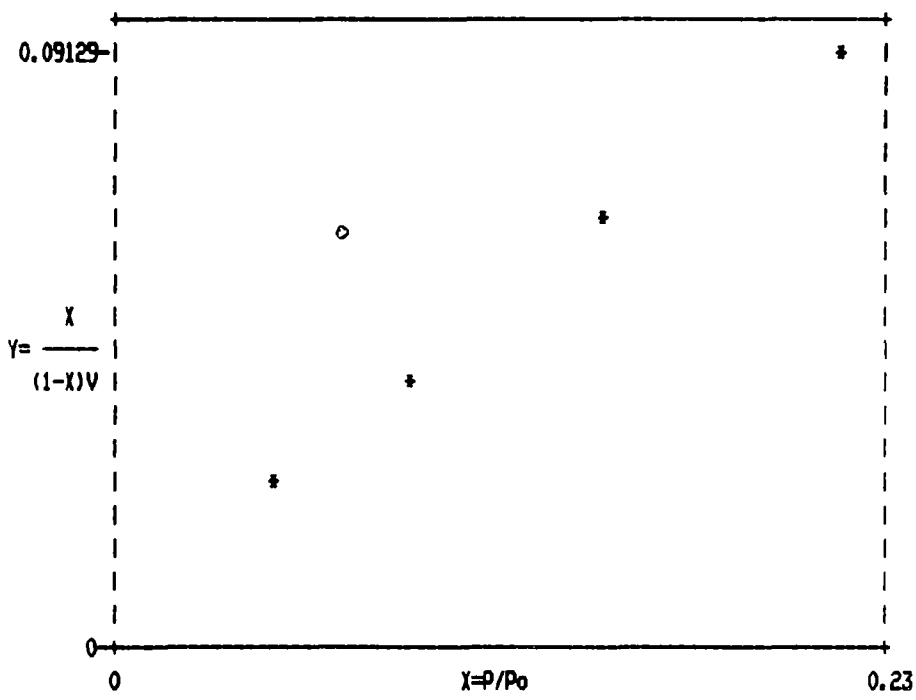

Figure B-48. Plot of BET equation versus relative pressure for Converter A337/0151-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/1/87

SAMPLE I.D.: A337/0151-B (UR-1)
SAMPLE WEIGHT: 21.5900 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	50.72	2.35	0.0490	0.02195
8.860	51.19	2.37	0.0869	0.04013
14.900	54.14	2.51	0.1461	0.06824

BET SURFACE AREA: 9.16 +/- 0.03 m^2/g
SLOPE: 0.4766 +/- 0.0015
INTERCEPT: -0.0014 +/- 0.0002
C: -347.42
Vm: 2.10 cm^3/g.
CORRELATION COEFFICIENT 1.0000

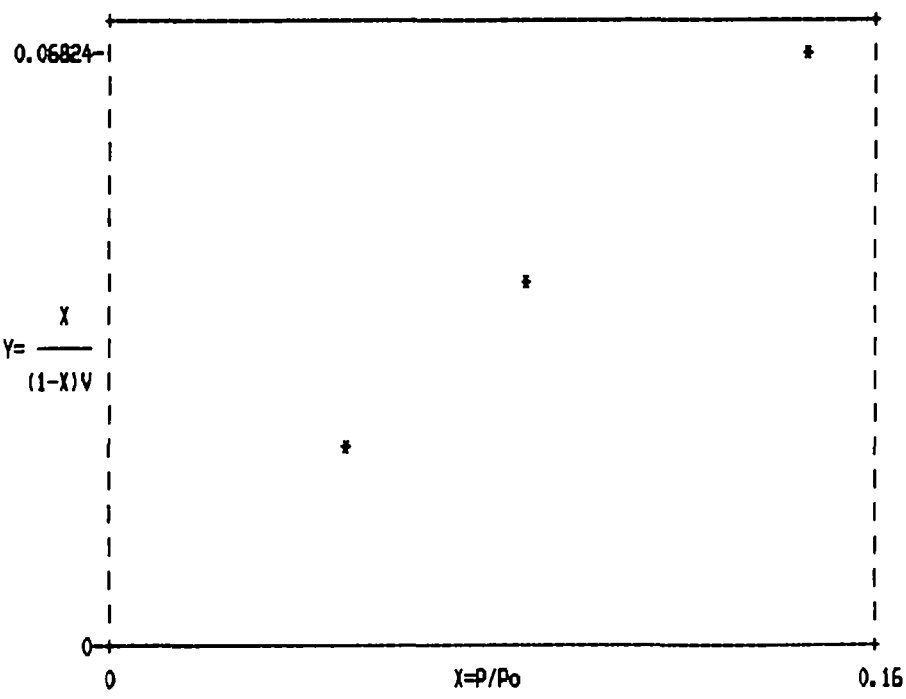

Figure B-49. Plot of BET equation versus relative pressure for Converter A337/0151-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/1/87

SAMPLE I.D.: A337/0151-B (UR-2)
SAMPLE WEIGHT: 20.9600 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	35.15	1.68	0.0490	0.03075
8.860	37.01	1.77	0.0869	0.05389
14.900	39.64	1.89	0.1461	0.09048

BET SURFACE AREA: 7.07 +/- 0.02 m^2/g
SLOPE: 0.6155 +/- 0.0018
INTERCEPT: 0.0005 +/- 0.0002
C: 1217.54
Vm: 1.62 cm^3/g
CORRELATION COEFFICIENT 1.0000

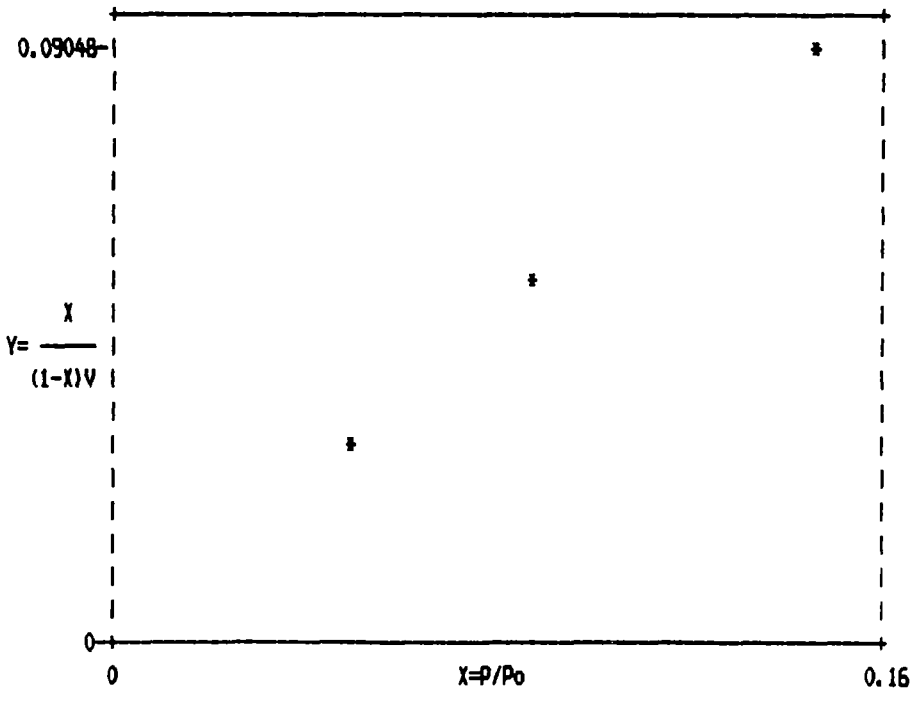

Figure B-50. Plot of BET equation versus relative pressure for Converter A337/0151-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/25/87

SAMPLE I.D.: A279/0002-A (LL-1)
SAMPLE WEIGHT: 13.2000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	40.57	3.07	0.0490	0.01678
8.860	41.75	3.16	0.0869	0.03008
14.900	47.99	3.64	0.1461	0.04707

BET SURFACE AREA: 13.95 +/- 0.79 m^2/g
SLOPE: 0.3098 +/- 0.0175
INTERCEPT: 0.0022 +/- 0.0018
C: 142.74
Vm: 3.21 cm^3/g
CORRELATION COEFFICIENT 0.9984

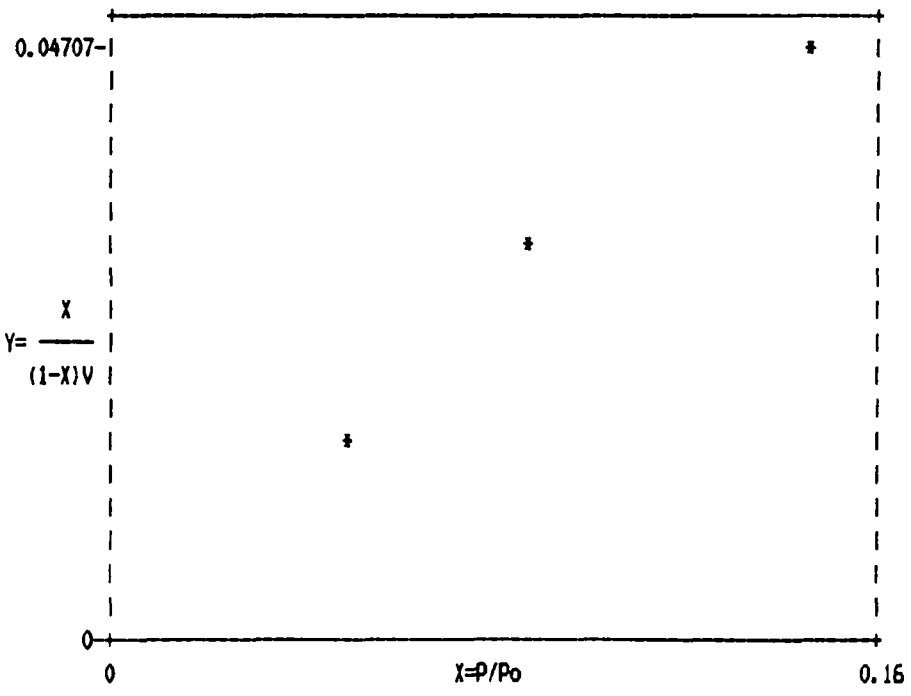

Figure B-51. Plot of BET equation versus relative pressure for Converter A279/0002L-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A279/0002L-A LL-2
SAMPLE WEIGHT: 14.8200 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	57.20	3.86	0.0490	0.01336
8.860	64.50	4.35	0.0869	0.02186
14.900	72.24	4.87	0.1461	0.03511

BET SURFACE AREA: 19.23 +/- 0.03 m^2/g
SLOPE: 0.2240 +/- 0.0004
INTERCEPT: 0.0024 +/- 0.0000
C: 94.79
Vm: 4.42 cm^3/g
CORRELATION COEFFICIENT 1.0000

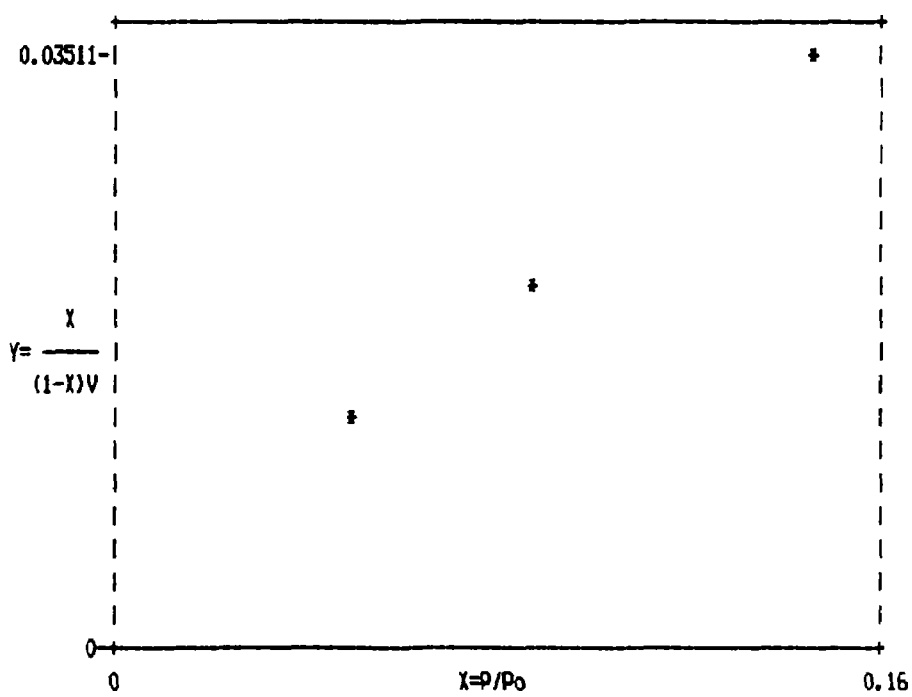

Figure B-52. Plot of BET equation versus relative pressure for Converter A279/0002L-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A279/0002L-A (LL-3)
SAMPLE WEIGHT: 15.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	56.29	3.75	0.0490	0.01374
8.860	60.39	4.03	0.0869	0.02363
14.900	64.77	4.32	0.1461	0.03963

BET SURFACE AREA: 16.27 +/- 0.14 m^2/g
SLOPE: 0.2670 +/- 0.0023
INTERCEPT: 0.0006 +/- 0.0002
C: 469.66
Vm: 3.74 cm^3/g
CORRELATION COEFFICIENT 1.0000

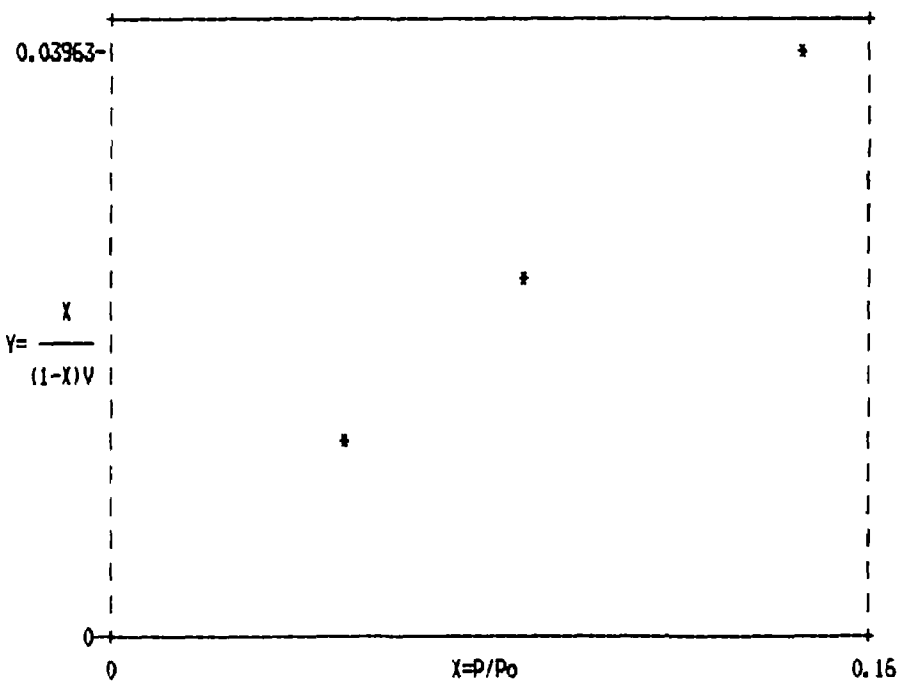

Figure B-53. Plot of BET equation versus relative pressure for Converter A279/0002L-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/25/87

SAMPLE I.D.: A279/0002L-A LL-1
SAMPLE WEIGHT: 1.5596 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	5.63	3.61	0.0490	0.01428
8.860	6.15	3.94	0.0869	0.02413
14.900	6.69	4.29	0.1461	0.03989
22.000	7.83	5.02	0.2157	0.05479

BET SURFACE AREA: 17.62 +/- 0.66 m^2/g
SLOPE: 0.2442 +/- 0.0092
INTERCEPT: 0.0029 +/- 0.0013
C: 85.70
Vm: 4.05 cm^3/g
CORRELATION COEFFICIENT 0.9986

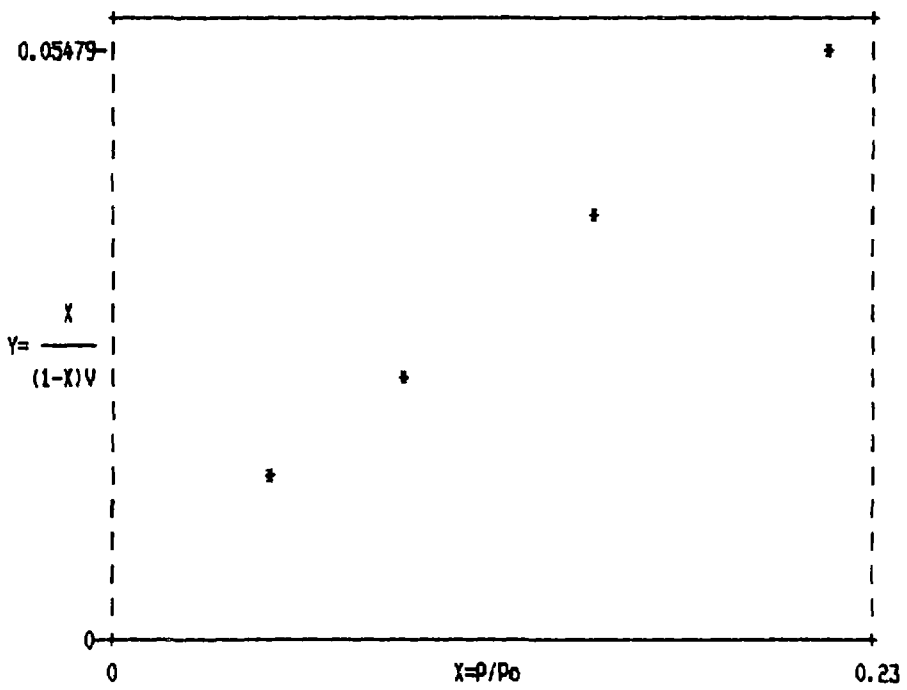

Figure B-54. Plot of BET equation versus relative pressure for Converter A279/0002L-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A279/0002L-B (UR-1)
SAMPLE WEIGHT: 12.0200 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	21.06	1.75	0.0490	0.02943
8.860	23.00	1.91	0.0869	0.04973
14.900	24.96	2.08	0.1461	0.08241

BET SURFACE AREA: 7.93 +/- 0.06 m^2/g
SLOPE: 0.5462 +/- 0.0042
INTERCEPT: 0.0025 +/- 0.0004
C: 219.25
Vm: 1.82 cm^3/g
CORRELATION COEFFICIENT 1.0000

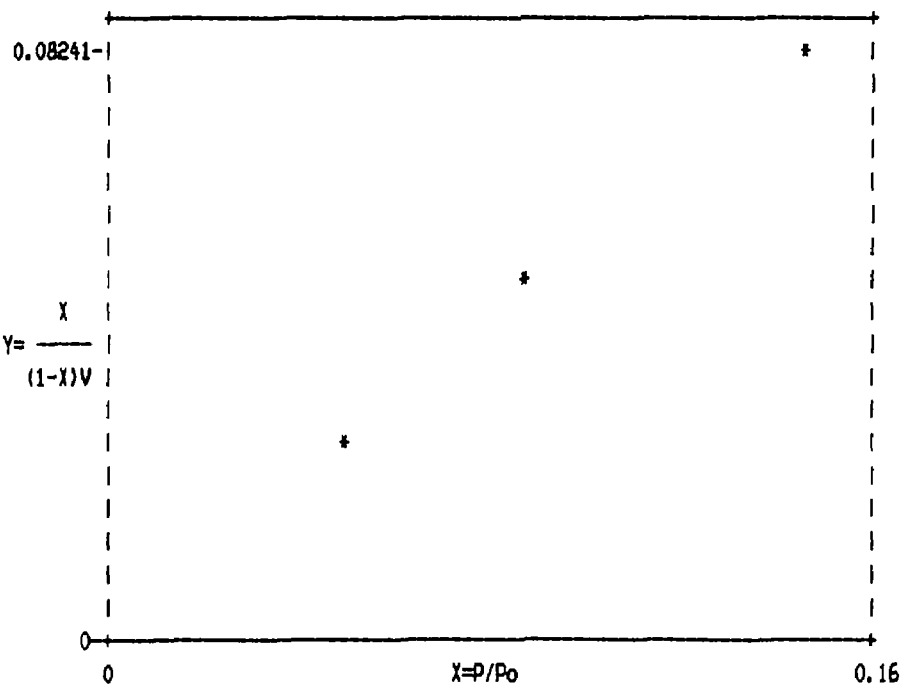

Figure B-55. Plot of BET equation versus relative pressure for Converter A279/0002L-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A279/0002L-B (UR-2)
SAMPLE WEIGHT: 12.3800 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	16.11	1.30	0.0490	0.03962
8.860	17.48	1.41	0.0869	0.06739
14.900	20.89	1.69	0.1461	0.10141

BET SURFACE AREA: 6.79 +/- 0.46 m^2/g
SLOPE: 0.6310 +/- 0.0430
INTERCEPT: 0.0102 +/- 0.0044
C: 63.12
Vm: 1.56 cm^3/g
CORRELATION COEFFICIENT 0.9977

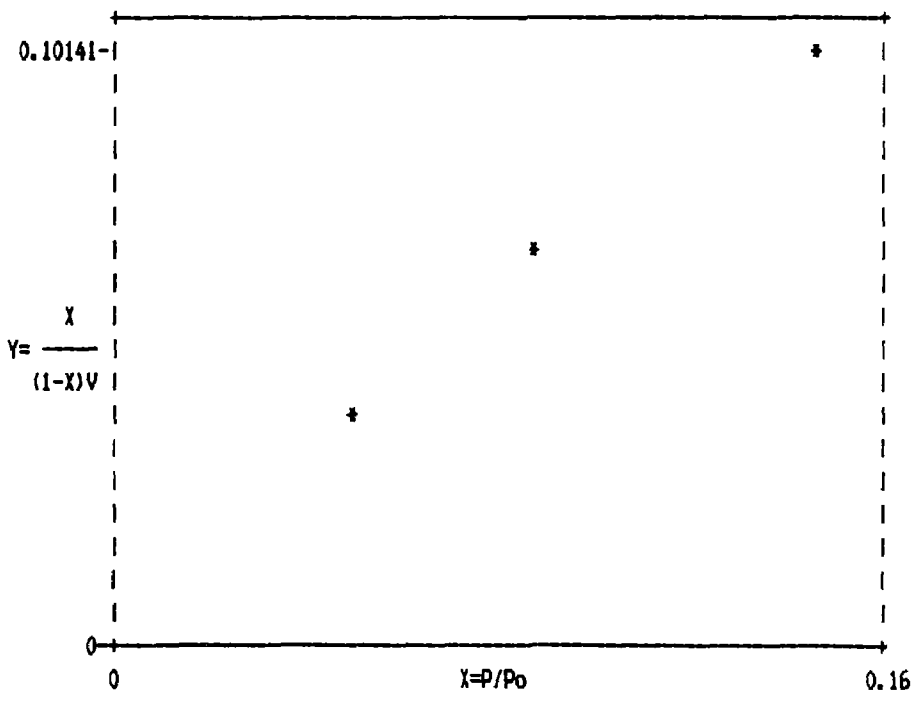

Figure B-56. Plot of BET equation versus relative pressure for Converter A279/0002L-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/27/87

SAMPLE I.D.: A279/0003L-A (LL-1)
SAMPLE WEIGHT: 12.1300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	31.91	2.63	0.0490	0.01960
8.860	33.77	2.78	0.0869	0.03418
14.900	35.77	2.95	0.1461	0.05803

BET SURFACE AREA: 10.98 +/- 0.13 m^2/g
SLOPE: 0.3964 +/- 0.0047
INTERCEPT: 0.0000 +/- 0.0005
C: 9999.99
Vm: 2.52 cm^3/g
CORRELATION COEFFICIENT 0.9999

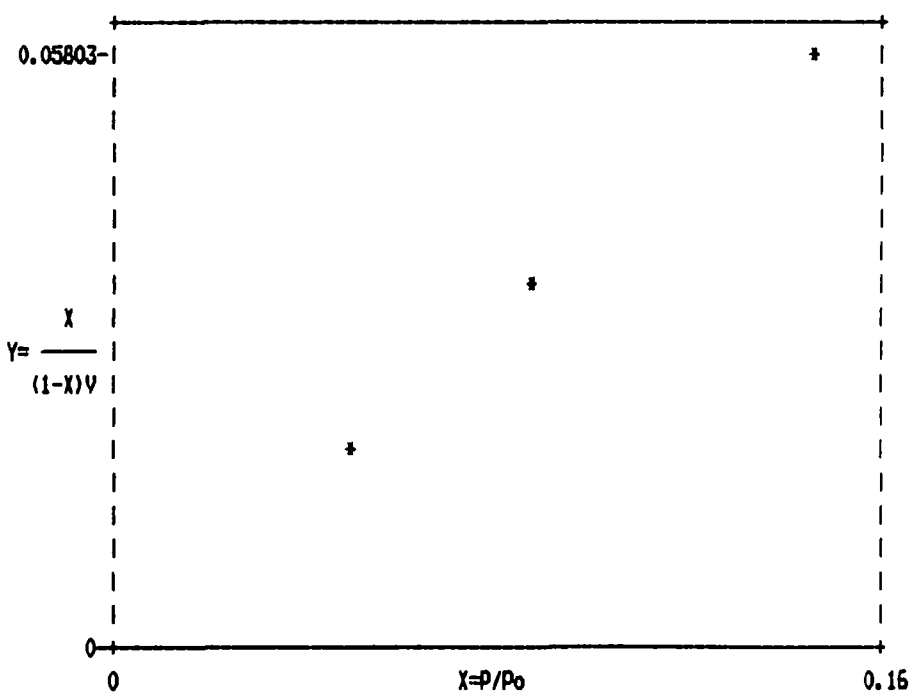

Figure B-57. Plot of BET equation versus relative pressure for Converter A279/0003L-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/27/87

SAMPLE I.D.: A279/0003L-A (LL-2)
SAMPLE WEIGHT: 14.8500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	57.35	3.86	0.0490	0.01335
8.860	61.86	4.17	0.0869	0.02284
14.900	66.01	4.45	0.1461	0.03850

BET SURFACE AREA: 16.74 +/- 0.24 m^2/g
SLOPE: 0.2595 +/- 0.0037
INTERCEPT: 0.0005 +/- 0.0004
C: 516.58
Vm: 3.85 cm^3/g
CORRELATION COEFFICIENT 0.9999

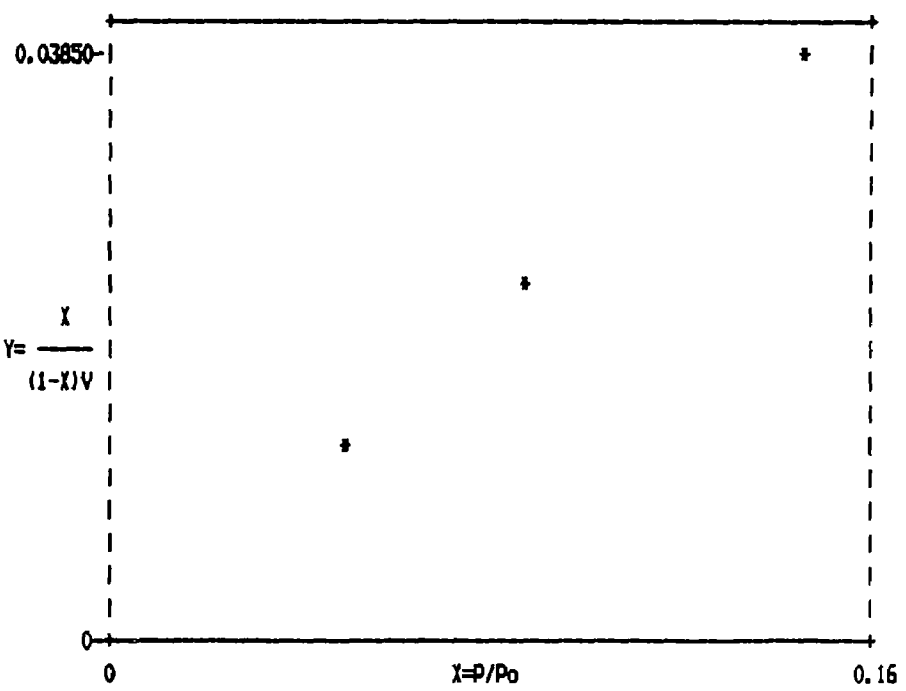

Figure B-58. Plot of BET equation versus relative pressure for Converter A279/0003L-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/11/87

SAMPLE I.D.: A279/0003L-A LL-3
SAMPLE WEIGHT: 13.0300 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	37.72	2.89	0.0490	0.01781
8.860	41.45	3.18	0.0869	0.02991
12.100	43.80	3.36	0.1187	0.04005

BET SURFACE AREA: 13.54 +/- 0.01 m^2/g
SLOPE: 0.3194 +/- 0.0002
INTERCEPT: 0.0022 +/- 0.0000
C: 149.52
Vm: 3.11 cm^3/g
CORRELATION COEFFICIENT 1.0000

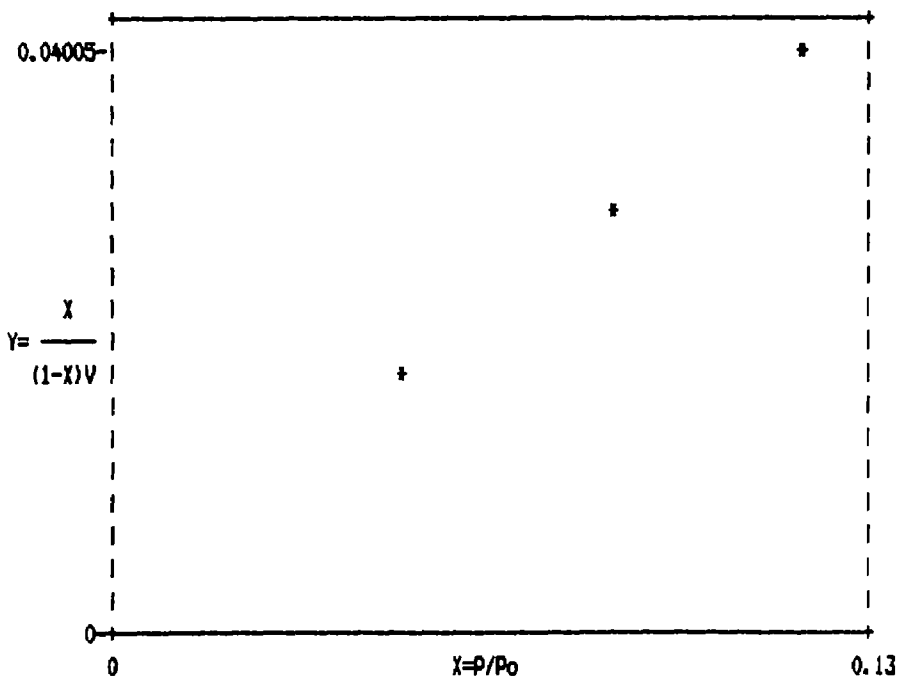

Figure B-59. Plot of BET equation versus relative pressure for Converter A279/0003L-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/31/87

SAMPLE I.D.: A279/0003L-A (LL-1) 100 MESH
SAMPLE WEIGHT: 1.5394 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	4.26	2.77	0.0490	0.01863
8.860	4.73	3.07	0.0869	0.03097
14.900	5.29	3.44	0.1461	0.04980
22.000	6.01	3.90	0.2157	0.07046

BET SURFACE AREA: 13.83 +/- 0.21 m^2/g
SLOPE: 0.3109 +/- 0.0046
INTERCEPT: 0.0038 +/- 0.0006
C: 83.35
Vm: 3.18 cm^3/g
CORRELATION COEFFICIENT 0.9998

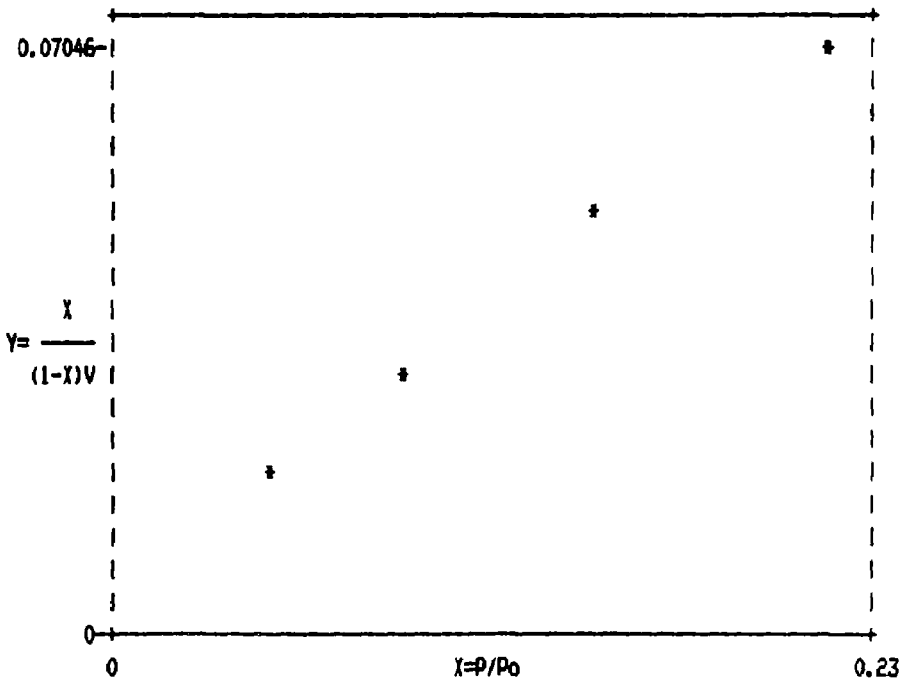

Figure B-60. Plot of BET equation versus relative pressure for Converter A279/0003L-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A279/0003L-B (UR-1)
SAMPLE WEIGHT: 13.1700 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	28.06	2.13	0.0490	0.02420
8.860	29.71	2.26	0.0869	0.04218
14.900	32.97	2.50	0.1461	0.06835

BET SURFACE AREA: 9.55 +/- 0.19 m^2/g
SLOPE: 0.4537 +/- 0.0089
INTERCEPT: 0.0023 +/- 0.0009
C: 201.62
Vm: 2.19 cm^3/g
CORRELATION COEFFICIENT 0.9998

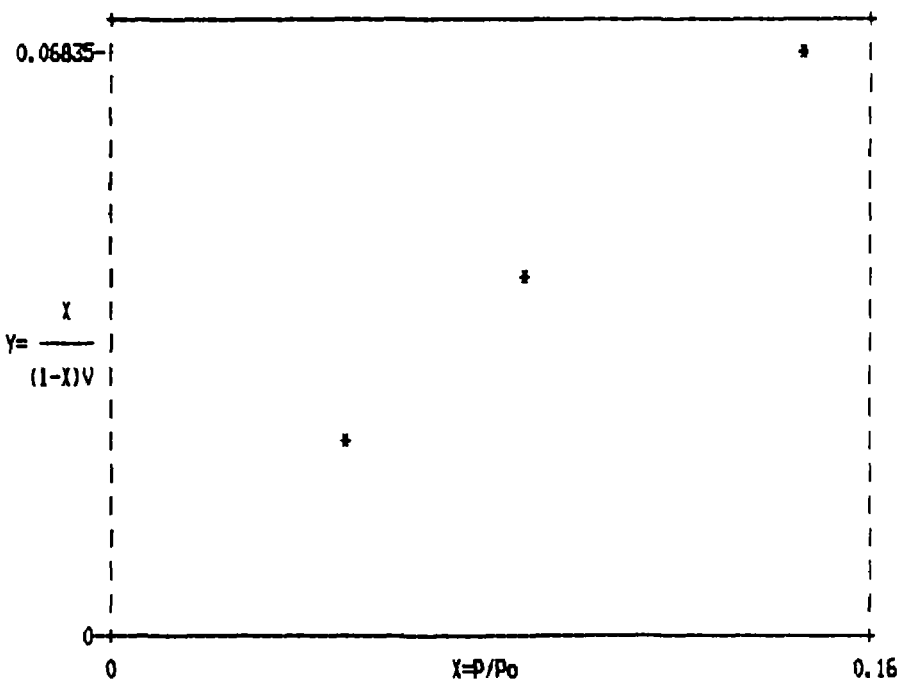

Figure B-61. Plot of BET equation versus relative pressure for Converter A279/0003L-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/25/87

SAMPLE I.D.: A279/0003L-B (UR-2)
SAMPLE WEIGHT: 12.5400 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	21.65	1.73	0.0490	0.02986
8.860	22.95	1.83	0.0869	0.05199
14.900	24.41	1.95	0.1461	0.08791

BET SURFACE AREA: 7.27 +/- 0.07 m^2/g
SLOPE: 0.5986 +/- 0.0059
INTERCEPT: 0.0003 +/- 0.0006
C: 1924.70
Vm: 1.67 cm^3/g
CORRELATION COEFFICIENT 1.0000

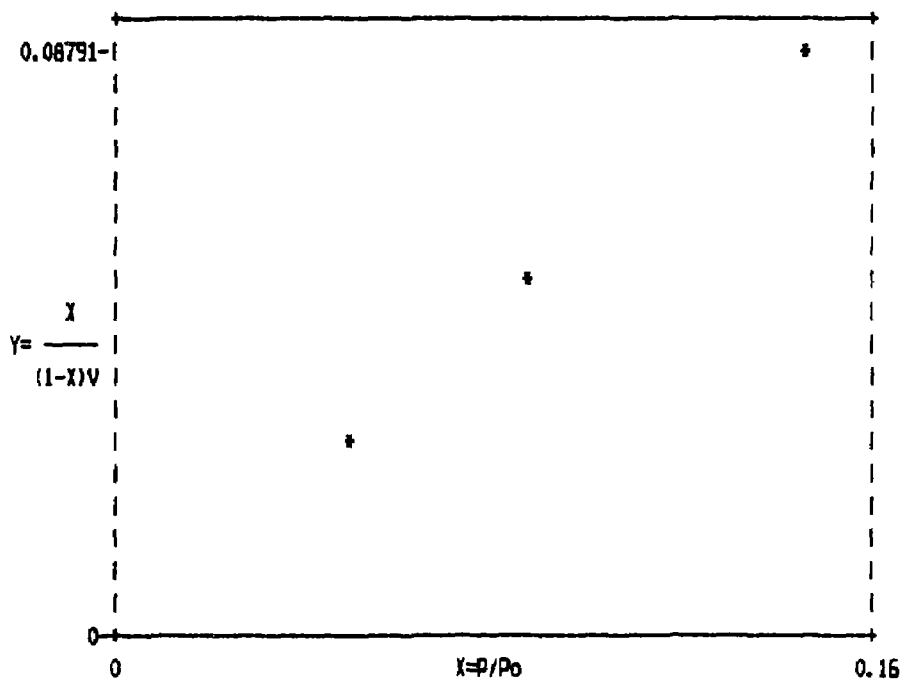

Figure B-62. Plot of BET equation versus relative pressure for Converter A279/0003L-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/20/87

SAMPLE I.D.: A279/0004L-A LL-1
SAMPLE WEIGHT: 12.0600 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	28.02	2.32	0.0490	0.02219
8.860	29.68	2.46	0.0869	0.03866
14.900	33.10	2.74	0.1461	0.06235

BET SURFACE AREA: 10.50 +/- 0.24 m^2/g
SLOPE: 0.4124 +/- 0.0096
INTERCEPT: 0.0023 +/- 0.0010
C: 180.53
Vm: 2.41 cm^3/g
CORRELATION COEFFICIENT 0.9997

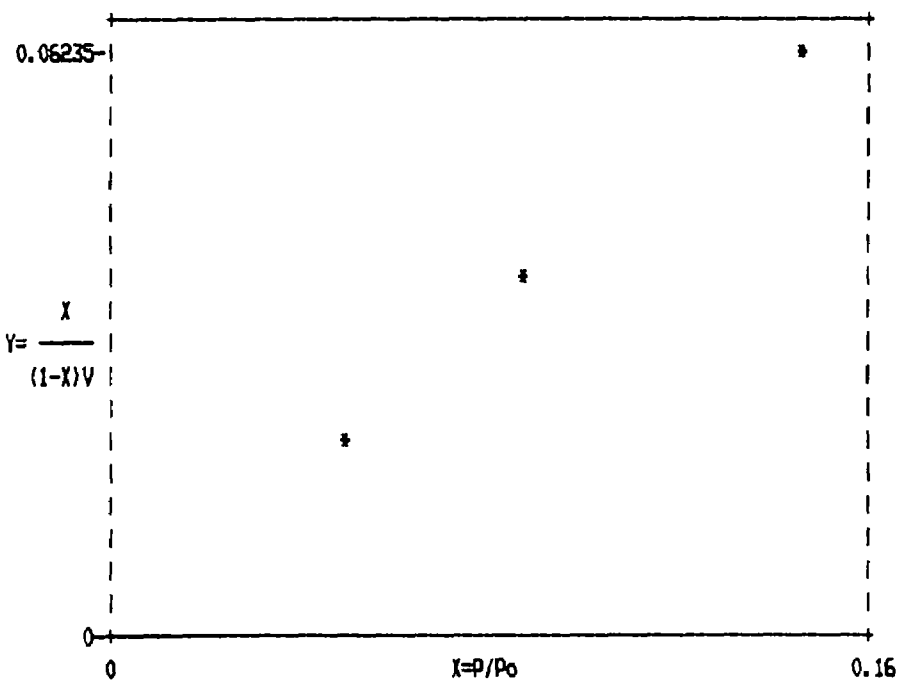

Figure B-63. Plot of BET equation versus relative pressure for Converter A279/0004L-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/20/87

SAMPLE I.D.: A279/0004L-A LL-2 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 18.5900 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	4.48	0.24	0.0490	0.21395
8.860	4.98	0.27	0.0869	0.35520
14.900	5.56	0.30	0.1461	0.57214

BET SURFACE AREA: 1.17 +/- 0.01 m^2/g
SLOPE: 3.6871 +/- 0.0184
INTERCEPT: 0.0338 +/- 0.0019
C: 110.09
Vm: 0.27 cm^3/g
CORRELATION COEFFICIENT 1.0000

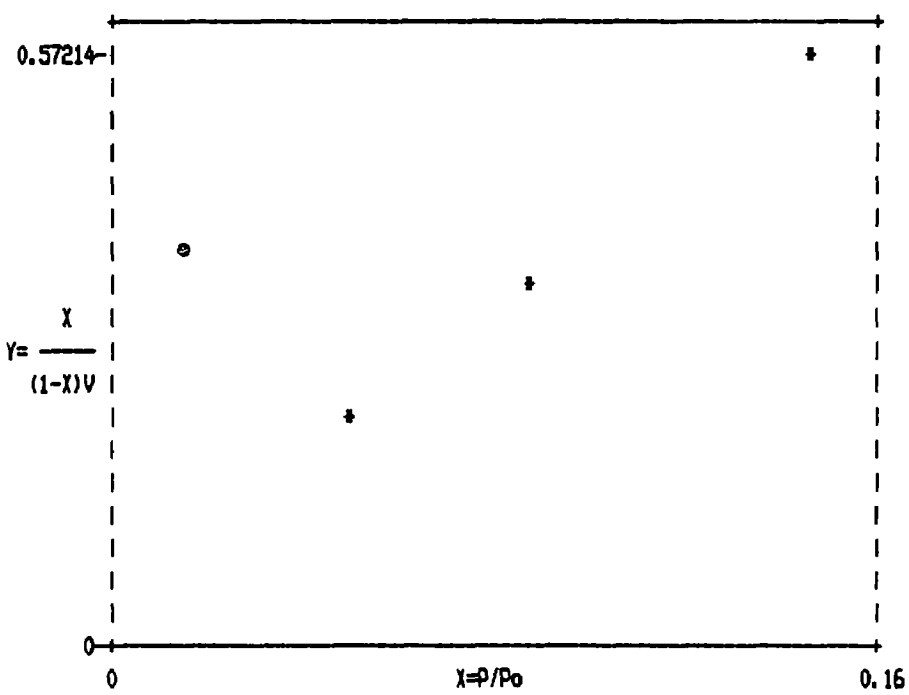

Figure B-64. Plot of BET equation versus relative pressure for Converter A279/0004L-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/11/87

SAMPLE I.D.: A279/0004L-A (LL-3)
SAMPLE WEIGHT: 10.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	22.11	2.07	0.0490	0.02495
8.860	23.95	2.24	0.0869	0.04251
12.100	24.34	2.27	0.1187	0.05919

BET SURFACE AREA: 8.86 +/- 0.32 m^2/g
SLOPE: 0.4908 +/- 0.0174
INTERCEPT: 0.0006 +/- 0.0016
C: 865.26
Vm: 2.04 cm^3/g
CORRELATION COEFFICIENT 0.9994

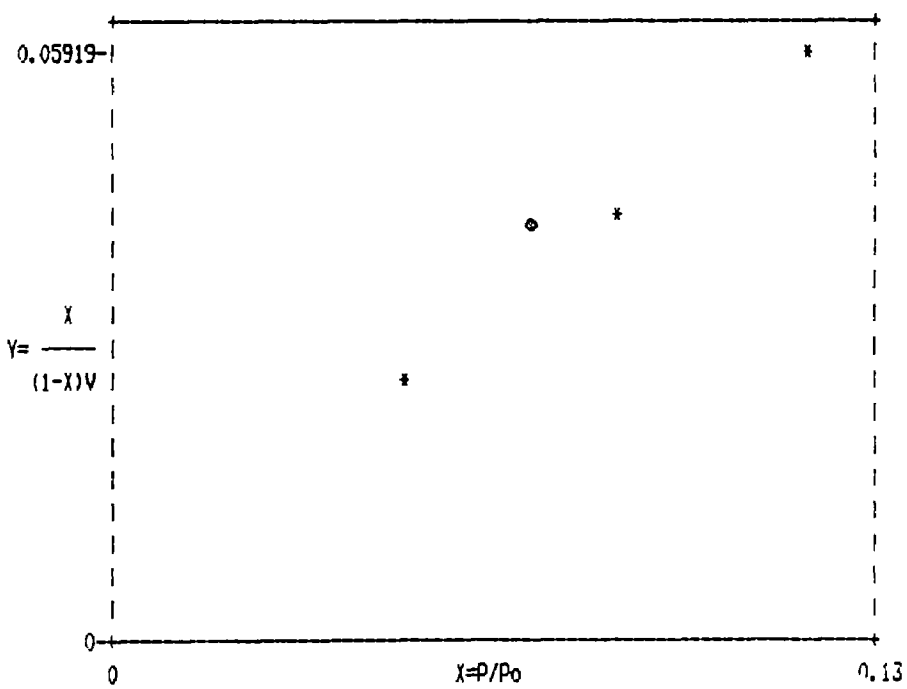

Figure B-65. Plot of BET equation versus relative pressure for Converter A279/0004L-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A279/0004L-A (LL-1)
SAMPLE WEIGHT: 1.5278 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	5.24	3.43	0.0490	0.01503
8.860	5.74	3.76	0.0869	0.02533
14.900	6.78	4.44	0.1461	0.03856
22.000	7.34	4.80	0.2157	0.05726

BET SURFACE AREA: 17.20 +/- 0.46 m^2/g
SLOPE: 0.2502 +/- 0.0067
INTERCEPT: 0.0029 +/- 0.0009
C: 86.91
Vm: 3.95 cm^3/g
CORRELATION COEFFICIENT 0.9993

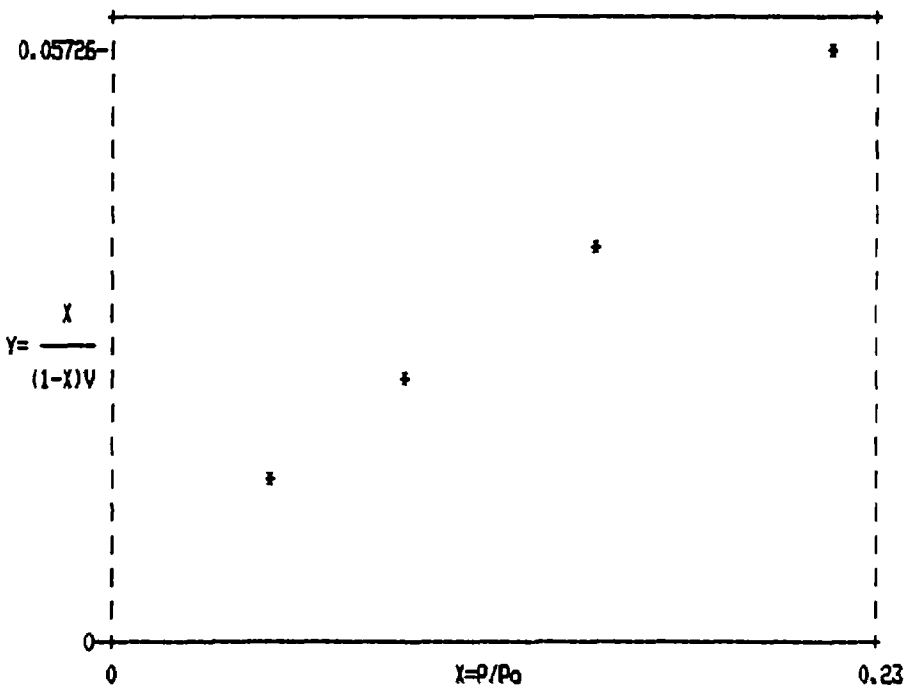

Figure B-66. Plot of BET equation versus relative pressure for Converter A279/0004L-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/20/87

SAMPLE I.D.: A279/0004L-B UR-1
SAMPLE WEIGHT: 12.5000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	11.36	0.91	0.0490	0.05673
8.860	12.62	1.01	0.0869	0.09425
14.900	14.01	1.12	0.1461	0.15268

BET SURFACE AREA: 4.37 +/- 0.00 m^2/g
SLOPE: 0.9881 +/- 0.0010
INTERCEPT: 0.0083 +/- 0.0001
C: 119.63
Vm: 1.00 cm^3/g
CORRELATION COEFFICIENT 1.0000

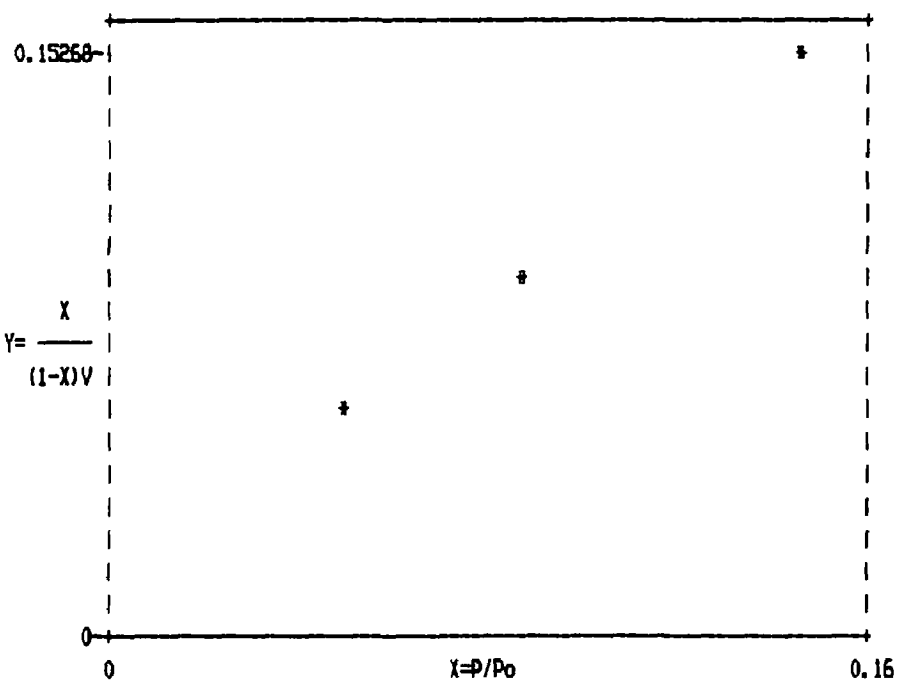

Figure B-67. Plot of BET equation versus relative pressure for Converter A279/0004L-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A279/004L-B (UR-2)
SAMPLE WEIGHT: 13.5800 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	16.88	1.24	0.0490	0.04148
8.860	18.21	1.34	0.0869	0.07096
14.900	19.35	1.42	0.1461	0.12009

BET SURFACE AREA: 5.36 +/- 0.09 m^2/g
SLOPE: 0.8115 +/- 0.0137
INTERCEPT: 0.0012 +/- 0.0014
C: 664.81
Vm: 1.23 cm^3/g
CORRELATION COEFFICIENT 0.9999

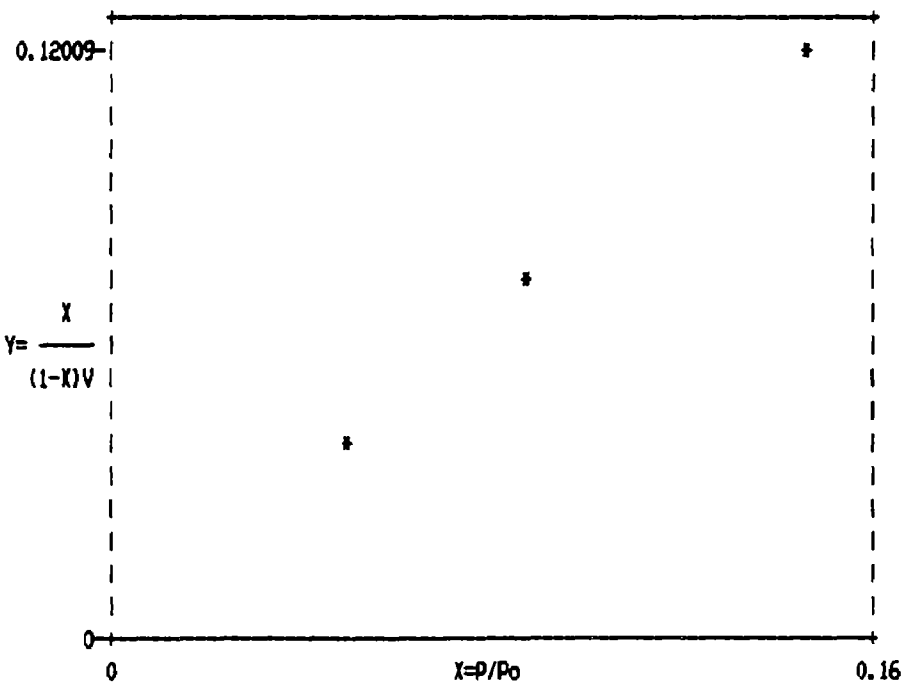

Figure B-68. Plot of BET equation versus relative pressure for Converter A279/0004L-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/8/87

SAMPLE I.D.: A316/0460-1 LL-1 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 15.2000 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	43.40	2.86	0.0490	0.01806
8.860	45.87	3.02	0.0869	0.03153
14.900	47.99	3.16	0.1461	0.05420

BET SURFACE AREA: 11.68 +/- 0.23 m^2/g
SLOPE: 0.3732 +/- 0.0072
INTERCEPT: -0.0005 +/- 0.0007
C: -764.01
Vm: 2.68 cm^3/g
CORRELATION COEFFICIENT 0.9998

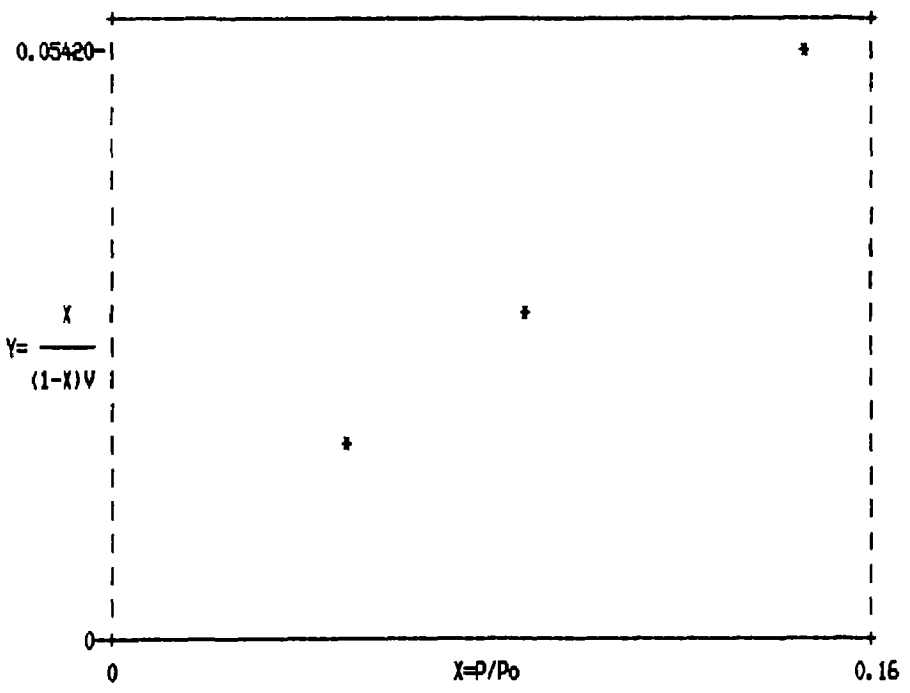

Figure B-69. Plot of BET equation versus relative pressure for Converter A316/0460-1-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/10/87

SAMPLE I.D.: A316/0460-1 (LL-2)
SAMPLE WEIGHT: 16.6000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	44.38	2.67	0.0490	0.01929
8.860	47.66	2.87	0.0869	0.03314
14.900	52.18	3.14	0.1461	0.05444

BET SURFACE AREA: 11.98 +/- 0.06 m^2/g
SLOPE: 0.3619 +/- 0.0018
INTERCEPT: 0.0016 +/- 0.0002
C: 226.73
Vm: 2.75 cm^3/g
CORRELATION COEFFICIENT 1.0000

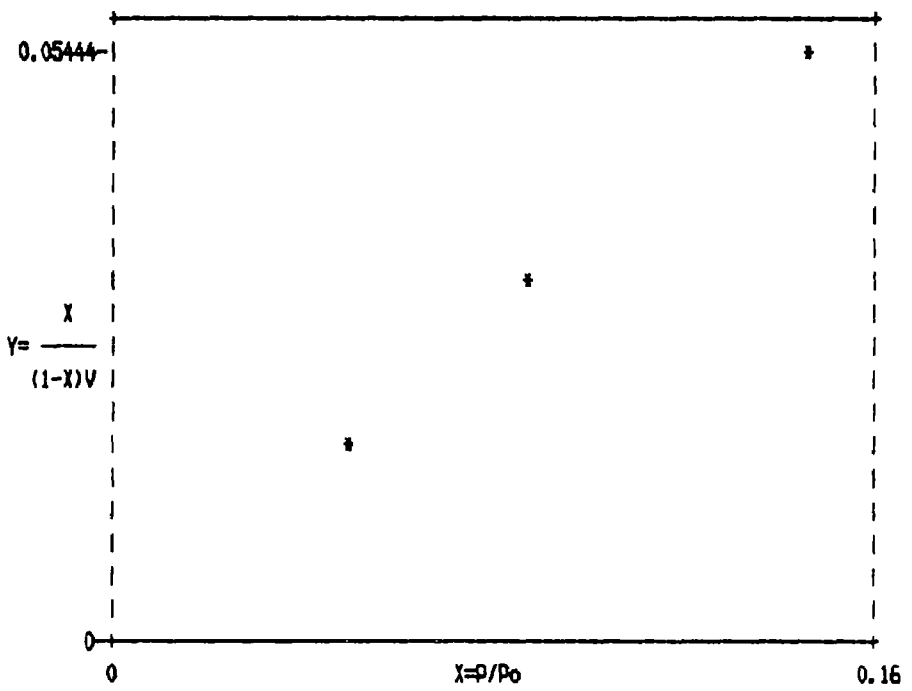

Figure B-70. Plot of BET equation versus relative pressure for Converter A316/0460-1-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/11/87

SAMPLE I.D.: A316/0460-1 (LL-3)
SAMPLE WEIGHT: 11.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	19.71	1.68	0.0490	0.03061
8.860	22.01	1.88	0.0869	0.05058
14.900	24.97	2.13	0.1461	0.08018

BET SURFACE AREA: 8.44 +/- 0.12 m^2/g
SLOPE: 0.5097 +/- 0.0076
INTERCEPT: 0.0059 +/- 0.0008
C: 87.75
Vm: 1.94 cm^3/g
CORRELATION COEFFICIENT 0.9999

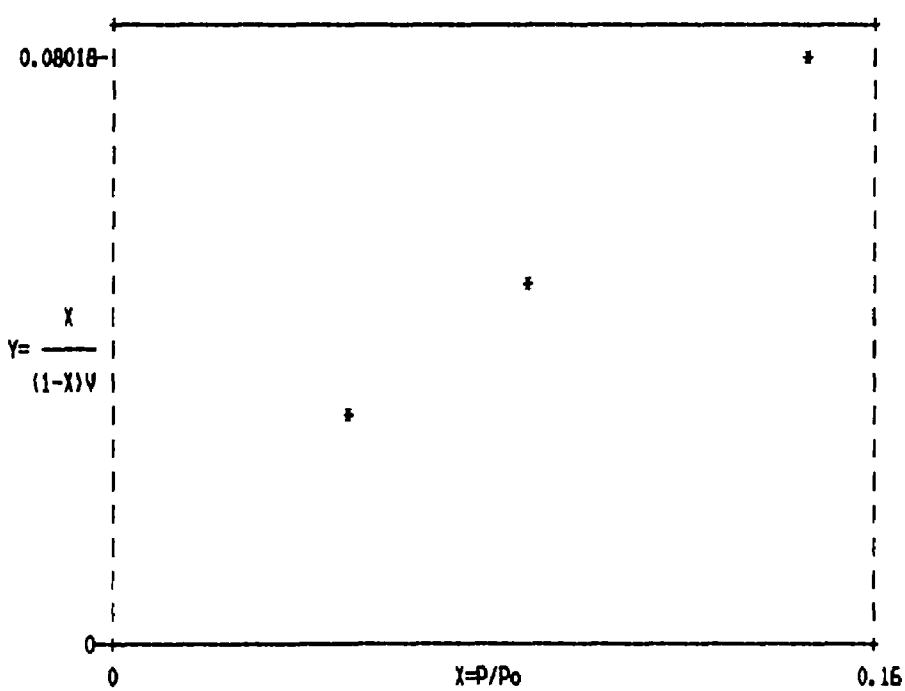

Figure B-71. Plot of BET equation versus relative pressure for Converter A316/0460-1-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/15/87

SAMPLE I.D.: A316/0460-1 (LL-1)
SAMPLE WEIGHT: 1.6490 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	5.21	3.16	0.0490	0.01632
8.860	6.00	3.64	0.0859	0.02615
14.900	6.91	4.19	0.1461	0.04084
22.000	7.43	4.51	0.2157	0.06105

BET SURFACE AREA: 16.13 +/- 0.42 m^2/g
SLOPE: 0.2670 +/- 0.0070
INTERCEPT: 0.0029 +/- 0.0010
C: 94.30
Vm: 3.71 cm^3/g
CORRELATION COEFFICIENT 0.9993

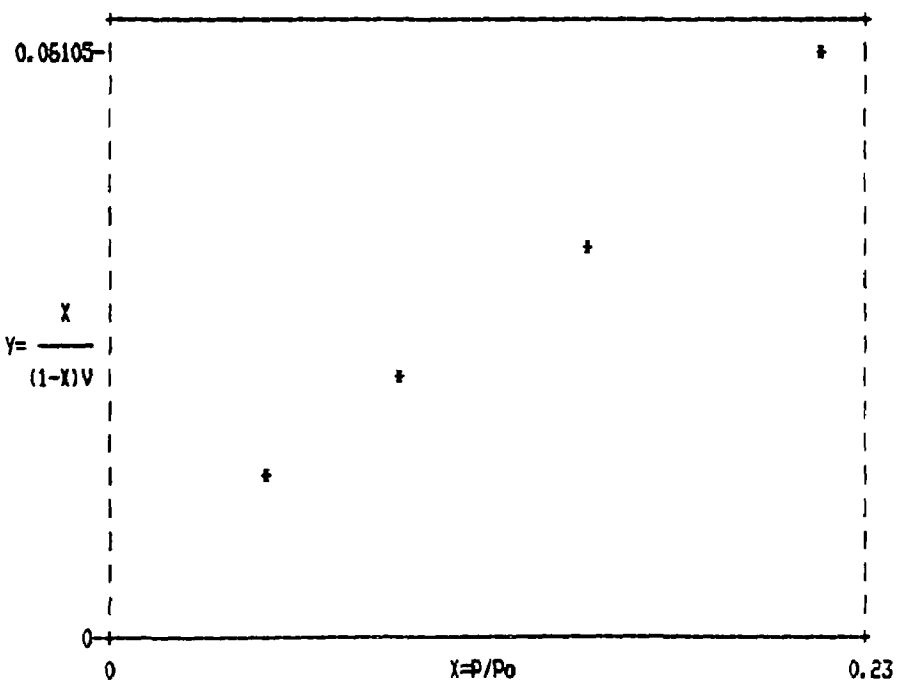

Figure B-72. Plot of BET equation versus relative pressure for Converter A316/0460-1-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/10/87

SAMPLE I.D.: A316/0460-2 (LL-1)
SAMPLE WEIGHT: 16.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	36.63	2.29	0.0490	0.02252
8.860	38.95	2.43	0.0869	0.03909
14.900	46.07	2.88	0.1461	0.05943

BET SURFACE AREA: 11.40 +/- 0.76 m^2/g
SLOPE: 0.3769 +/- 0.0255
INTERCEPT: 0.0049 +/- 0.0026
C: 77.76
Vm: 2.62 cm^3/g
CORRELATION COEFFICIENT 0.9977

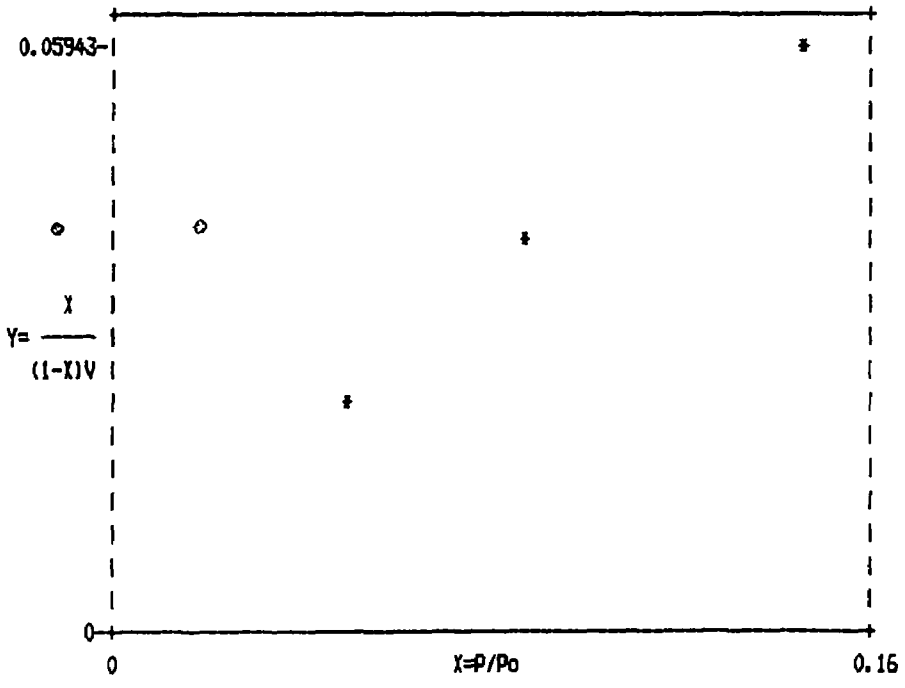

Figure B-73. Plot of BET equation versus relative pressure for Converter A316/0460-2-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/11/87

SAMPLE I.D.: A316/0460-2 (LL-2)
SAMPLE WEIGHT: 14.6000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	35.33	2.42	0.0490	0.02131
8.860	38.39	2.67	0.0869	0.03563
14.900	44.42	3.04	0.1461	0.05624

BET SURFACE AREA: 12.00 +/- 0.27 m^2/g
SLOPE: 0.3588 +/- 0.0082
INTERCEPT: 0.0040 +/- 0.0008
C: 90.83
Vm: 2.76 cm^3/g
CORRELATION COEFFICIENT 0.9997

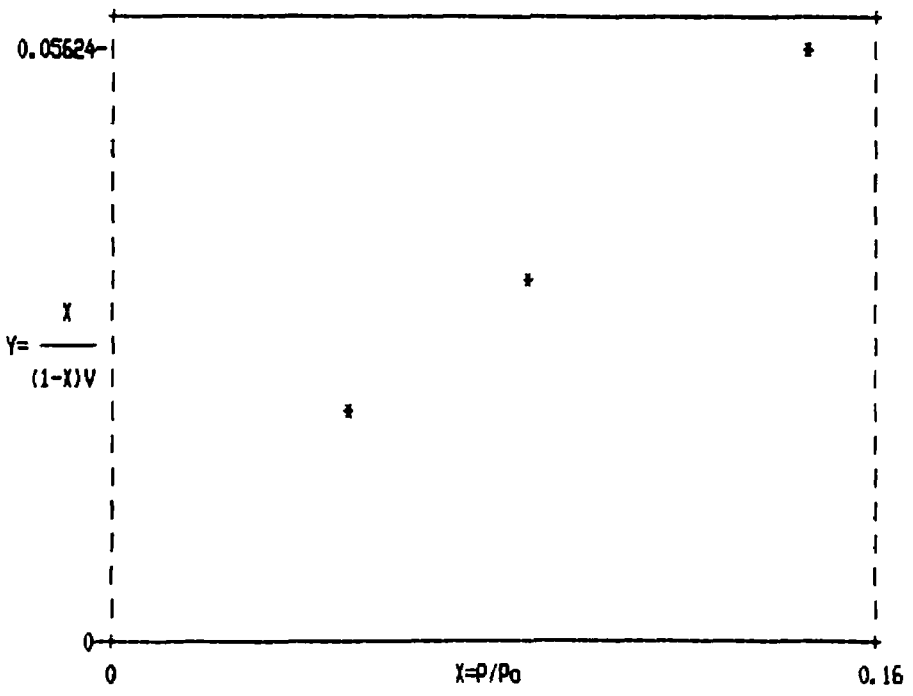

Figure B-74. Plot of BET equation versus relative pressure for Converter A316/0460-2-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/11/87

SAMPLE I.D.: A316/0460-2 LL-3
SAMPLE WEIGHT: 14.9000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	35.40	2.38	0.0490	0.02170
8.860	39.87	2.68	0.0869	0.03556
14.900	43.08	2.89	0.1461	0.05918

BET SURFACE AREA: 11.17 +/- 0.26 m^2/g
SLOPE: 0.3872 +/- 0.0089
INTERCEPT: 0.0024 +/- 0.0009
C: 161.45
Vm: 2.57 cm^3/g
CORRELATION COEFFICIENT 0.9997

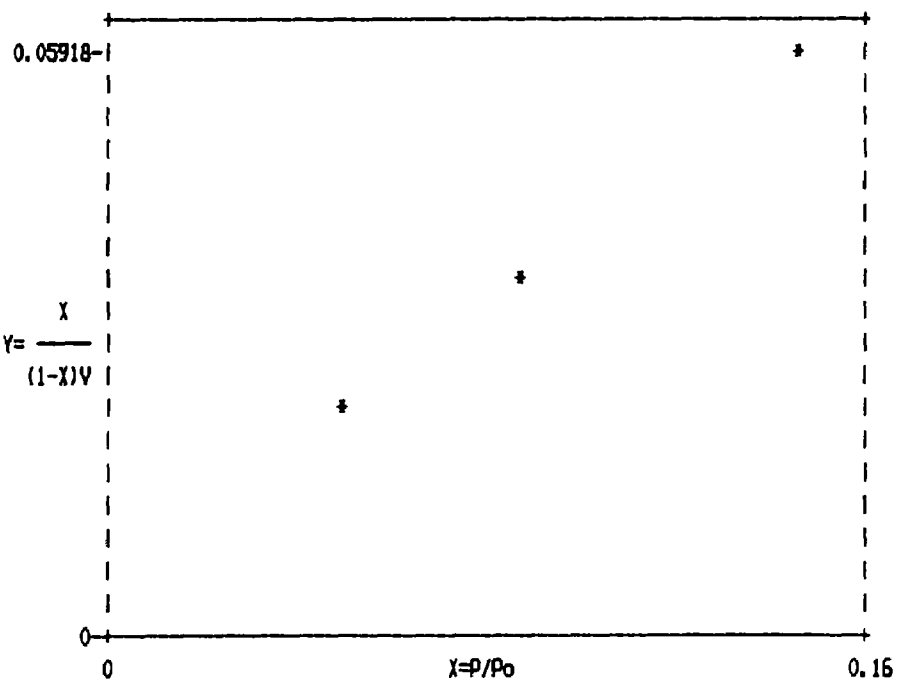

Figure B-75. Plot of BET equation versus relative pressure for Converter A316/0460-2-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/15/87

SAMPLE I.D.: A316/0460-2 (LL-1)
SAMPLE WEIGHT: 1.7100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.96	2.32	0.0490	0.02226
8.860	4.56	2.67	0.0869	0.03568
14.900	5.00	2.92	0.1461	0.05852
22.000	5.78	3.38	0.2157	0.08138

BET SURFACE AREA: 12.02 +/- 0.29 m^2/g
SLOPE: 0.3571 +/- 0.0087
INTERCEPT: 0.0050 +/- 0.0012
C: 72.14
Vm: 2.76 cm^3/g
CORRELATION COEFFICIENT 0.9994

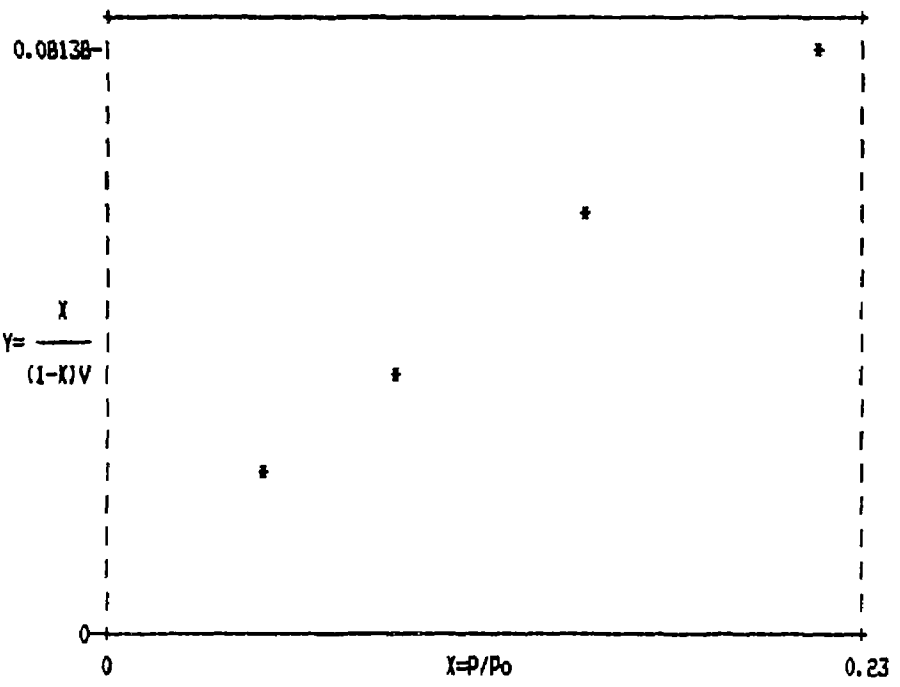

Figure B-76. Plot of BET equation versus relative pressure for Converter A316/0460-2-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/9/87

SAMPLE I.D.: A316/0460-3 LL-1
SAMPLE WEIGHT: 19.4000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	10.97	0.57	0.0490	0.09118
8.860	11.89	0.61	0.0869	0.15525
14.900	12.80	0.66	0.1461	0.25935

BET SURFACE AREA: 2.50 +/- 0.03 m^2/g
SLOPE: 1.7344 +/- 0.0176
INTERCEPT: 0.0055 +/- 0.0018
C: 314.16
Vm: 0.57 cm^3/g
CORRELATION COEFFICIENT 0.9999

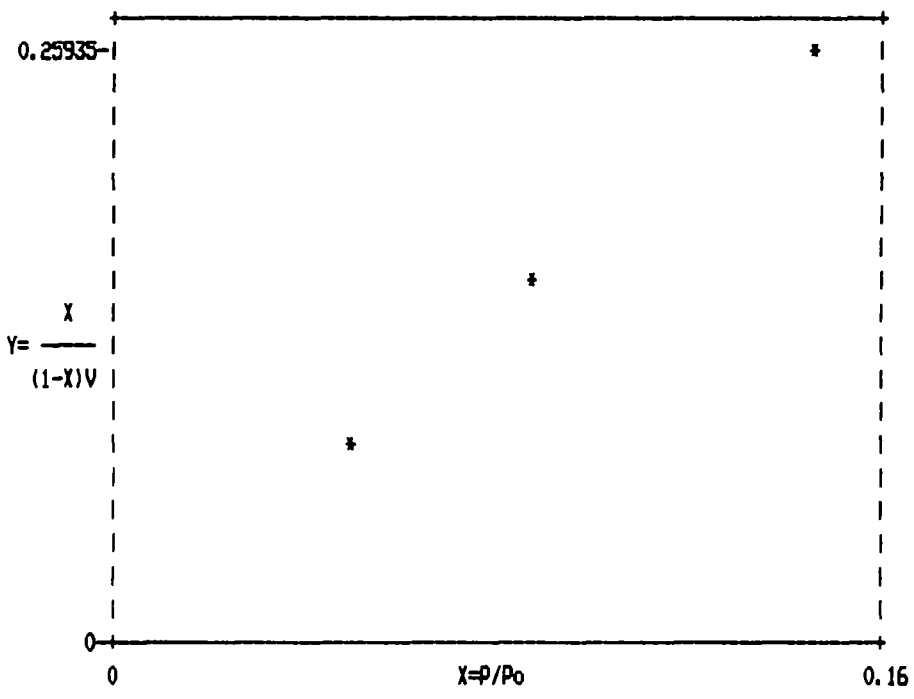

Figure B-77. Plot of BET equation versus relative pressure for Converter A316/0460-3-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/10/87

SAMPLE I.D.: A316/0460-3 LL-2
SAMPLE WEIGHT: 15.6000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	16.56	1.06	0.0490	0.04857
8.860	18.29	1.17	0.0869	0.08116
14.900	19.71	1.26	0.1461	0.13544

BET SURFACE AREA: 4.83 +/- 0.08 m^2/g
SLOPE: 0.8967 +/- 0.0150
INTERCEPT: 0.0041 +/- 0.0015
C: 220.07
Vm: 1.11 cm^3/g
CORRELATION COEFFICIENT 0.9999

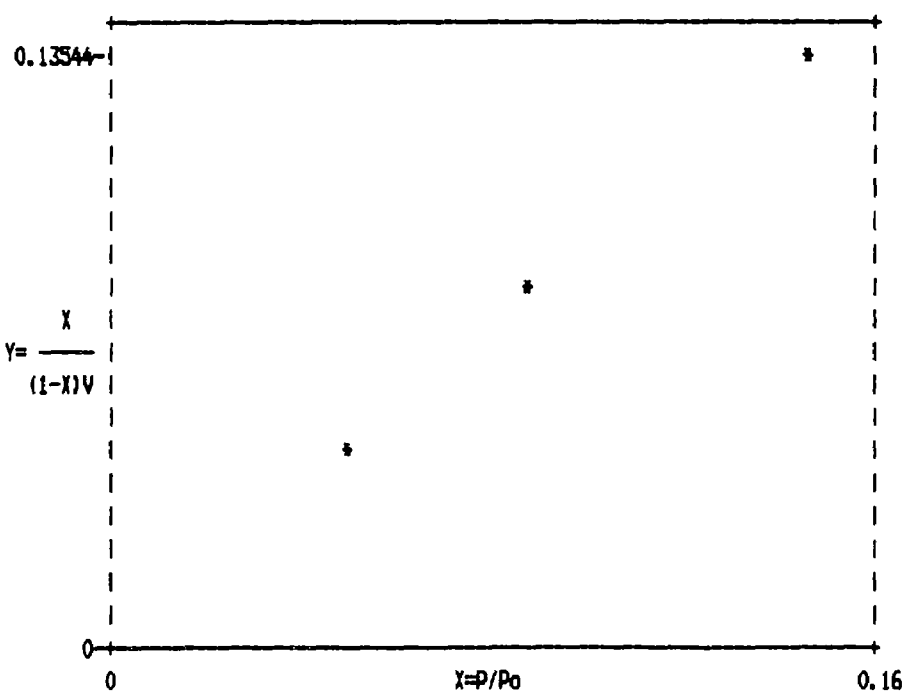

Figure B-78. Plot of BET equation versus relative pressure for Converter A316/0460-3-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/11/87

SAMPLE I.D.: A316/0460-3 (LL-3)
SAMPLE WEIGHT: 17.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	10.37	0.61	0.0490	0.08453
8.860	11.06	0.65	0.0869	0.14626
14.900	11.60	0.68	0.1461	0.25078

BET SURFACE AREA: 2.54 +/- 0.05 m^2/g
SLOPE: 1.7171 +/- 0.0362
INTERCEPT: -0.0009 +/- 0.0037
C: -1898.57
Vm: 0.58 cm^3/g
CORRELATION COEFFICIENT 0.9998

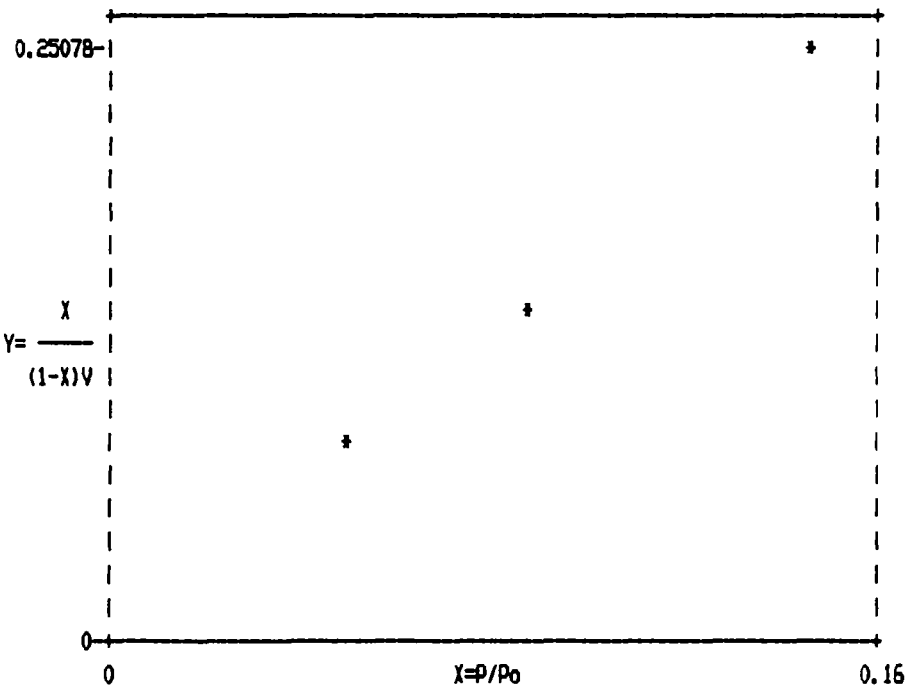

Figure B-79. Plot of BET equation versus relative pressure for Converter A316/0460-3-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/15/87

SAMPLE I.D.: A316/0460-3 (LL-1)
SAMPLE WEIGHT: 1.3272 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.05	0.79	0.0490	0.06517
8.860	1.12	0.84	0.0869	0.11276
14.900	1.28	0.96	0.1461	0.17743
22.000	1.56	1.18	0.2157	0.23404

BET SURFACE AREA: 4.22 +/- 0.28 m^2/g
SLOPE: 1.0101 +/- 0.0675
INTERCEPT: 0.0217 +/- 0.0094
C: 47.65
Vm: 0.97 cm^3/g
CORRELATION COEFFICIENT 0.9956

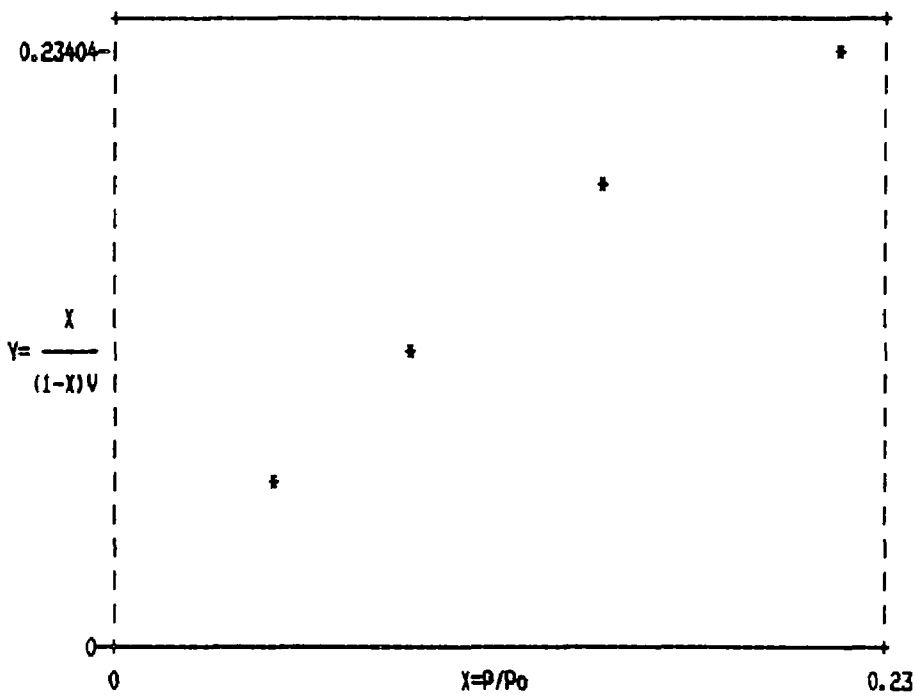

Figure B-80. Plot of BET equation versus relative pressure for Converter A316/0460-3-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A316/0665-1 LL-1
SAMPLE WEIGHT: 14.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	15.61	1.12	0.0490	0.04624
8.680	17.68	1.26	0.0851	0.07367
14.900	18.37	1.31	0.1461	0.13041

BET SURFACE AREA: 4.97 +/- 0.26 m^2/g
SLOPE: 0.8736 +/- 0.0449
INTERCEPT: 0.0018 +/- 0.0046
C: 479.36
Vm: 1.14 cm^3/g
CORRELATION COEFFICIENT 0.9987

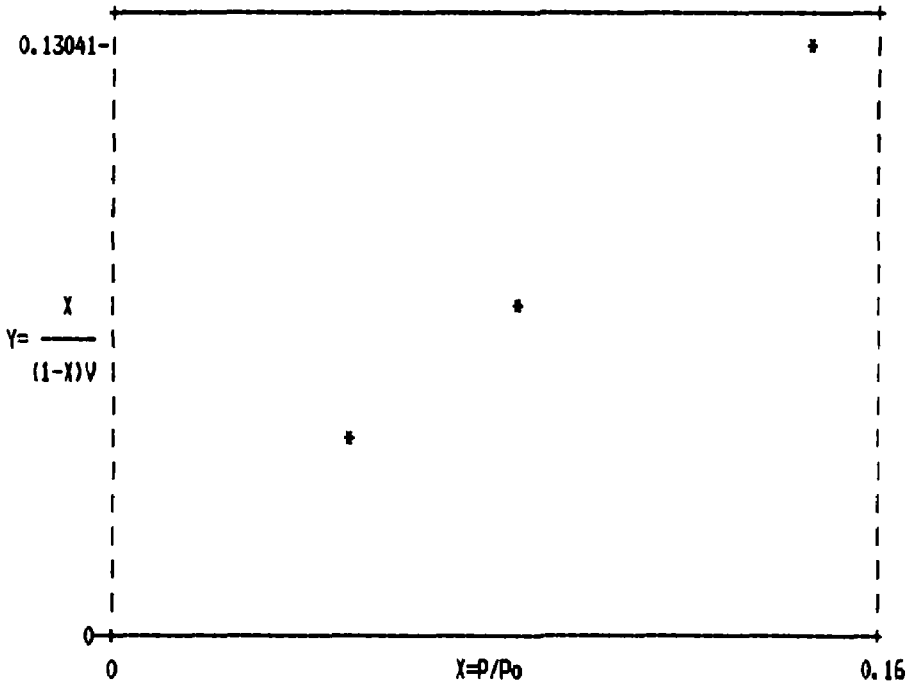

Figure B-81. Plot of BET equation versus relative pressure for Converter A316/0665-1-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A316/0665-1 (LL-2)
SAMPLE WEIGHT: 13.6000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	22.26	1.64	0.0490	0.03150
8.860	23.55	1.73	0.0869	0.05495
14.900	26.11	1.92	0.1461	0.08913

BET SURFACE AREA: 7.32 +/- 0.14 m^2/g
SLOPE: 0.5922 +/- 0.0115
INTERCEPT: 0.0029 +/- 0.0012
C: 208.16
Vm: 1.68 cm^3/g
CORRELATION COEFFICIENT 0.9998

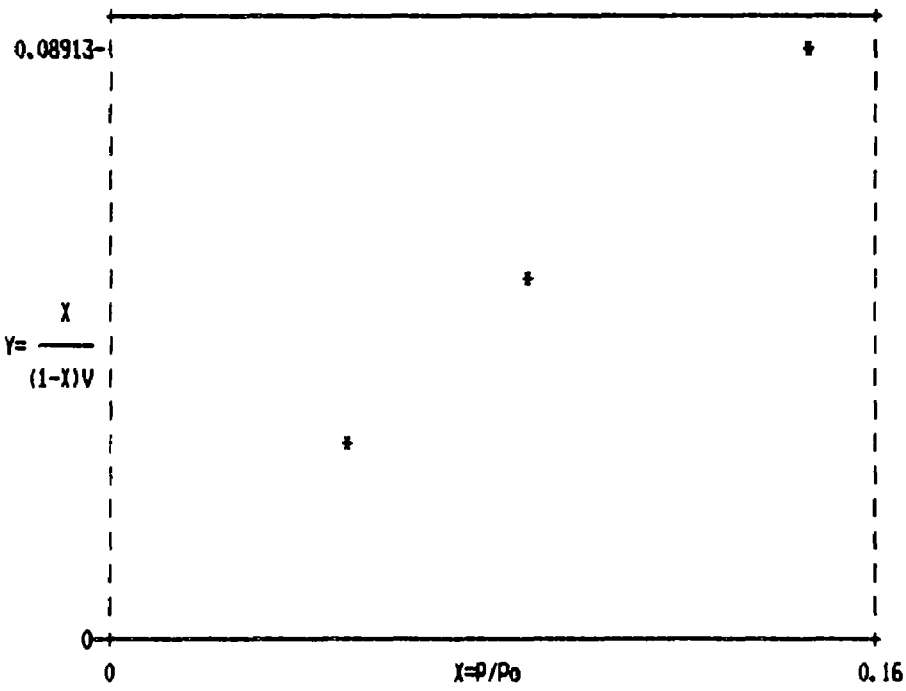

Figure B-82. Plot of BET equation versus relative pressure for Converter A316/0665-1-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A316/0665-1 LL-3
SAMPLE WEIGHT: 14.5000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	27.67	1.91	0.0490	0.02702
8.860	29.67	2.05	0.0869	0.04650
14.900	32.75	2.26	0.1461	0.07576

BET SURFACE AREA: 8.64 +/- 0.10 m^2/g
SLOPE: 0.5014 +/- 0.0056
INTERCEPT: 0.0026 +/- 0.0006
C: 191.82
Vm: 1.98 cm^3/g
CORRELATION COEFFICIENT 0.9999

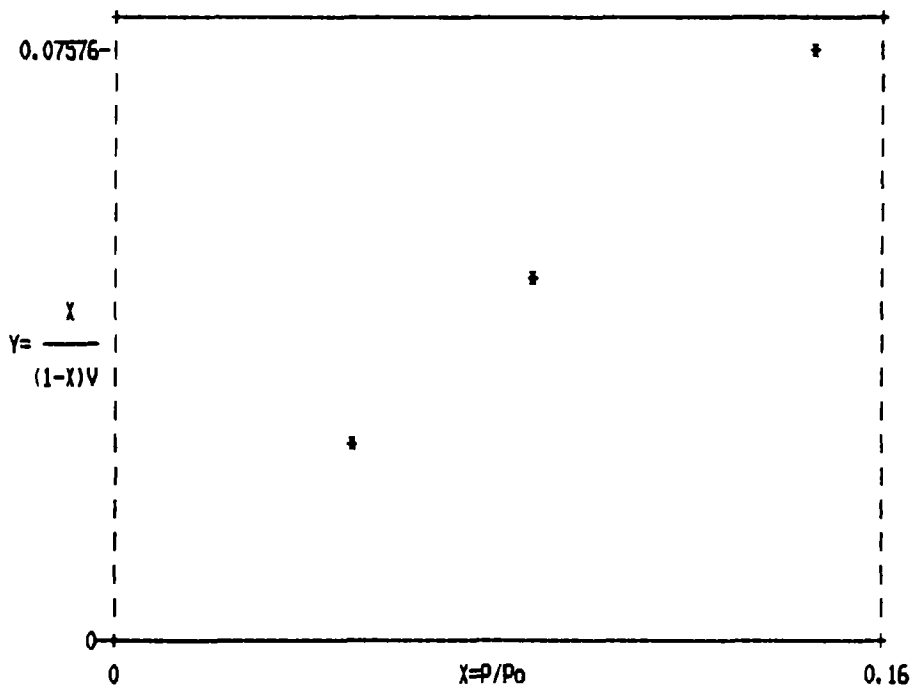

Figure B-83. Plot of BET equation versus relative pressure for Converter A316/0665-1-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/31/87

SAMPLE I.D.: A316/0665-1 (LL-1) 100 MESH
SAMPLE WEIGHT: 1.4353 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.69	1.18	0.0490	0.04379
8.860	1.94	1.35	0.0869	0.07040
14.900	2.34	1.63	0.1461	0.10496
22.000	2.67	1.86	0.2157	0.14788

BET SURFACE AREA: 6.88 +/- 0.14 m^2/g
SLOPE: 0.6181 +/- 0.0131
INTERCEPT: 0.0148 +/- 0.0018
C: 42.66
Vm: 1.58 cm^3/g
CORRELATION COEFFICIENT 0.9996

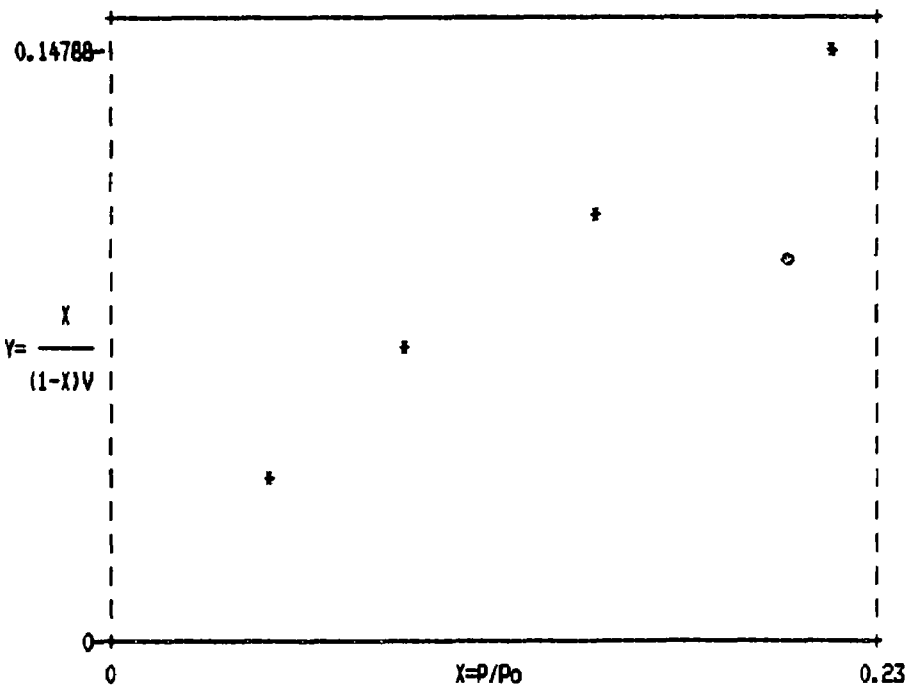

Figure B-84. Plot of BET equation versus relative pressure for Converter A316/0665-1-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/31/87

SAMPLE I.D.: A316/0665-2 (LL-1)
SAMPLE WEIGHT: 15.9000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	23.75	1.49	0.0490	0.03452
8.860	25.65	1.61	0.0869	0.05898
14.900	28.23	1.78	0.1461	0.09638

BET SURFACE AREA: 6.80 +/- 0.04 m^2/g
SLOPE: 0.6367 +/- 0.0040
INTERCEPT: 0.0034 +/- 0.0004
C: 186.16
Vm: 1.56 cm^3/g
CORRELATION COEFFICIENT 1.0000

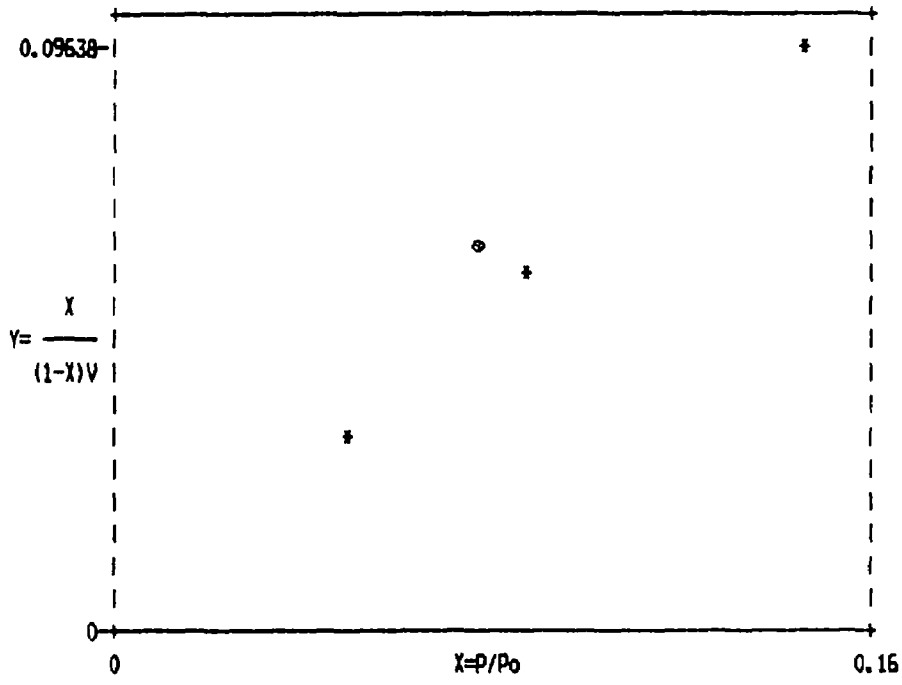

Figure B-85. Plot of BET equation versus relative pressure for Converter A316-0665-2-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/31/87

SAMPLE I.D.: A316/0665-2 (LL-2)
SAMPLE WEIGHT: 13.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	21.09	1.54	0.0490	0.03349
8.860	23.61	1.72	0.0869	0.05521
14.900	24.15	1.76	0.1461	0.09707

BET SURFACE AREA: 6.60 +/- 0.36 m^2/g
SLOPE: 0.6595 +/- 0.0359
INTERCEPT: -0.0001 +/- 0.0037
C: -9327.91
Vm: 1.52 cm^3/g
CORRELATION COEFFICIENT 0.9985

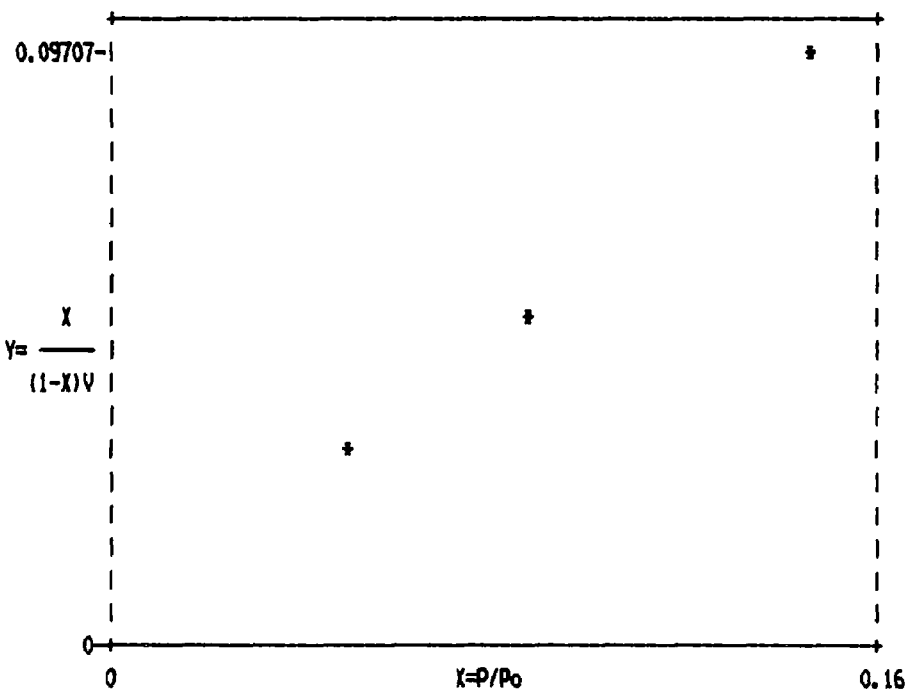

Figure B-86. Plot of BET equation versus relative pressure for Converter A316/0665-2-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/31/87

SAMPLE I.D.: A316/0665-2 (LL-3)
SAMPLE WEIGHT: 17.4500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	29.76	1.71	0.0490	0.03023
8.860	31.51	1.81	0.0869	0.05269
14.900	34.47	1.98	0.1461	0.08663

BET SURFACE AREA: 7.48 +/- 0.07 m^2/g
SLOPE: 0.5802 +/- 0.0056
INTERCEPT: 0.0020 +/- 0.0006
C: 294.74
Vm: 1.72 cm^3/g
CORRELATION COEFFICIENT 1.0000

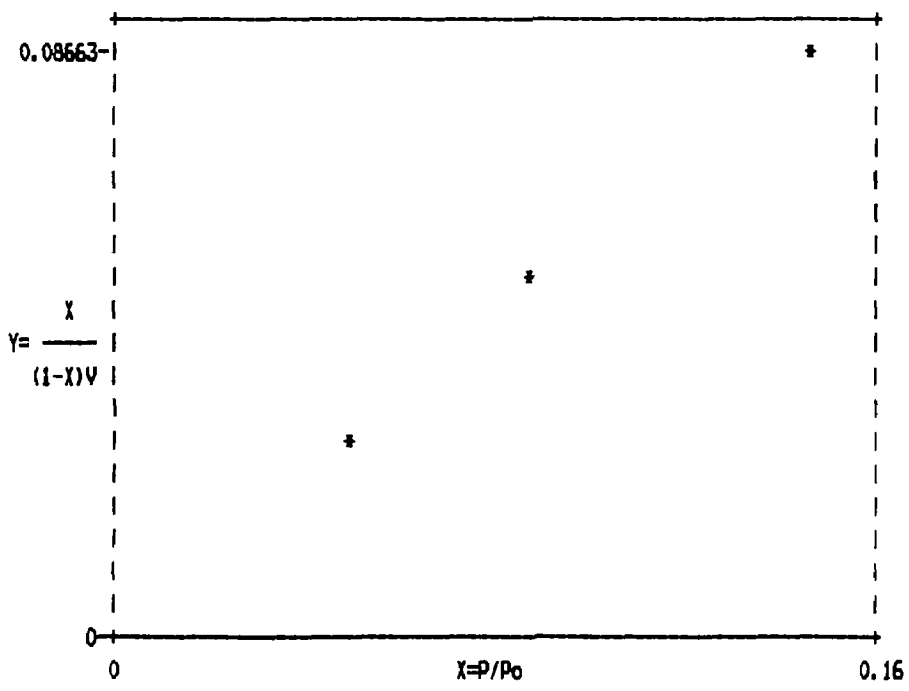

Figure B-87. Plot of BET equation versus relative pressure for Converter A316/0665-2-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A316/0665-2 (LL-1) 100
SAMPLE WEIGHT: 1.8037 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.95	1.64	0.0490	0.03153
8.860	3.22	1.79	0.0869	0.05330
14.900	3.62	2.01	0.1461	0.08526
22.000	4.19	2.32	0.2157	0.11842

BET SURFACE AREA: 8.24 +/- 0.24 m^2/g
SLOPE: 0.5207 +/- 0.0151
INTERCEPT: 0.0073 +/- 0.0021
C: 72.01
Vm: 1.89 cm^3/g
CORRELATION COEFFICIENT 0.9992

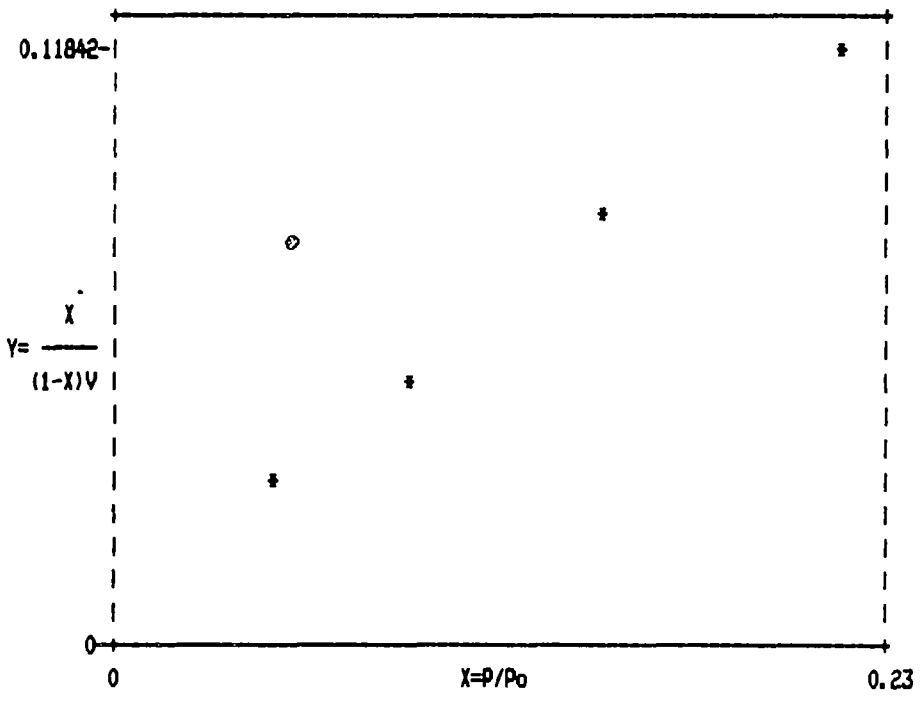

Figure B-88. Plot of BET equation versus relative pressure for Converter A316/0665-2-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/31/87

SAMPLE I.D.: A316/0665-3 (LL-1)
SAMPLE WEIGHT: 20.2000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	40.72	2.02	0.0490	0.02558
8.860	42.31	2.09	0.0869	0.04543
14.900	47.20	2.34	0.1461	0.07323

BET SURFACE AREA: 8.86 +/- 0.27 m^2/g
SLOPE: 0.4890 +/- 0.0149
INTERCEPT: 0.0021 +/- 0.0015
C: 232.74
Vm: 2.04 cm^3/g
CORRELATION COEFFICIENT: 0.9995

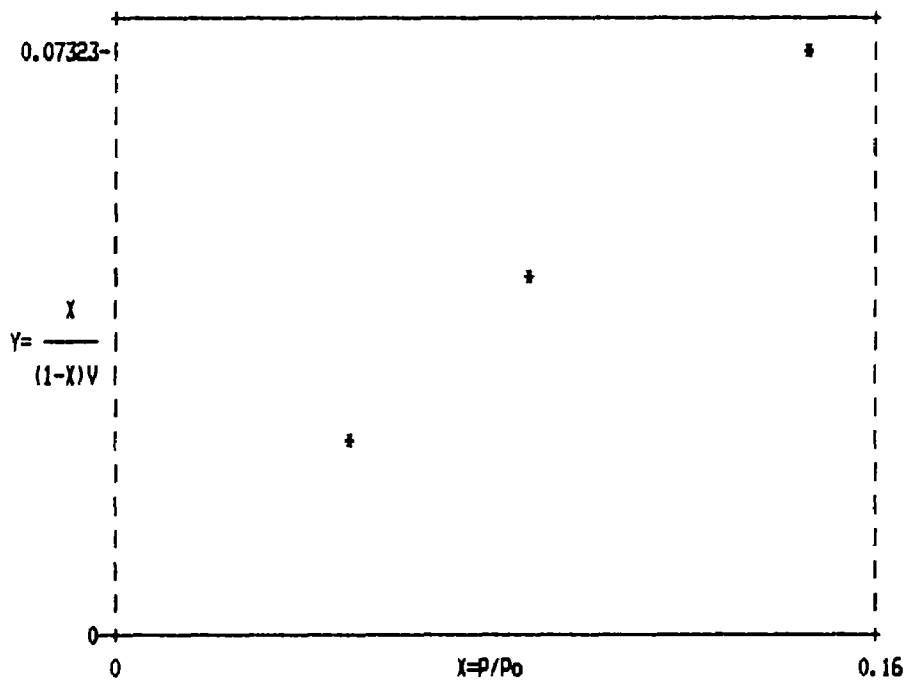

Figure B-89. Plot of BET equation versus relative pressure for Converter A316/0665-3-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/1/87

SAMPLE I.D.: A316/0665-3 (LL-2)
SAMPLE WEIGHT: 21.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	48.03	2.29	0.0490	0.02254
8.860	53.93	2.57	0.0869	0.03705
14.900	57.80	2.75	0.1461	0.06217

BET SURFACE AREA: 10.57 +/- 0.29 m^2/g
SLOPE: 0.4096 +/- 0.0110
INTERCEPT: 0.0021 +/- 0.0011
C: 197.59
Vm: 2.43 cm^3/g
CORRELATION COEFFICIENT 0.9996

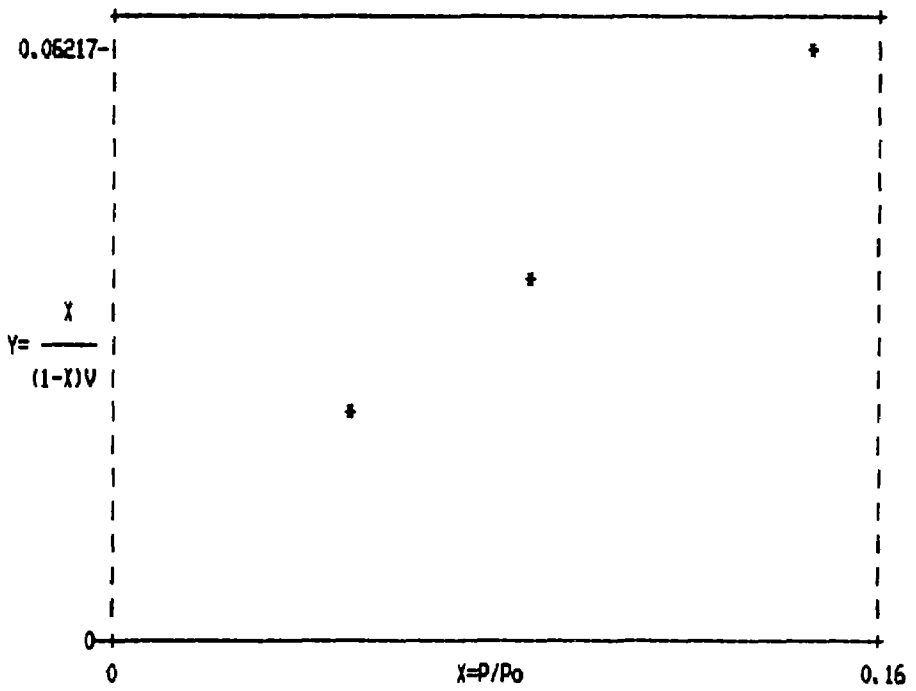

Figure B-90. Plot of BET equation versus relative pressure for Converter A316/0665-3-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/1/87

SAMPLE I.D.: A316/0665-3 (LL-3)
SAMPLE WEIGHT: 16.8000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	32.19	1.92	0.0490	0.02691
8.860	35.20	2.10	0.0869	0.04541
14.900	37.45	2.23	0.1461	0.07676

BET SURFACE AREA: 8.43 +/- 0.18 m^2/g
SLOPE: 0.5149 +/- 0.0109
INTERCEPT: 0.0013 +/- 0.0011
C: 400.63
Vm: 1.94 cm^3/g
CORRELATION COEFFICIENT 0.9998

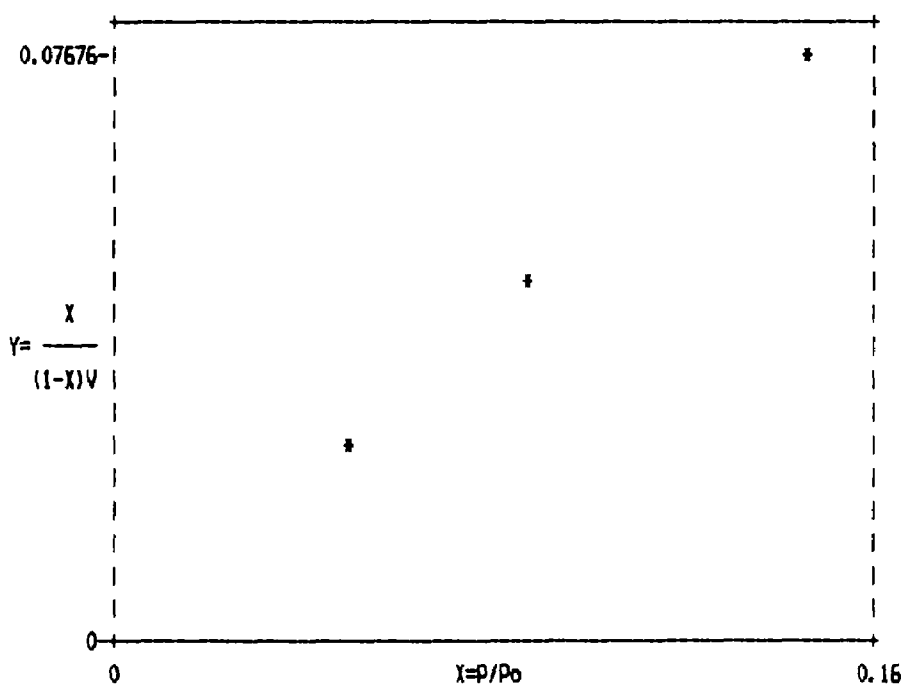

Figure B-91. Plot of BET equation versus relative pressure for Converter A316/0665-3-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A316/0665-3 (LL-1) 100
SAMPLE WEIGHT: 1.4843 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.77	2.54	0.0490	0.02030
8.860	3.89	2.62	0.0869	0.03631
14.900	4.90	3.30	0.1461	0.05184
22.000	5.20	3.50	0.2157	0.07852

BET SURFACE AREA: 12.66 +/- 0.72 m^2/g
SLOPE: 0.3394 +/- 0.0193
INTERCEPT: 0.0045 +/- 0.0027
C: 76.41
Vm: 2.91 cm^3/g
CORRELATION COEFFICIENT 0.9968

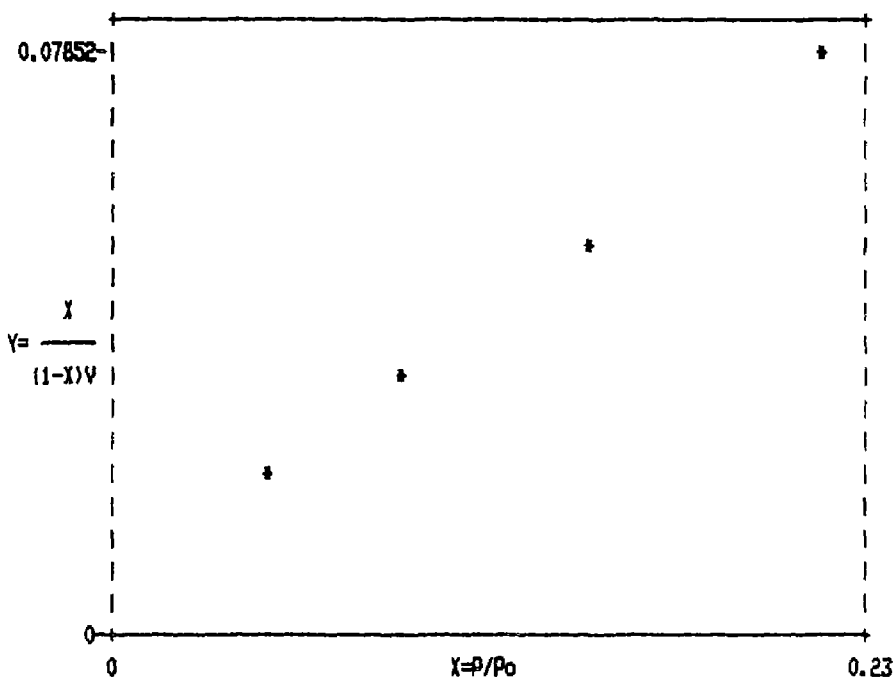

Figure B-92. Plot of BET equation versus relative pressure for Converter A316/0665-3-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/9/87

SAMPLE I.D.: A338/0124-1 LL-1
SAMPLE WEIGHT: 14.1000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	26.64	1.89	0.0490	0.02729
8.860	29.07	2.06	0.0869	0.04615
14.900	31.64	2.24	0.1461	0.07626

BET SURFACE AREA: 8.58 +/- 0.05 m^2/g
SLOPE: 0.5047 +/- 0.0027
INTERCEPT: 0.0024 +/- 0.0003
C: 207.01
Vm: 1.97 cm^3/g
CORRELATION COEFFICIENT 1.0000

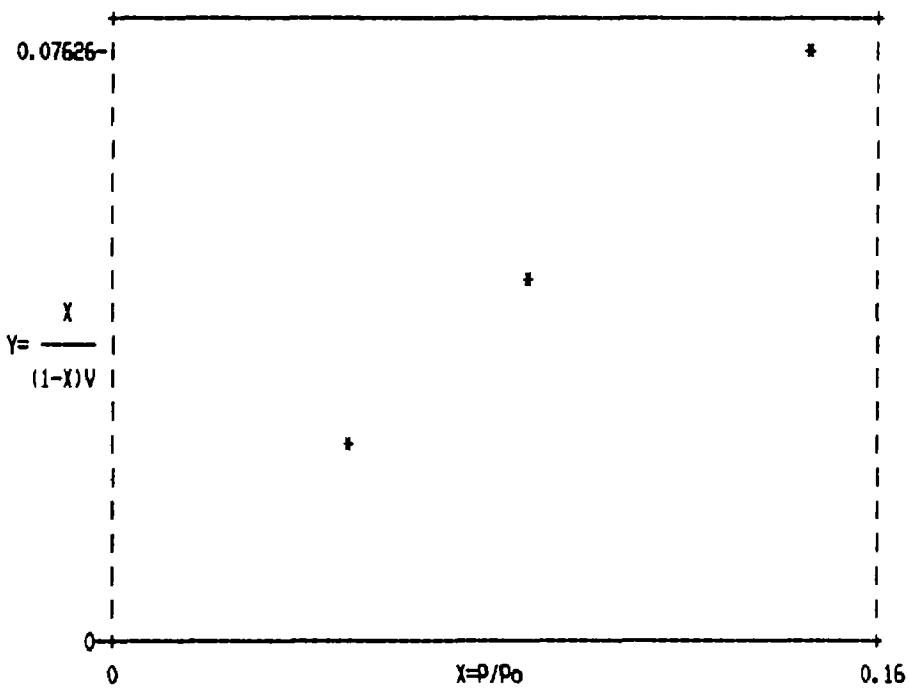

Figure B-93. Plot of BET equation versus relative pressure for Converter A338/0124-1-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/8/87

SAMPLE I.D.: A338/0124-1 LL-2
SAMPLE WEIGHT: 13.3000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	34.64	2.60	0.0490	0.01980
8.860	39.15	2.94	0.0869	0.03233
14.900	41.88	3.15	0.1461	0.05434

BET SURFACE AREA: 12.12 +/- 0.37 m^2/g
SLOPE: 0.3572 +/- 0.0110
INTERCEPT: 0.0019 +/- 0.0011
C: 188.68
Vm: 2.78 cm^3/g
CORRELATION COEFFICIENT 0.9995

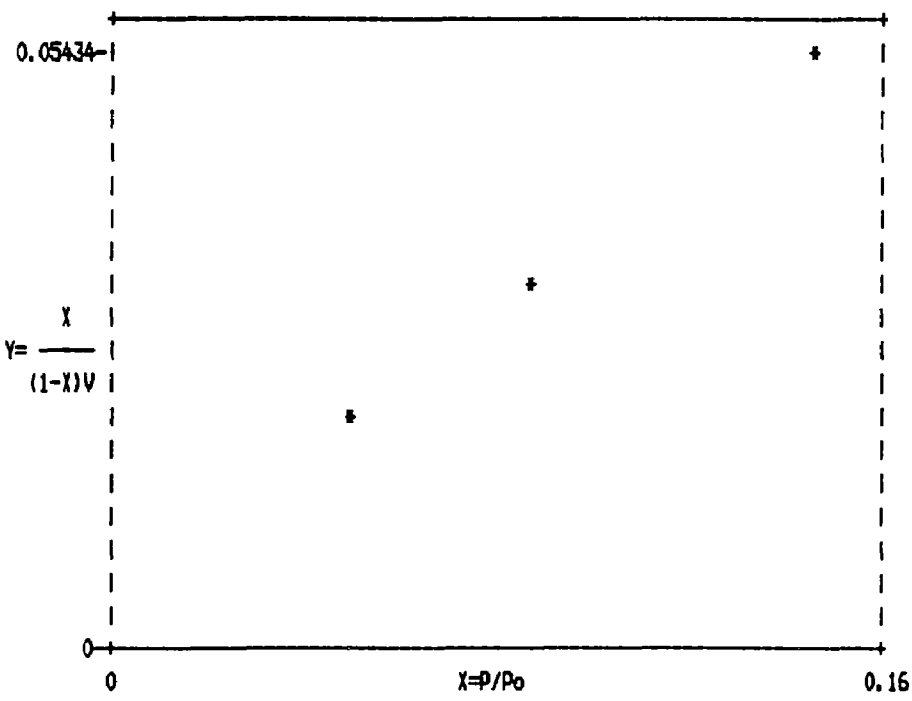

Figure B-94. Plot of BET equation versus relative pressure for Converter A338/0124-1-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/8/87

SAMPLE I.D.: A3380124-1 LL-3
SAMPLE WEIGHT: 12.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	31.32	2.47	0.0490	0.02091
8.860	34.46	2.71	0.0869	0.03507
14.900	36.25	2.85	0.1461	0.05995

BET SURFACE AREA: 10.76 +/- 0.33 m^2/g
SLOPE: 0.4037 +/- 0.0124
INTERCEPT: 0.0007 +/- 0.0013
C: 589.89
Vm: 2.47 cm^3/g
CORRELATION COEFFICIENT 0.9995

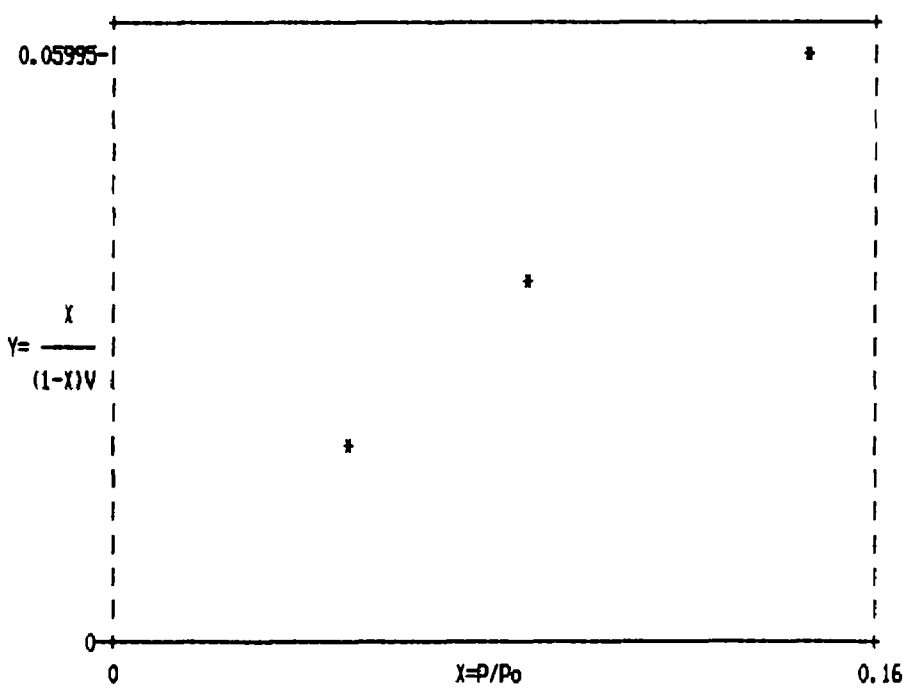

Figure B-95. Plot of BET equation versus relative pressure for Converter A338/0124-1-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/11/87

SAMPLE I.D.: A338/0124-1 (LL-1)
SAMPLE WEIGHT: 1.2642 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.39	1.89	0.0490	0.02727
8.860	2.75	2.18	0.0869	0.04374
14.900	3.25	2.57	0.1461	0.06656
22.000	3.65	2.89	0.2157	0.09528

BET SURFACE AREA: 10.54 +/- 0.14 m^2/g
SLOPE: 0.4051 +/- 0.0053
INTERCEPT: 0.0078 +/- 0.0007
C: 52.90
Vm: 2.42 cm^3/g
CORRELATION COEFFICIENT 0.9998

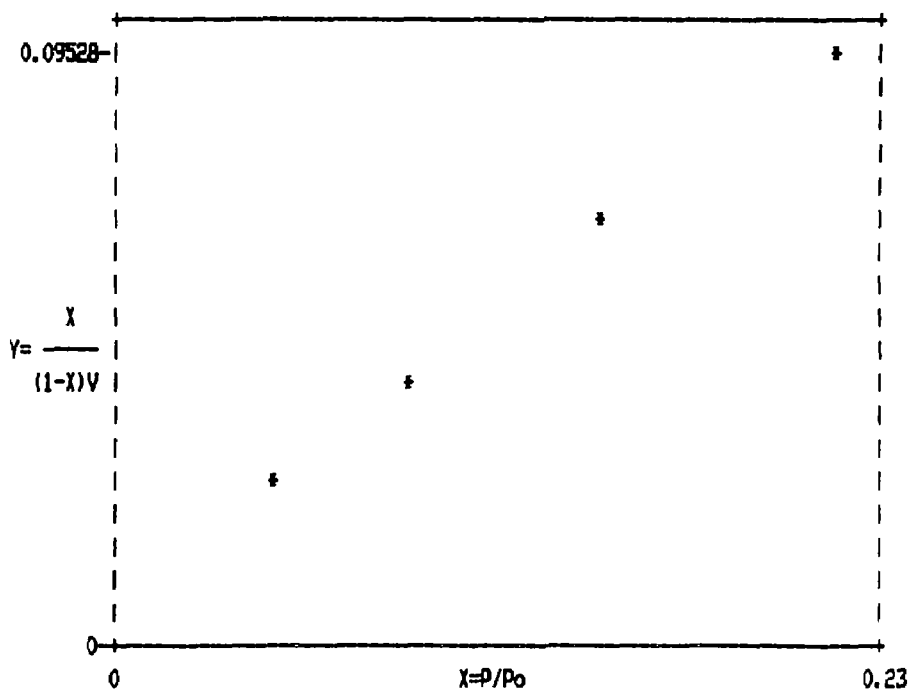

Figure B-96. Plot of BET equation versus relative pressure for Converter A338/0124-1-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/8/87

SAMPLE I.D.: A338/0124-2 LL-1
SAMPLE WEIGHT: 14.1000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	32.68	2.32	0.0490	0.02225
8.860	34.24	2.43	0.0869	0.03918
14.900	35.12	2.49	0.1461	0.06870

BET SURFACE AREA: 9.10 +/- 0.26 m^2/g
SLOPE: 0.4803 +/- 0.0138
INTERCEPT: -0.0018 +/- 0.0014
C: -269.99
Vm: 2.09 cm^3/g
CORRELATION COEFFICIENT 0.9996

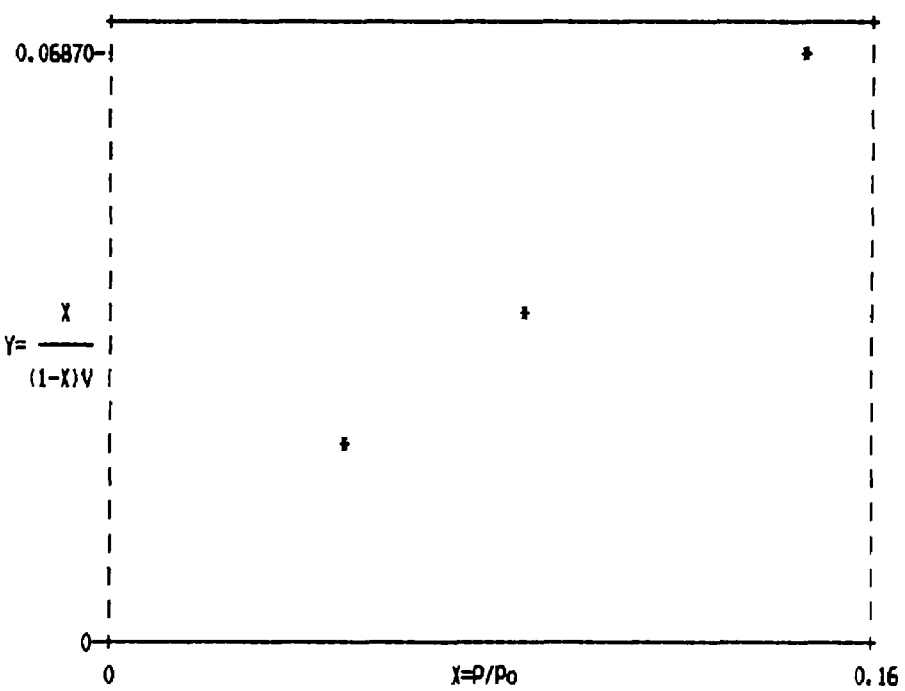

Figure B-97. Plot of BET equation versus relative pressure for Converter A338/0124-2-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/4/87

SAMPLE I.D.: A338/0124-2 (LL-2)
SAMPLE WEIGHT: 13.4000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	35.80	2.67	0.0490	0.01930
8.860	38.40	2.87	0.0869	0.03320
14.900	42.32	3.16	0.1461	0.05418

BET SURFACE AREA: 12.07 +/- 0.12 m^2/g
SLOPE: 0.3589 +/- 0.0036
INTERCEPT: 0.0018 +/- 0.0004
C: 197.61
Vm: 2.77 cm^3/g
CORRELATION COEFFICIENT 1.0000

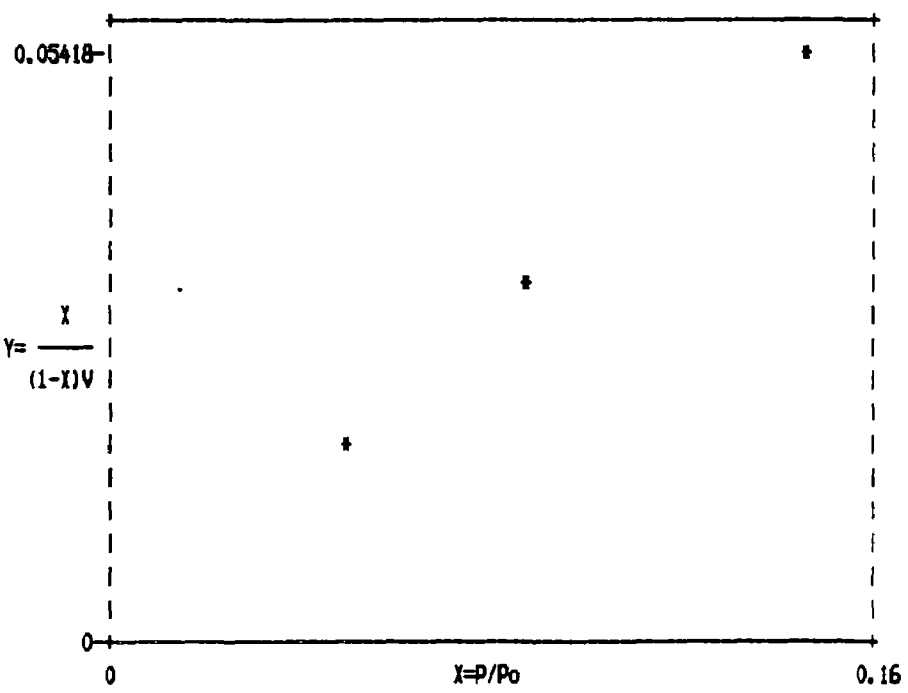

Figure B-98. Plot of BET equation versus relative pressure for Converter A338/0124-2-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/4/87

SAMPLE I.D.: A338/0124-2 (LL-3)
SAMPLE WEIGHT: 12.6000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	33.54	2.66	0.0490	0.01937
8.860	36.51	2.90	0.0869	0.03284
14.900	39.15	3.11	0.1461	0.05507

BET SURFACE AREA: 11.78 +/- 0.17 m^2/g
SLOPE: 0.3684 +/- 0.0053
INTERCEPT: 0.0011 +/- 0.0005
C: 328.83
Vm: 2.71 cm^3/g
CORRELATION COEFFICIENT 0.9999

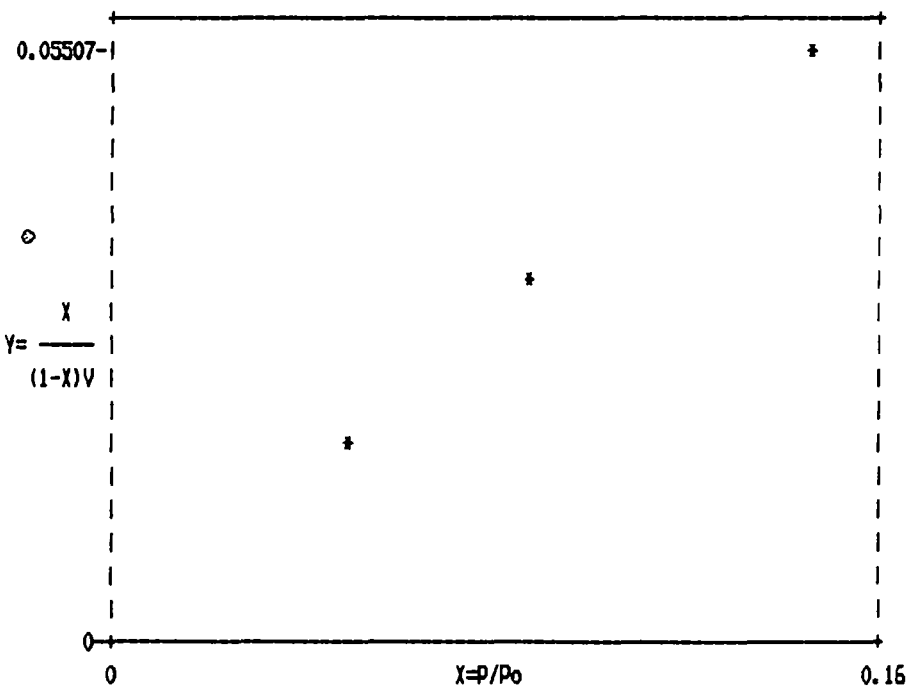

Figure B-99. Plot of BET equation versus relative pressure for Converter A338/0124-2-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/9/87

SAMPLE I.D.: A338/0124-2 LL-1
SAMPLE WEIGHT: 1.4997 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.75	2.50	0.0490	0.02062
8.860	4.23	2.82	0.0869	0.03374
14.900	4.99	3.33	0.1461	0.05143
22.000	5.36	3.57	0.2157	0.07697

BET SURFACE AREA: 12.86 +/- 0.39 m^2/g
SLOPE: 0.3345 +/- 0.0101
INTERCEPT: 0.0041 +/- 0.0014
C: 83.39
Vm: 2.95 cm^3/g
CORRELATION COEFFICIENT 0.9991

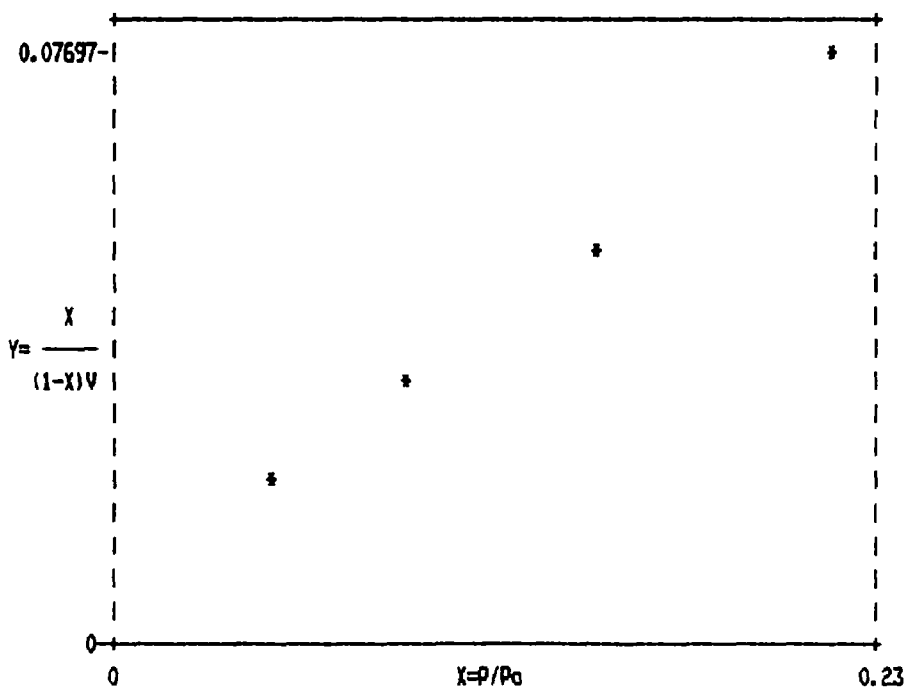

Figure B-100. Plot of BET equation versus relative pressure for Converter A338/0124-2-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/4/87

SAMPLE I.D.: A338/0124-3 (LL-1)
SAMPLE WEIGHT: 15.9000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	30.10	1.89	0.0490	0.02724
8.860	33.96	2.14	0.0869	0.04455
14.900	36.47	2.29	0.1461	0.07460

BET SURFACE AREA: 8.84 +/- 0.24 m^2/g
SLOPE: 0.4896 +/- 0.0135
INTERCEPT: 0.0028 +/- 0.0014
C: 177.96
Vm: 2.03 cm^3/g
CORRELATION COEFFICIENT 0.9996

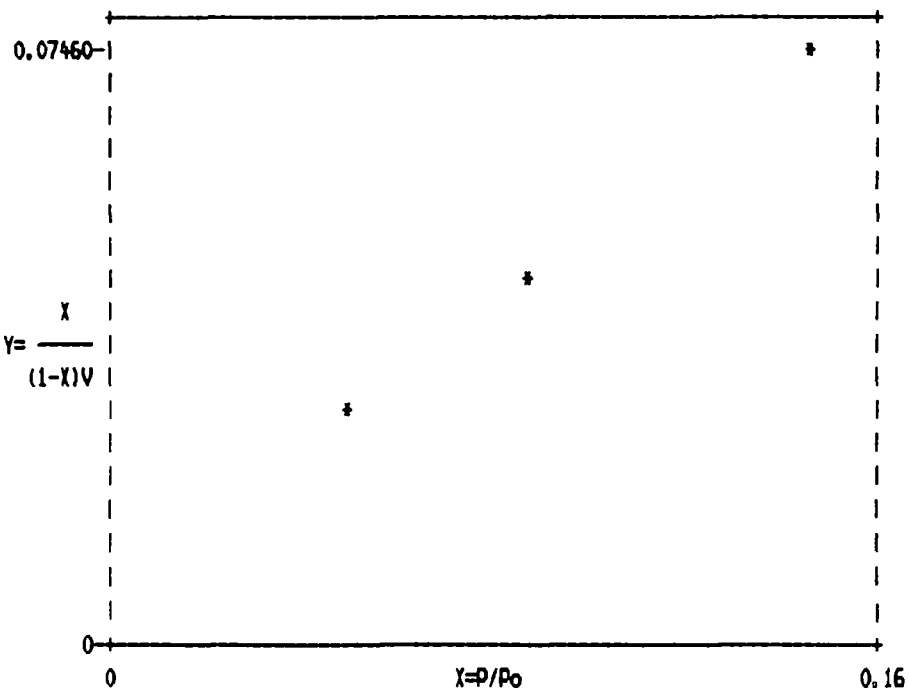

Figure B-101. Plot of BET equation versus relative pressure for Converter A338/0124-3-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/3/87

SAMPLE I.D.: A338/0124-3 LL-2
SAMPLE WEIGHT: 19.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	41.56	2.11	0.0490	0.02444
8.860	45.60	2.31	0.0869	0.04111
14.900	49.05	2.49	0.1461	0.06873

BET SURFACE AREA: 9.49 +/- 0.15 m^2/g
SLOPE: 0.4571 +/- 0.0070
INTERCEPT: 0.0018 +/- 0.0007
C: 256.42
Vm: 2.18 cm^3/g
CORRELATION COEFFICIENT 0.9999

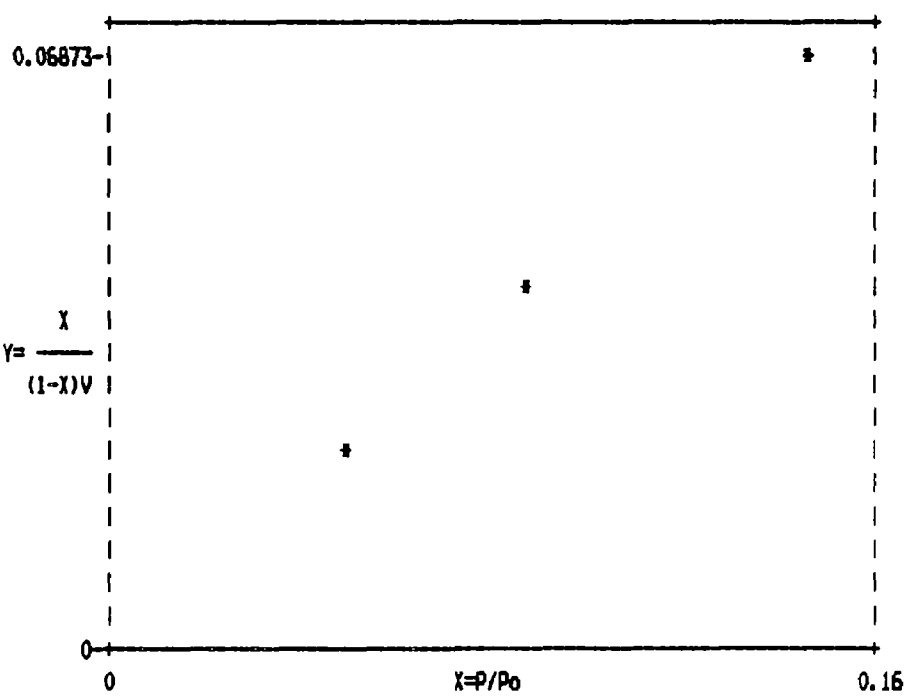

Figure B-102. Plot of BET equation versus relative pressure for Converter A338/0124-3-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/3/87

SAMPLE I.D.: A338/0124-3 (LL-3)
SAMPLE WEIGHT: 18.4000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	49.97	2.72	0.0490	0.01899
8.860	55.22	3.00	0.0869	0.03171
14.900	57.64	3.13	0.1461	0.05463

BET SURFACE AREA: 11.79 +/- 0.44 m^2/g
SLOPE: 0.3689 +/- 0.0138
INTERCEPT: 0.0004 +/- 0.0014
C: 859.68
Vm: 2.71 cm^3/g
CORRELATION COEFFICIENT 0.9993

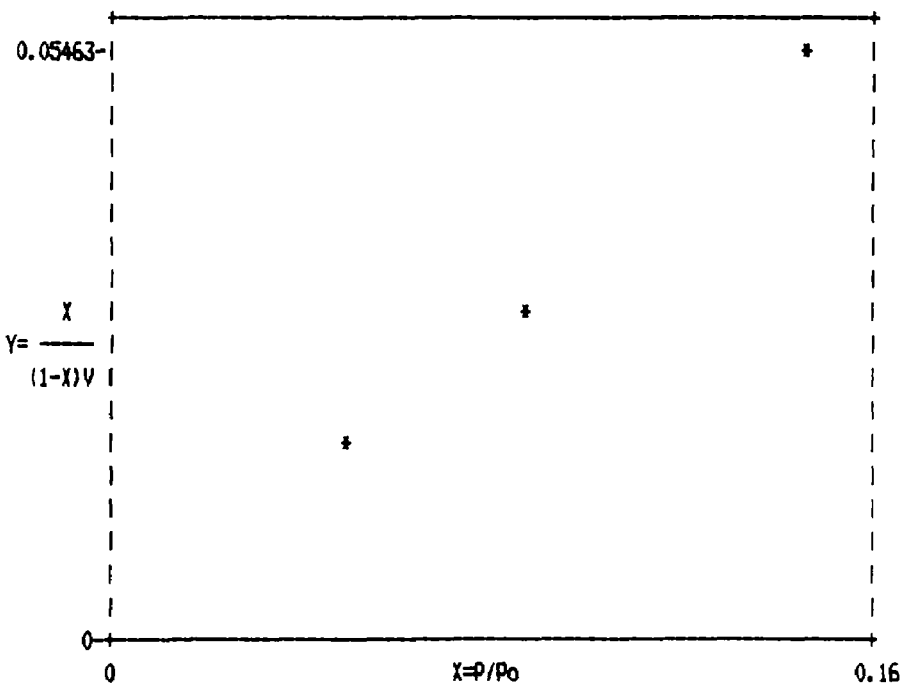

Figure B-103. Plot of BET equation versus relative pressure for Converter A338/0124-3-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/8/87

SAMPLE I.D.: A338/0124-3 LL-1
SAMPLE WEIGHT: 1.4449 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.49	2.42	0.0490	0.02135
8.860	3.75	2.60	0.0869	0.03666
14.900	4.21	2.91	0.1461	0.05873
22.000	4.66	3.23	0.2157	0.08530

BET SURFACE AREA: 11.31 +/- 0.10 m^2/g
SLOPE: 0.3819 +/- 0.0035
INTERCEPT: 0.0030 +/- 0.0005
C: 129.05
Vm: 2.60 cm^3/g
CORRELATION COEFFICIENT 0.9999

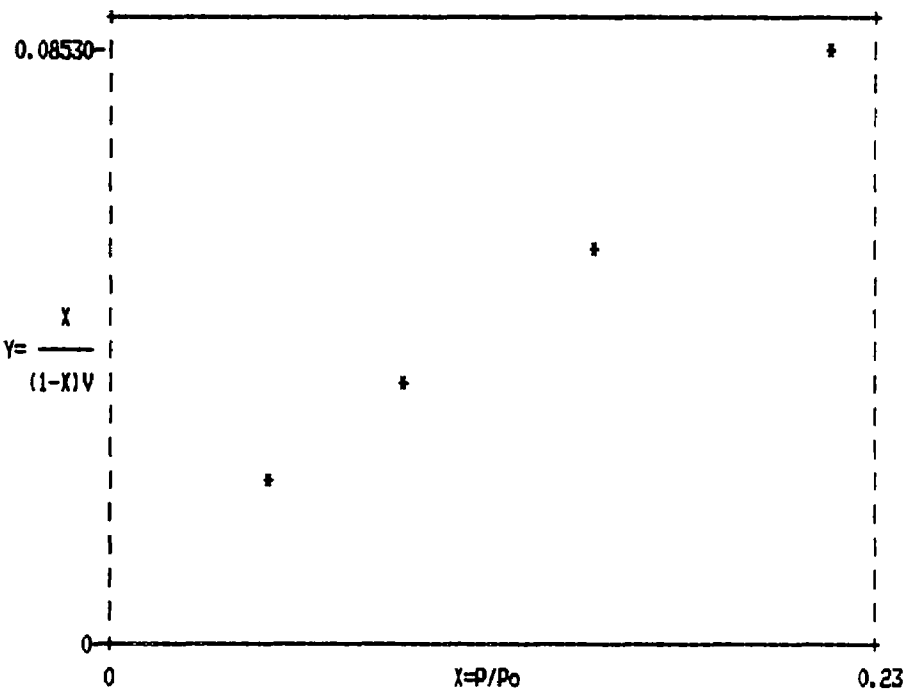

Figure B-104. Plot of BET equation versus relative pressure for Converter A338/0124-3-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A338/0136-1 LL-1
SAMPLE WEIGHT: 1.4874 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	5.61	3.77	0.0490	0.01367
8.860	6.13	4.12	0.0869	0.02309
14.900	6.83	4.59	0.1461	0.03727
22.000	7.56	5.08	0.2157	0.05412

BET SURFACE AREA: 17.84 +/- 0.08 m^2/g
SLOPE: 0.2422 +/- 0.0010
INTERCEPT: 0.0019 +/- 0.0001
C: 128.31
Vm: 4.10 cm^3/g
CORRELATION COEFFICIENT 1.0000

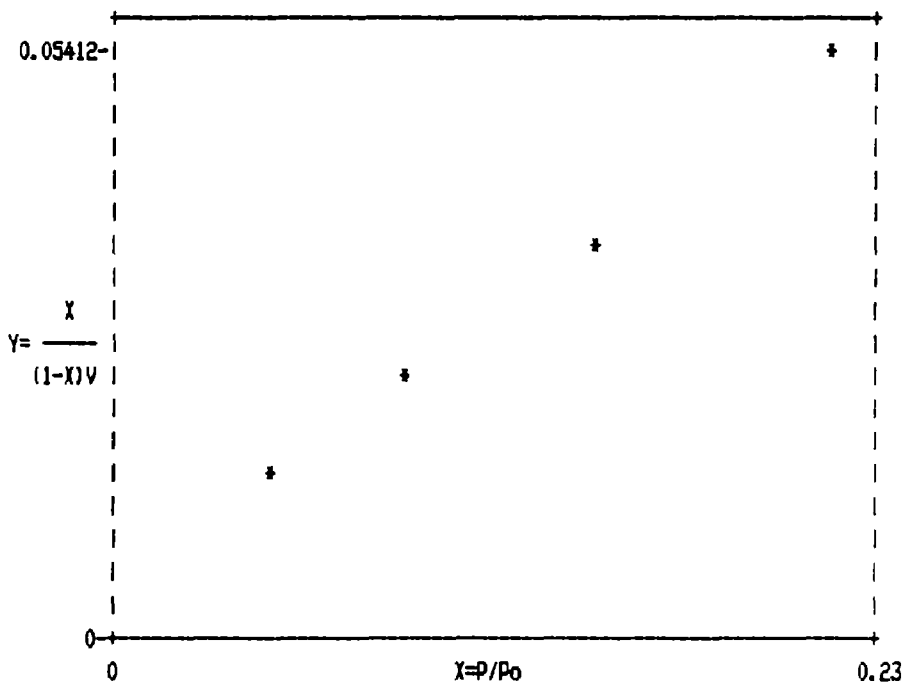

Figure B-105. Plot of BET equation versus relative pressure for Converter A338/0136-1-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/26/87

SAMPLE I.D.: A338/0136-2 LL-1 (BET)
SAMPLE WEIGHT: 1.5174 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.74	2.46	0.0490	0.02092
8.860	4.08	2.69	0.0869	0.03539
14.900	4.64	3.06	0.1461	0.05596
22.000	5.38	3.55	0.2157	0.07759

BET SURFACE AREA: 12.65 +/- 0.38 m^2/g
SLOPE: 0.3389 +/- 0.0103
INTERCEPT: 0.0053 +/- 0.0014
C: 65.10
Vm: 2.91 cm^3/g
CORRELATION COEFFICIENT 0.9991

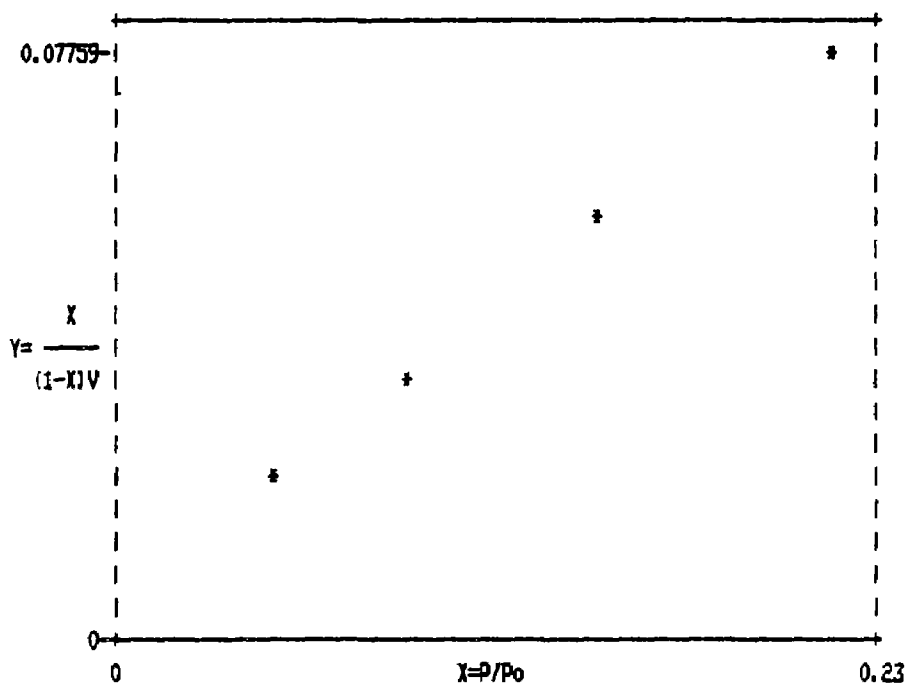

Figure B-106. Plot of BET equation versus relative pressure for Converter A338/0136-2-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/25/87

SAMPLE I.D.: A338/0136-3 (LL-1 100 MESH) ADSORBATE: Nitrogen
SAMPLE WEIGHT: 1.3494 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.52	2.61	0.0490	0.01977
8.860	3.91	2.90	0.0869	0.03284
14.900	4.52	3.35	0.1461	0.05109
22.000	4.87	3.61	0.2157	0.07622

BET SURFACE AREA: 12.84 +/- 0.30 m^2/g
SLOPE: 0.3359 +/- 0.0078
INTERCEPT: 0.0032 +/- 0.0011
C: 106.86
Vm: 2.95 cm^3/g
CORRELATION COEFFICIENT 0.9995

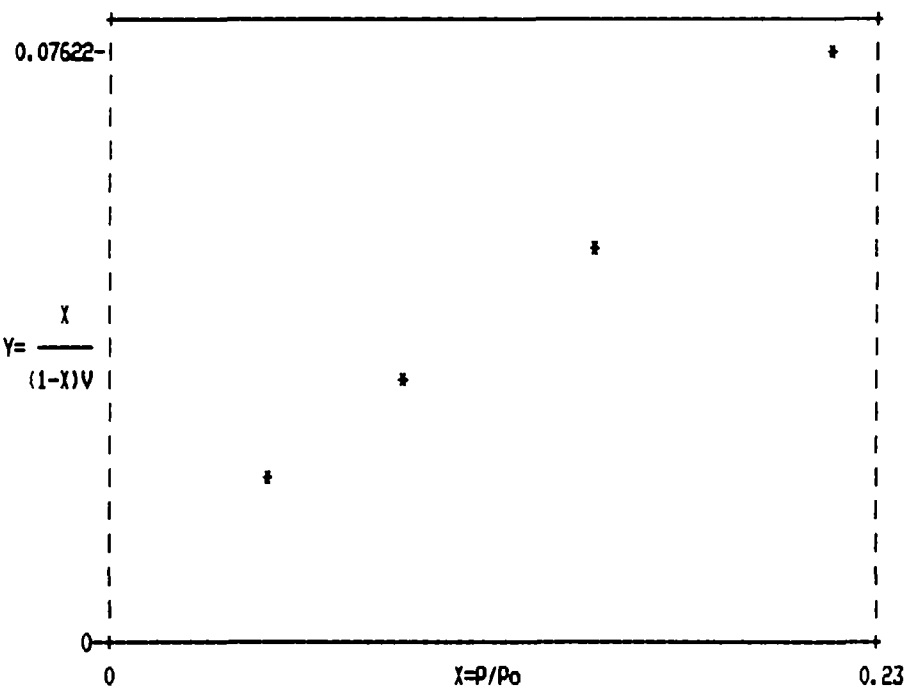

Figure B-107. Plot of BET equation versus relative pressure for Converter A338/0136-3-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/14/87

SAMPLE I.D.: A230/0734-A LL-1
SAMPLE WEIGHT: 19.2000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	50.36	2.62	0.0490	0.01966
8.860	52.26	2.72	0.0869	0.03496
12.100	56.55	2.95	0.1187	0.04571

BET SURFACE AREA: 11.55 +/- 0.58 m^2/g
SLOPE: 0.3751 +/- 0.0188
INTERCEPT: 0.0016 +/- 0.0017
C: 234.22
Vm: 2.65 cm^3/g
CORRELATION COEFFICIENT 0.9987

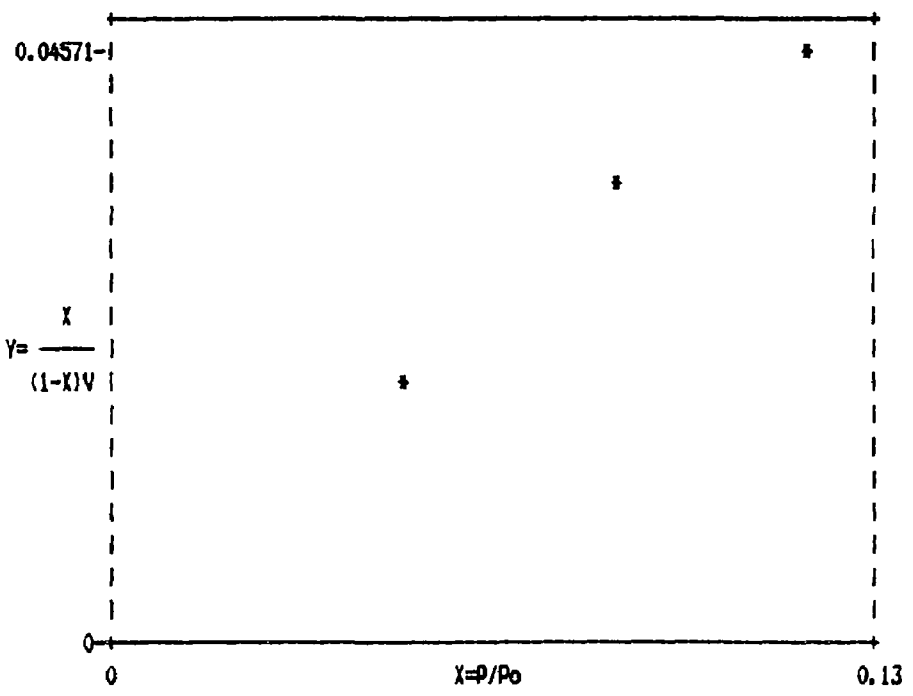

Figure B-108. Plot of BET equation versus relative pressure for Converter A230/0734-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/21/87

SAMPLE I.D.: A230/0734-A LL-2
SAMPLE WEIGHT: 12.1000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.00	0.08	0.0490	0.62388
8.860	1.11	0.09	0.0869	1.03725
12.100	1.23	0.10	0.1187	1.32444

BET SURFACE AREA: 0.43 +/- 0.02 m^2/g
SLOPE: 10.0889 +/- 0.5378
INTERCEPT: 0.1391 +/- 0.0481
C: 73.55
Vm: 0.10 cm^3/g
CORRELATION COEFFICIENT 0.9986

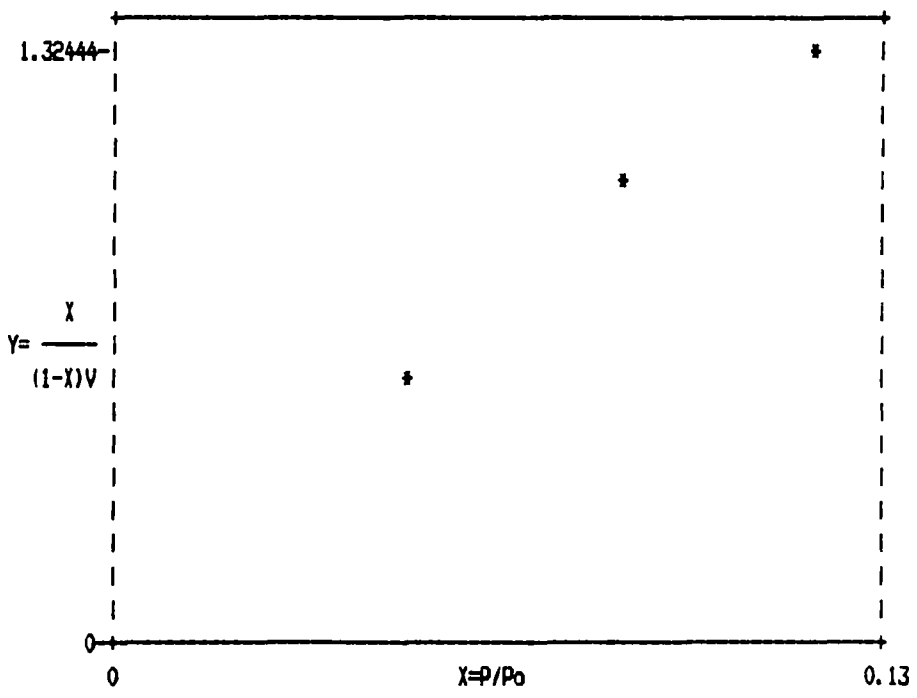

Figure B-109. Plot of BET equation versus relative pressure for Converter A230/0734-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/15/87

SAMPLE I.D.: A230/0734-A LL-3
SAMPLE WEIGHT: 13.0000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	8.73	0.67	0.0490	0.07678
8.860	9.22	0.71	0.0869	0.13416
12.100	10.36	0.80	0.1187	0.16894

BET SURFACE AREA: 3.24 +/- 0.29 m^2/g
SLOPE: 1.3297 +/- 0.1204
INTERCEPT: 0.0138 +/- 0.0108
C: 97.45
Vm: 0.74 cm^3/g
CORRELATION COEFFICIENT 0.9959

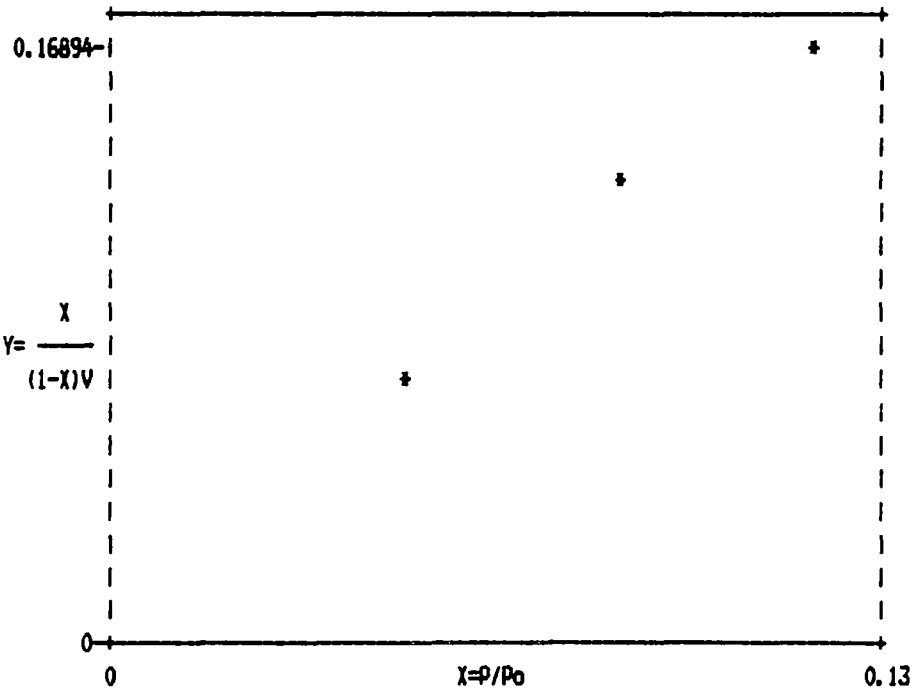

Figure B-110. Plot of BET equation versus relative pressure for Converter A230/0734-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/28/87

SAMPLE I.D.: A230/0734-A LL-1
SAMPLE WEIGHT: 1.2576 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.61	2.87	0.0490	0.01796
8.860	4.05	3.22	0.0869	0.02955
12.100	4.06	3.23	0.1187	0.04170
22.000	5.24	4.17	0.2157	0.06602

BET SURFACE AREA: 14.90 +/- 0.89 m^2/g
SLOPE: 0.2872 +/- 0.0173
INTERCEPT: 0.0050 +/- 0.0023
C: 57.98
Vm: 3.42 cm^3/g
CORRELATION COEFFICIENT 0.9964

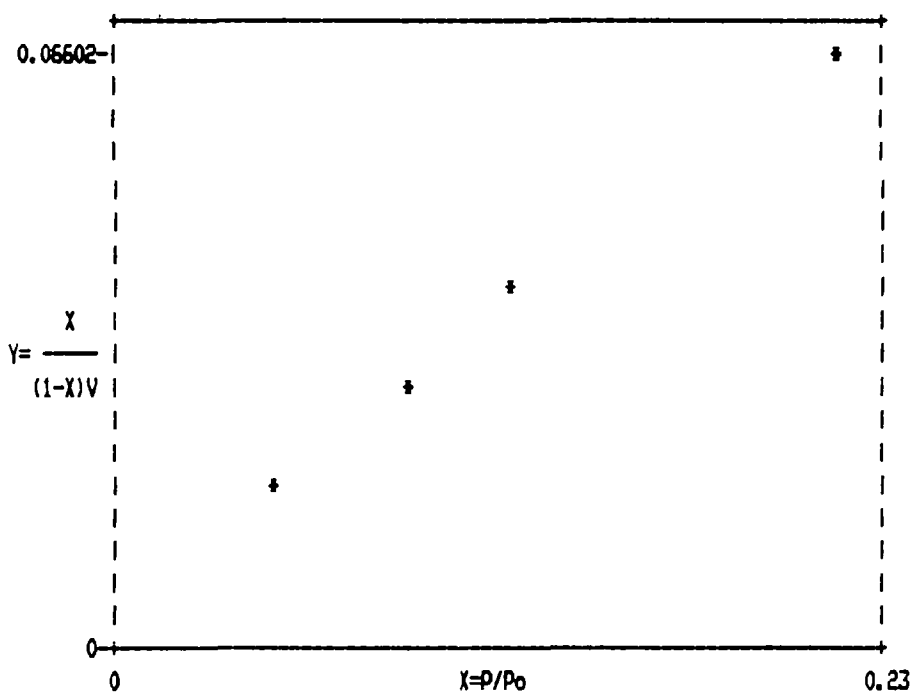

Figure B-111. Plot of BET equation versus relative pressure for Converter A230/0734-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 6/30/87

SAMPLE I.D.: A230/0734-B (UR-1)
SAMPLE WEIGHT: 15.9885 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	13.01	0.81	0.0490	0.06336
8.860	14.06	0.88	0.0869	0.10820
12.100	15.42	0.96	0.1187	0.13960

BET SURFACE AREA: 3.93 +/- 0.20 m^2/g
SLOPE: 1.0977 +/- 0.0562
INTERCEPT: 0.0106 +/- 0.0050
C: 104.84
Vm: 0.90 cm^3/g
CORRELATION COEFFICIENT 0.9987

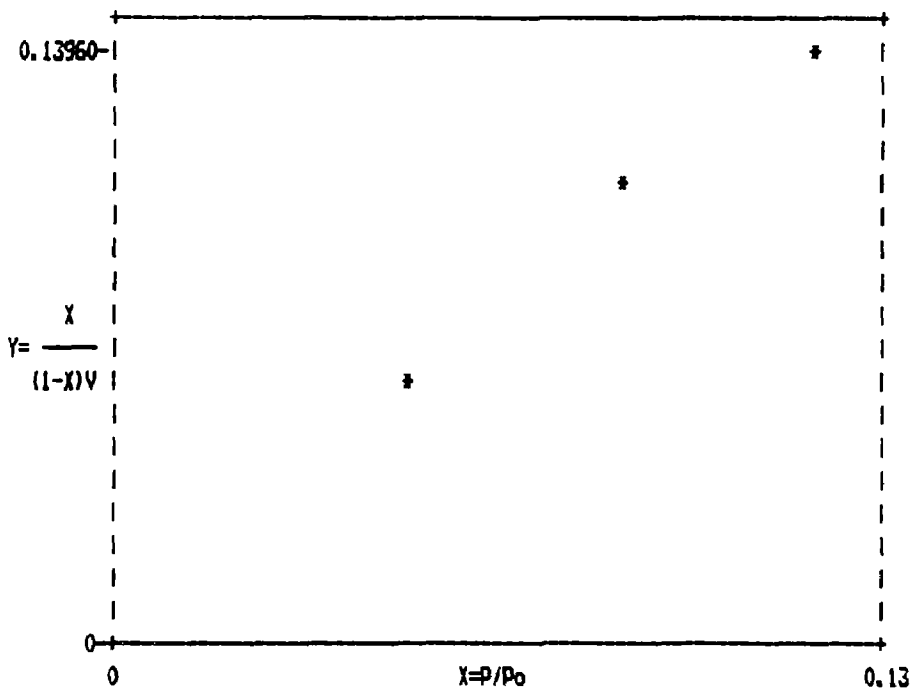

Figure B-112. Plot of BET equation versus relative pressure for Converter A230/0734-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/17/87

SAMPLE I.D.: A230/0734-B UR-2
SAMPLE WEIGHT: 17.1000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	18.68	1.09	0.0490	0.04720
8.860	21.22	1.24	0.0869	0.07668
12.100	23.30	1.36	0.1187	0.09881

BET SURFACE AREA: 5.78 +/- 0.18 m^2/g
SLOPE: 0.7424 +/- 0.0235
INTERCEPT: 0.0112 +/- 0.0021
C: 67.12
Vm: 1.33 cm^3/g
CORRELATION COEFFICIENT 0.9995

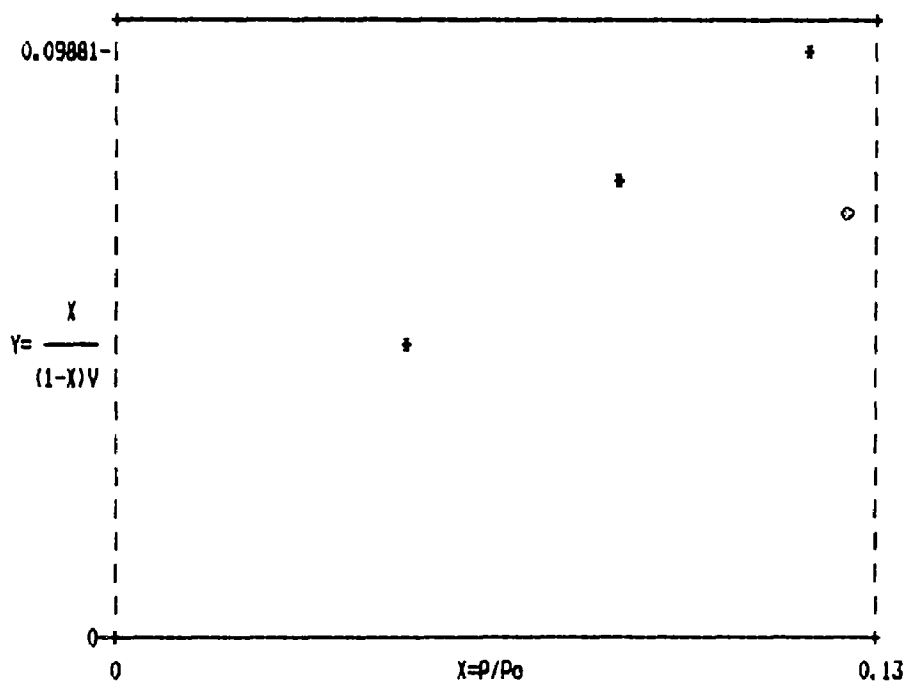

Figure B-113. Plot of BET equation versus relative pressure for Converter A230/0734-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/26/87

SAMPLE I.D.: A334/0677-A (LL-1)
SAMPLE WEIGHT: 27.9900 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	56.28	2.01	0.0490	0.02564
8.860	58.98	2.11	0.0869	0.04516
14.900	63.30	2.26	0.1461	0.07567

BET SURFACE AREA: 8.44 +/- 0.00 m^2/g
SLOPE: 0.5152 +/- 0.0002
INTERCEPT: 0.0004 +/- 0.0000
C: 1345.25
Vm: 1.94 cm^3/g
CORRELATION COEFFICIENT 1.0000

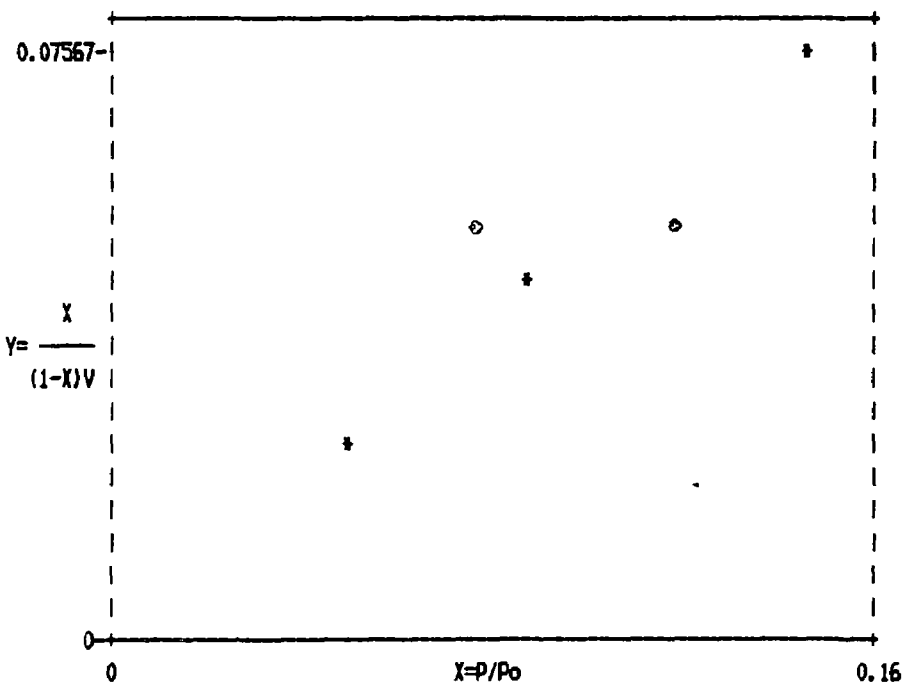

Figure B-114. Plot of BET equation versus relative pressure for Converter A334/0677-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/26/87

SAMPLE I.D.: A334/0677-A LL-2 (BET)
SAMPLE WEIGHT: 24.7400 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	29.90	1.21	0.0490	0.04266
8.860	31.30	1.27	0.0869	0.07521
14.900	35.88	1.45	0.1461	0.11799

BET SURFACE AREA: 5.60 +/- 0.27 m^2/g
SLOPE: 0.7712 +/- 0.0372
INTERCEPT: 0.0061 +/- 0.0038
C: 126.98
Vm: 1.29 cm^3/g
CORRELATION COEFFICIENT 0.9988

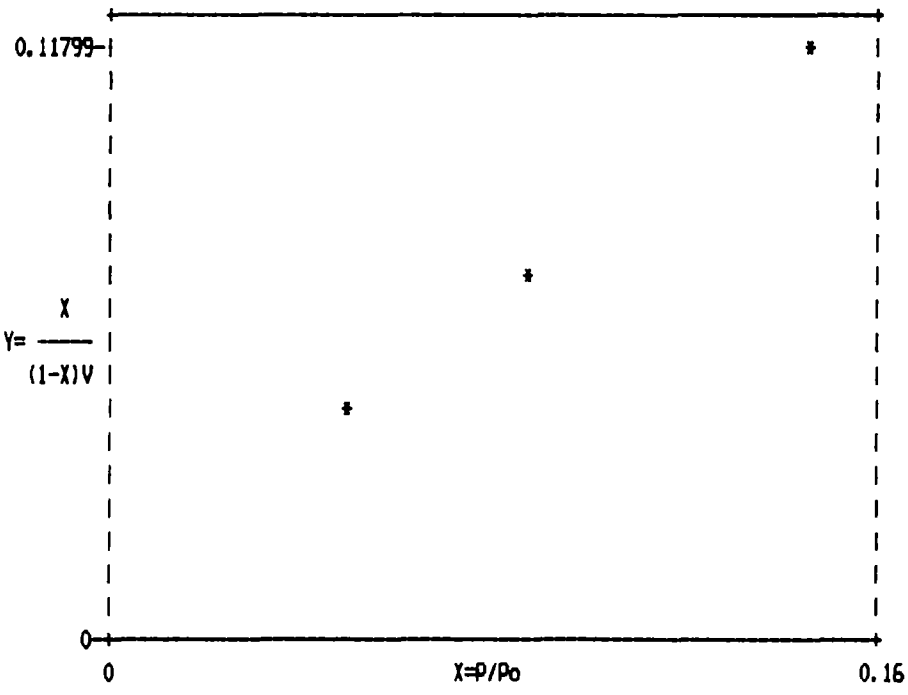

Figure B-115. Plot of BET equation versus relative pressure for Converter A334/0677-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/12/87

SAMPLE I.D.: A334/0677-A LL-3 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 19.9100 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	29.23	1.47	0.0490	0.03512
8.860	31.22	1.57	0.0869	0.06068
12.100	32.32	1.62	0.1187	0.08294

BET SURFACE AREA: 6.33 +/- 0.07 m^2/g
SLOPE: 0.6864 +/- 0.0072
INTERCEPT: 0.0013 +/- 0.0006
C: 516.44
Vm: 1.45 cm^3/g
CORRELATION COEFFICIENT 0.9999

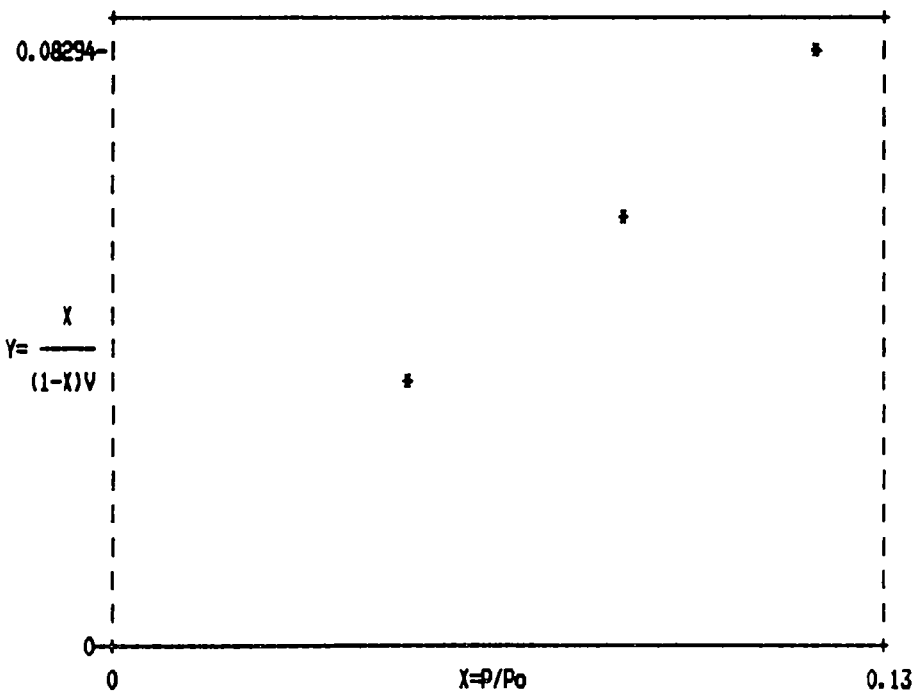

Figure B-116. Plot of BET equation versus relative pressure for Converter A334/0677-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/28/87

SAMPLE I.D.: A334/0677-A LL-1
SAMPLE WEIGHT: 1.6993 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	4.44	2.61	0.0490	0.01973
8.860	4.98	2.93	0.0869	0.03247
14.900	5.48	3.22	0.1461	0.05306
22.000	6.19	3.64	0.2157	0.07552

BET SURFACE AREA: 12.84 +/- 0.15 m^2/g
SLOPE: 0.3356 +/- 0.0039
INTERCEPT: 0.0034 +/- 0.0005
C: 98.82
Vm: 2.95 cm^3/g
CORRELATION COEFFICIENT 0.9999

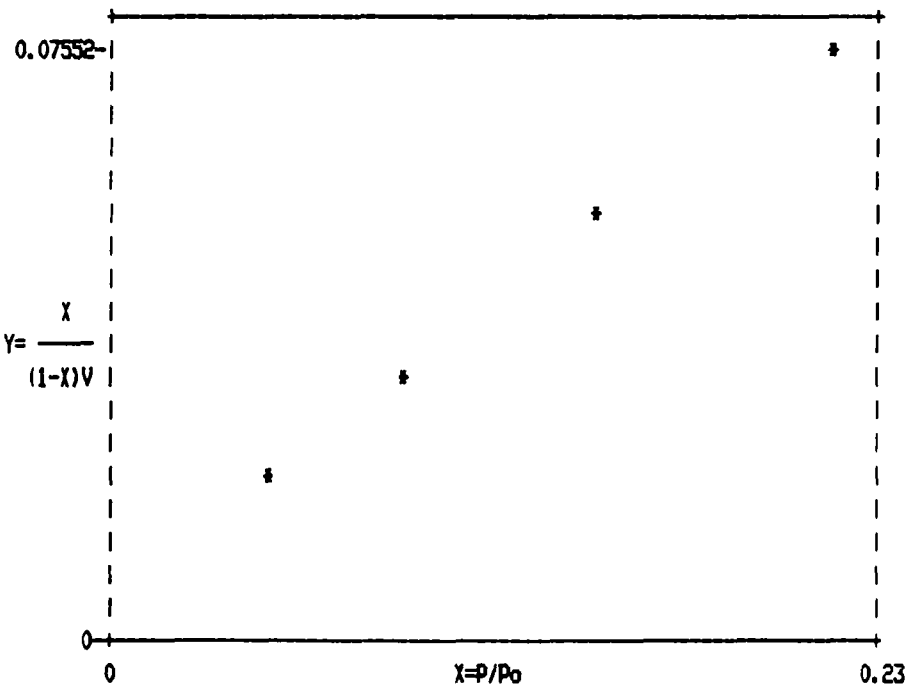

Figure B-117. Plot of BET equation versus relative pressure for Converter A334/0677-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/12/87

SAMPLE I.D.: A334/0677-B UR-1 ADSORBATE: Nitrogen
SAMPLE WEIGHT: 18.8300 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	22.66	1.20	0.0490	0.04285
8.860	24.84	1.32	0.0869	0.07213
12.100	25.96	1.38	0.1187	0.09766

BET SURFACE AREA: 5.50 +/- 0.06 m^2/g
SLOPE: 0.7868 +/- 0.0085
INTERCEPT: 0.0041 +/- 0.0008
C: 192.34
Vm: 1.26 cm^3/g
CORRELATION COEFFICIENT 0.9999

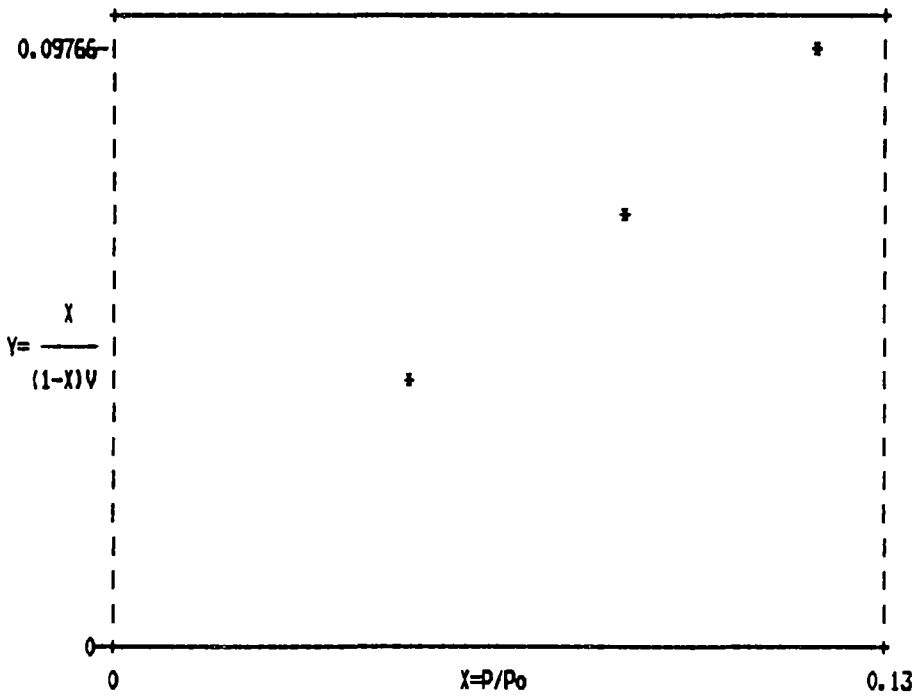

Figure B-118. Plot of BET equation versus relative pressure for Converter A334/0677-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/13/87

SAMPLE I.D.: A334/0677-B (UR-2)
SAMPLE WEIGHT: 16.2500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	25.63	1.58	0.0490	0.03269
8.860	28.62	1.76	0.0869	0.05403
12.100	30.14	1.85	0.1187	0.07259

BET SURFACE AREA: 7.54 +/- 0.08 m^2/g
SLOPE: 0.5727 +/- 0.0059
INTERCEPT: 0.0045 +/- 0.0005
C: 128.26
Vm: 1.73 cm^3/g
CORRELATION COEFFICIENT 0.9999

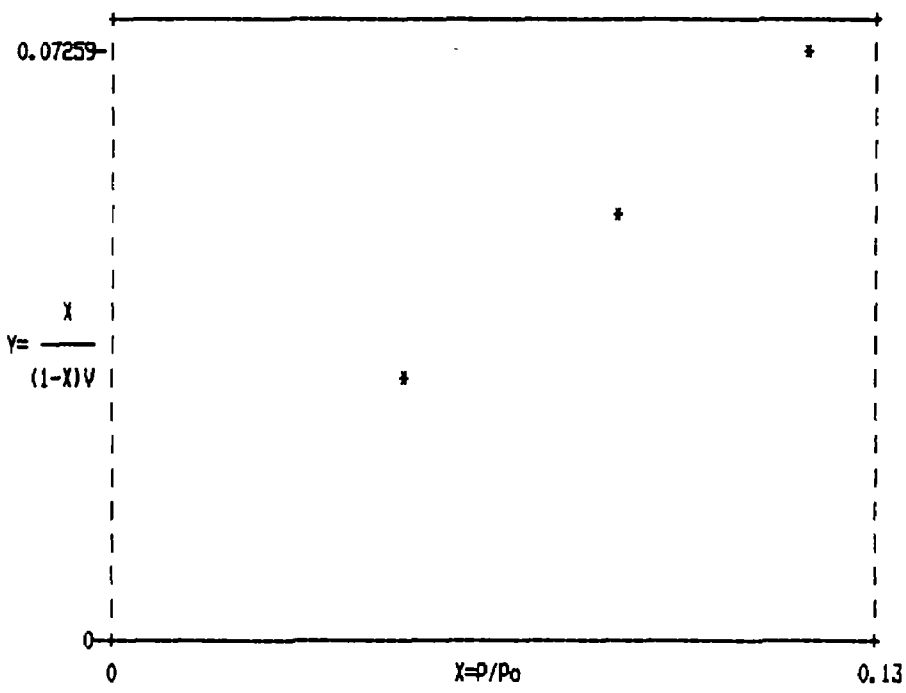

Figure B-119. Plot of BET equation versus relative pressure for Converter A334/0677-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A254/0031-A (LL-1)
SAMPLE WEIGHT: 18.5100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	28.02	1.51	0.0490	0.03406
8.860	30.45	1.65	0.0869	0.05784
14.900	33.55	1.81	0.1461	0.09441

BET SURFACE AREA: 6.97 +/- 0.03 m^2/g
SLOPE: 0.6212 +/- 0.0030
INTERCEPT: 0.0037 +/- 0.0003
C: 168.87
Vm: 1.60 cm^3/g
CORRELATION COEFFICIENT 1.0000

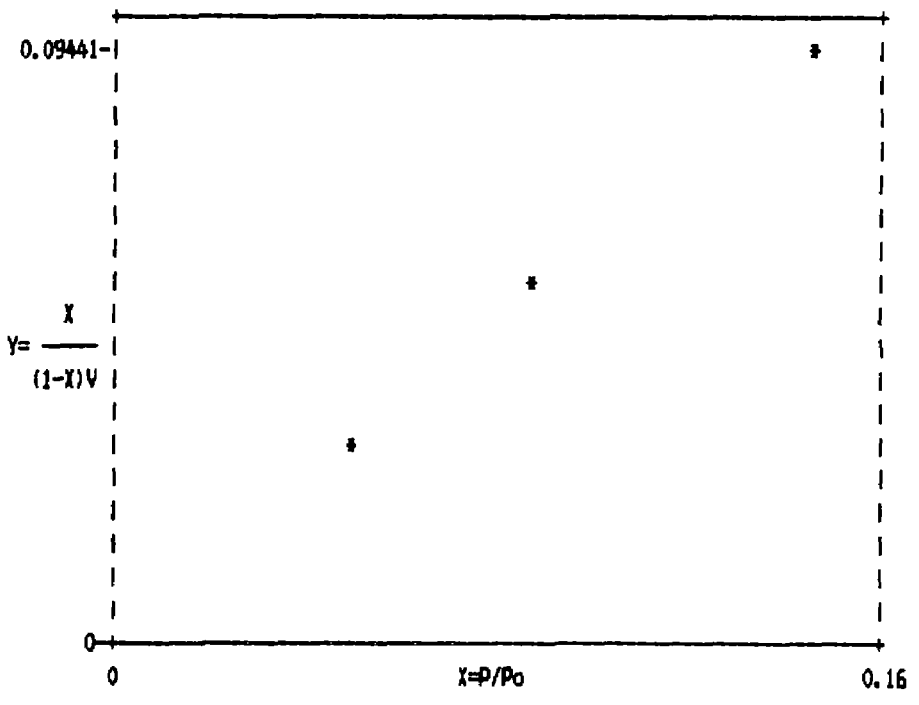

Figure B-120. Plot of BET equation versus relative pressure for Converter A254/0031-A-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/3/87

SAMPLE I.D.: A254/0031-A (LL-2)
SAMPLE WEIGHT: 20.7000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	44.79	2.16	0.0490	0.02383
8.860	46.21	2.23	0.0869	0.04262
14.900	52.78	2.55	0.1461	0.06711

BET SURFACE AREA: 9.76 +/- 0.49 m^2/g
SLOPE: 0.4430 +/- 0.0225
INTERCEPT: 0.0029 +/- 0.0023
C: 154.97
Vm: 2.24 cm^3/g
CORRELATION COEFFICIENT 0.9987

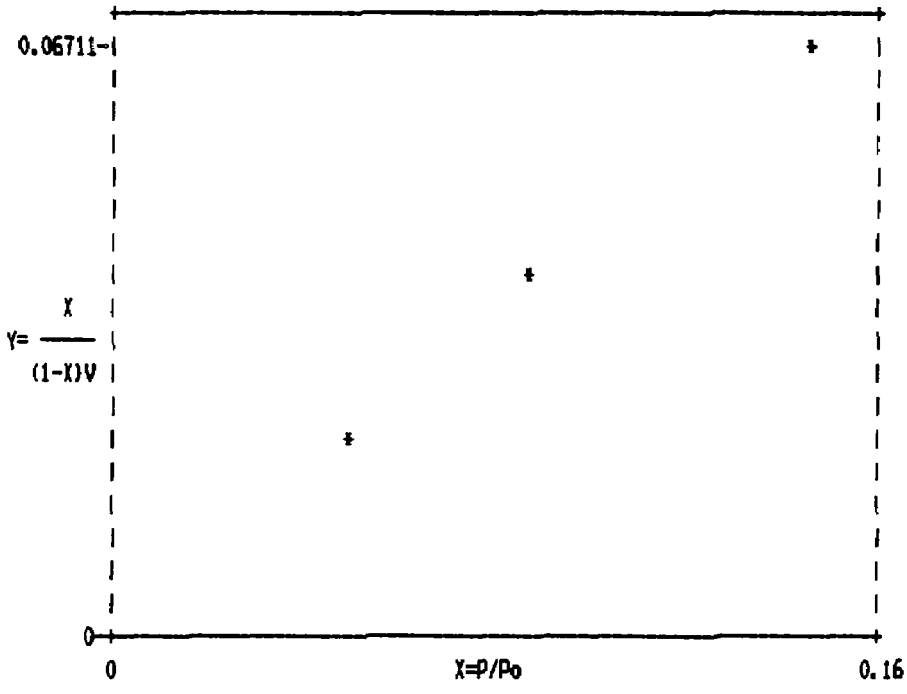

Figure B-121. Plot of BET equation versus relative pressure for Converter A254/0031-A-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A254/0031-A (LL-3)
SAMPLE WEIGHT: 21.6000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	50.10	2.32	0.0490	0.02223
8.860	55.70	2.58	0.0869	0.03690
14.900	58.98	2.73	0.1461	0.06267

BET SURFACE AREA: 10.38 +/- 0.32 m^2/g
SLOPE: 0.4182 +/- 0.0128
INTERCEPT: 0.0013 +/- 0.0013
C: 325.97
Vm: 2.38 cm^3/g
CORRELATION COEFFICIENT 0.9995

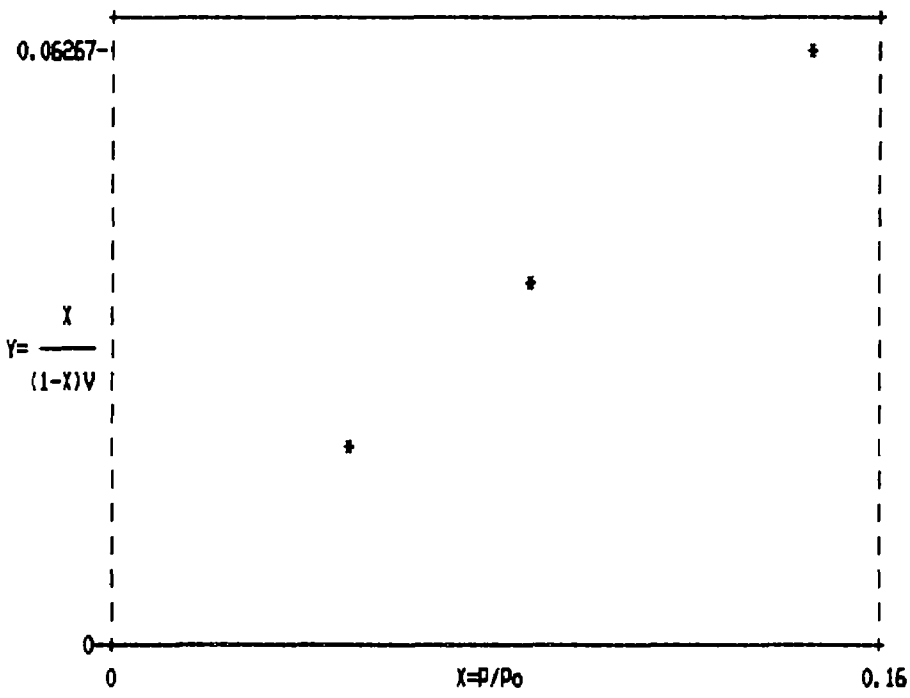

Figure B-122. Plot of BET equation versus relative pressure for Converter A254/0031-A-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/8/87

SAMPLE I.D.: A254/0031-A LL-1
SAMPLE WEIGHT: 1.6493 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.08	1.87	0.0490	0.02761
8.860	3.42	2.07	0.0869	0.04589
14.900	3.93	2.38	0.1461	0.07181
22.000	4.39	2.66	0.2157	0.10335

BET SURFACE AREA: 9.51 +/- 0.10 m^2/g
SLOPE: 0.4519 +/- 0.0048
INTERCEPT: 0.0059 +/- 0.0007
C: 77.22
Vm: 2.18 cm^3/g
CORRELATION COEFFICIENT 0.9999

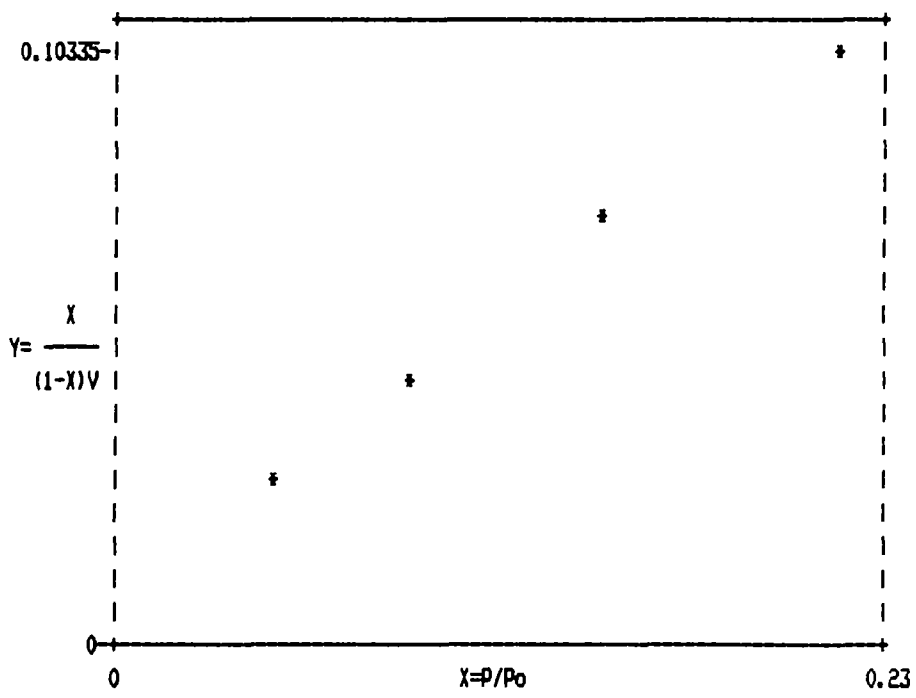

Figure B-123. Plot of BET equation versus relative pressure for Converter A254/0031-A-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/3/87

SAMPLE I.D.: A254/0031-B (UR-1)
SAMPLE WEIGHT: 24.3000 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	51.66	2.13	0.0490	0.02425
8.860	53.98	2.22	0.0869	0.04283
14.900	61.85	2.55	0.1461	0.06723

BET SURFACE AREA: 9.82 +/- 0.48 m^2/g
SLOPE: 0.4400 +/- 0.0214
INTERCEPT: 0.0034 +/- 0.0022
C: 129.99
Vm: 2.26 cm^3/g
CORRELATION COEFFICIENT 0.9988

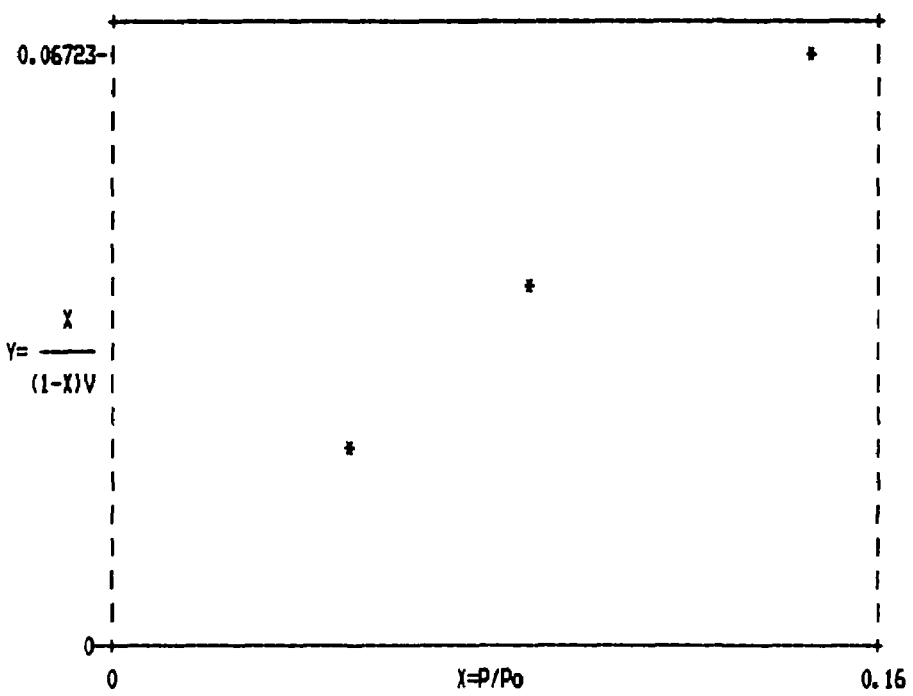

Figure B-124. Plot of BET equation versus relative pressure for Converter A254/0031-B-UR1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/2/87

SAMPLE I.D.: A254/0031-B (UR-2) ADSORBATE: Nitrogen
SAMPLE WEIGHT: 22.8900 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	41.68	1.82	0.0490	0.02832
8.860	42.67	1.86	0.0869	0.05104
14.900	46.30	2.02	0.1461	0.08460

BET SURFACE AREA: 7.52 +/- 0.12 m^2/g
SLOPE: 0.5786 +/- 0.0092
INTERCEPT: 0.0003 +/- 0.0009
C: 2216.31
Vm: 1.73 cm^3/g
CORRELATION COEFFICIENT 0.9999

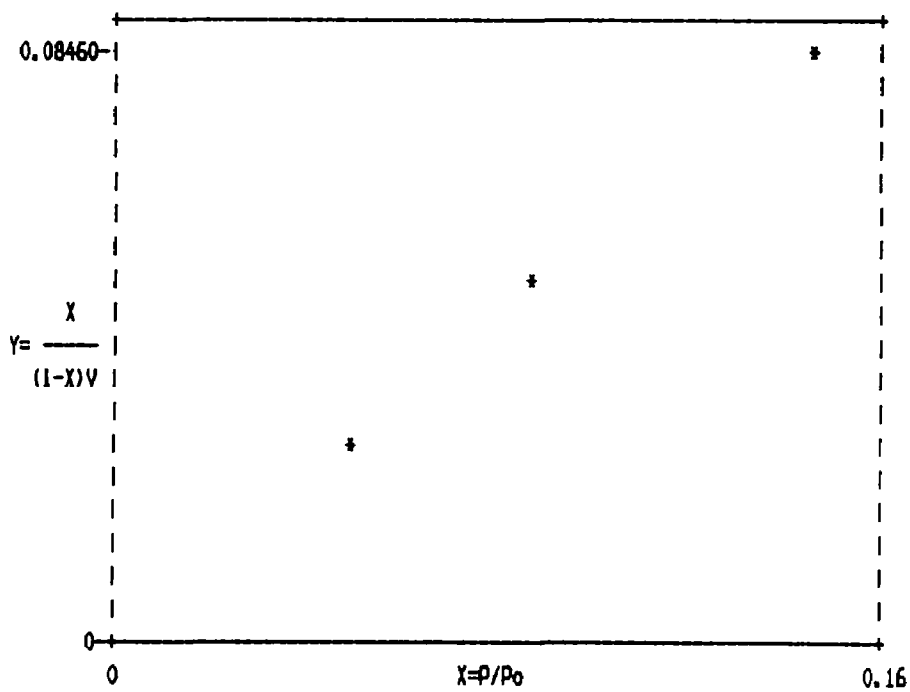

Figure B-125. Plot of BET equation versus relative pressure for Converter A254/0031-B-UR2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/7/87

SAMPLE I.D.: A306/0156 LL-1
SAMPLE WEIGHT: 19.8100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	59.03	2.98	0.0490	0.01730
8.860	61.99	3.13	0.0869	0.03041
12.100	64.44	3.25	0.1187	0.04139

BET SURFACE AREA: 12.57 +/- 0.00 m^2/g
SLOPE: 0.3459 +/- 0.0001
INTERCEPT: 0.0003 +/- 0.0000
C: 1005.72
Vm: 2.89 cm^3/g
CORRELATION COEFFICIENT 1.0000

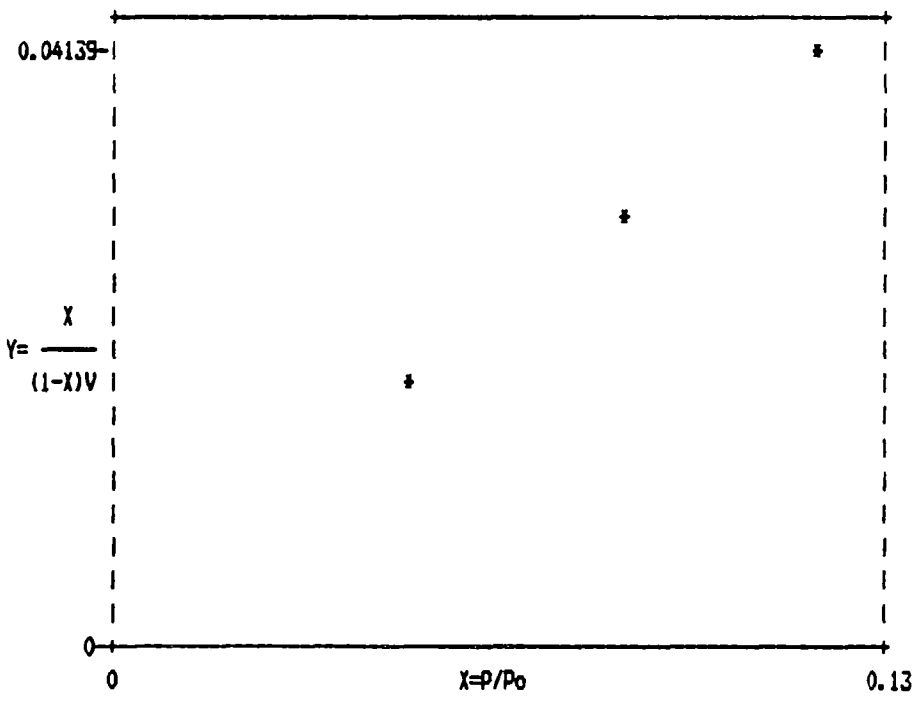

Figure B-126. Plot of BET equation versus relative pressure for Converter A306/0156-LL1

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/10/87

SAMPLE I.D.: A306/0156 (LL-2)
SAMPLE WEIGHT: 19.6100 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	63.75	3.25	0.0490	0.01586
8.860	69.15	3.53	0.0869	0.02698
12.100	72.75	3.71	0.1187	0.03629

BET SURFACE AREA: 14.76 +/- 0.02 m^2/g
SLOPE: 0.2934 +/- 0.0004
INTERCEPT: 0.0015 +/- 0.0000
C: 199.68
Vm: 3.39 cm^3/g
CORRELATION COEFFICIENT 1.0000

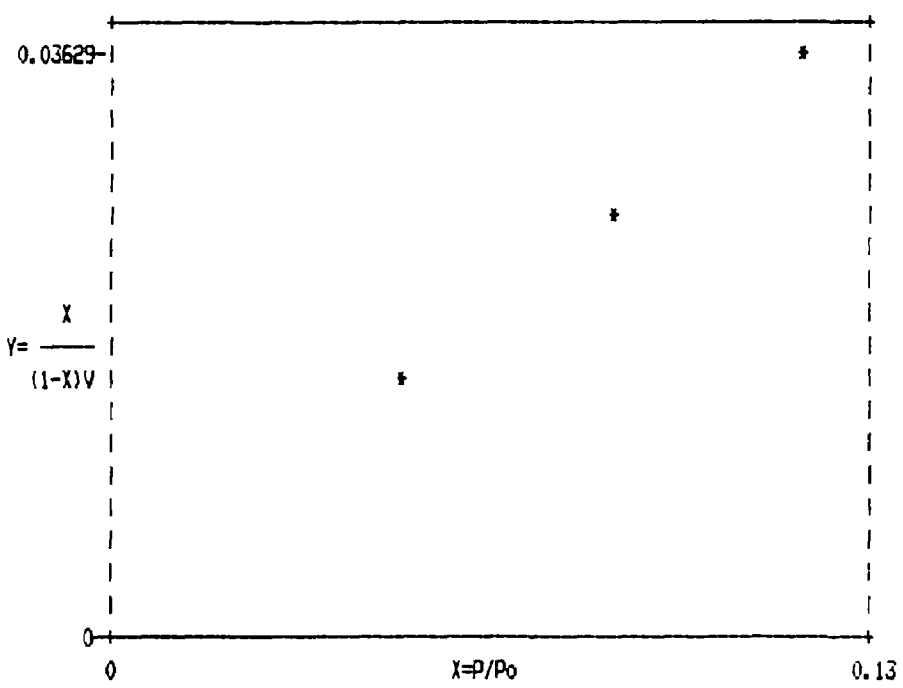

Figure B-127. Plot of BET equation versus relative pressure for Converter A306/0156-LL2

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/7/87

SAMPLE I.D.: A306/0156 LL-3
SAMPLE WEIGHT: 15.9500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	43.20	2.71	0.0490	0.01904
8.860	45.00	2.82	0.0869	0.03373
12.100	46.13	2.89	0.1187	0.04655

BET SURFACE AREA: 11.03 +/- 0.12 m^2/g
SLOPE: 0.3950 +/- 0.0045
INTERCEPT: -0.0004 +/- 0.0004
C: -961.75
Vm: 2.53 cm^3/g
CORRELATION COEFFICIENT 0.9999

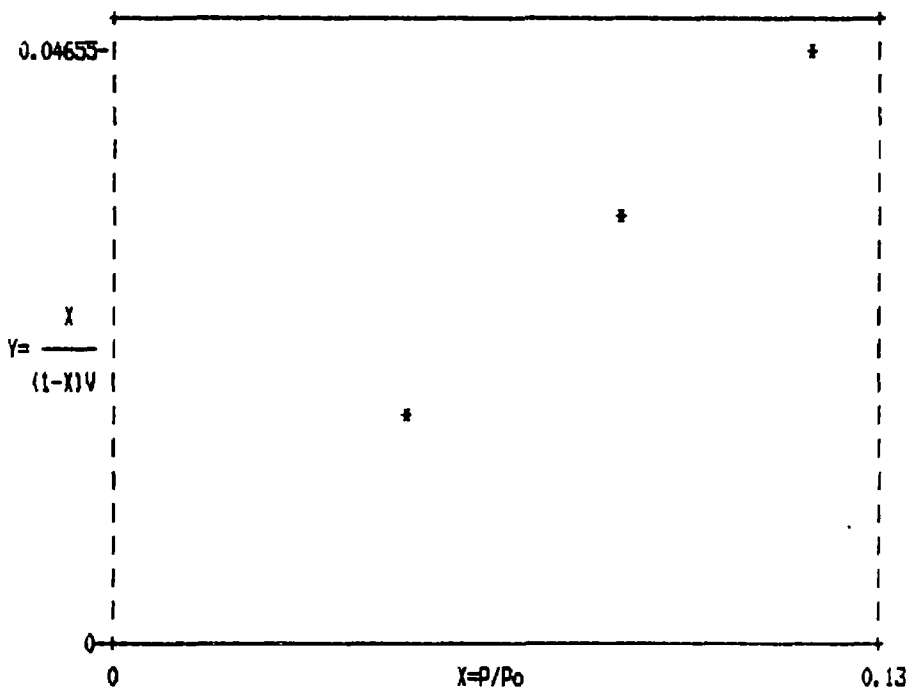

Figure B-128. Plot of BET equation versus relative pressure for Converter A306/0156-LL3

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/13/87

SAMPLE I.D.: A306/0156 LL-1 100 MESH
SAMPLE WEIGHT: 1.2277 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	3.76	3.06	0.0490	0.01684
8.860	4.23	3.45	0.0869	0.02762
12.100	4.81	3.92	0.1187	0.03436
22.000	5.48	4.46	0.2157	0.06163

BET SURFACE AREA: 16.06 +/- 0.44 m^2/g
SLOPE: 0.2674 +/- 0.0074
INTERCEPT: 0.0037 +/- 0.0010
C: 73.81
Vm: 3.69 cm^3/g
CORRELATION COEFFICIENT 0.9992

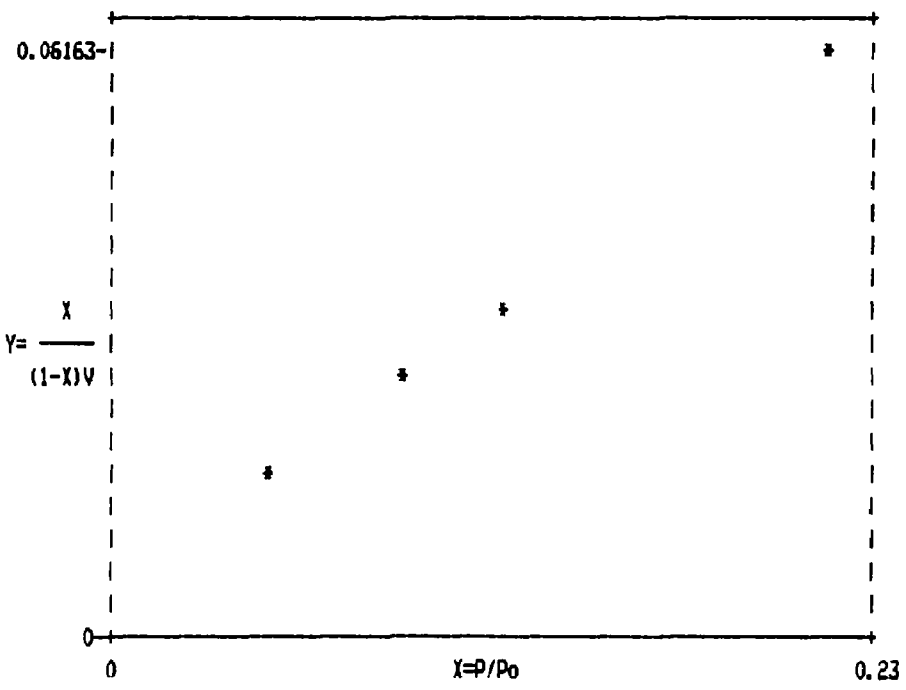

Figure B-129. Plot of BET equation versus relative pressure for Converter A306/0156-LL1 (Powder)

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 8/24/87

SAMPLE I.D.: A306/0192 LL-1 (BET)
SAMPLE WEIGHT: 1.5590 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.36	1.51	0.0490	0.03406
8.860	2.62	1.68	0.0869	0.05662
14.900	3.07	1.97	0.1461	0.08690
22.000	3.52	2.26	0.2157	0.12184

BET SURFACE AREA: 8.18 +/- 0.19 m^2/g
SLOPE: 0.5227 +/- 0.0124
INTERCEPT: 0.0098 +/- 0.0017
C: 54.27
Vm: 1.88 cm^3/g
CORRELATION COEFFICIENT 0.9994

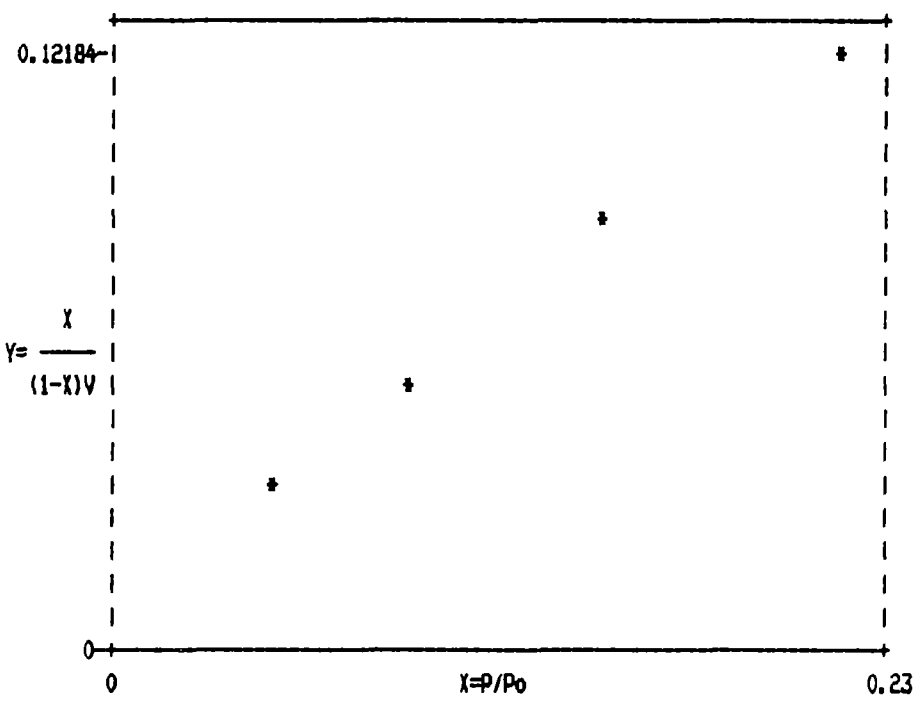

Figure B-130. Plot of BET equation versus relative pressure for Converter A306/0192-LL1 (Powder)

APPENDIX C

BET EQUATION VERSUS RELATIVE PRESSURE FOR MOD SAMPLES

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/9/87

SAMPLE I.D.: 219/0199-1-A
SAMPLE WEIGHT: 1.4375 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	2.17	1.51	0.0490	0.03416
8.860	2.37	1.65	0.0869	0.05771
12.100	2.52	1.75	0.1187	0.07680
22.000	3.10	2.16	0.2157	0.12756

BET SURFACE AREA: 7.71 +/- 0.24 m^2/g
SLOPE: 0.5558 +/- 0.0176
INTERCEPT: 0.0087 +/- 0.0023
C: 64.86
Vm: 1.77 cm^3/g
CORRELATION COEFFICIENT 0.9990

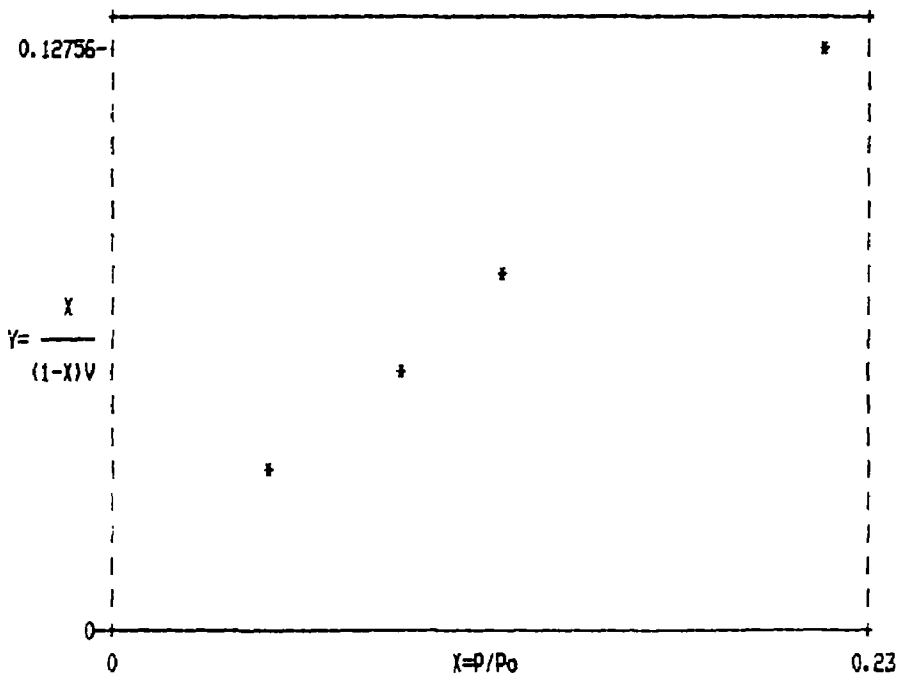

Figure C-1. Plot of BET equation versus relative pressure for MOD sample: Converter 219/0199-1-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/9/87

SAMPLE I.D.: 219/0199-1-B
SAMPLE WEIGHT: 1.1491 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.56	1.36	0.0490	0.03798
8.860	1.83	1.59	0.0869	0.05975
12.100	1.97	1.71	0.1187	0.07853
22.000	2.49	2.17	0.2157	0.12695

BET SURFACE AREA: 8.00 +/- 0.24 m^2/g
SLOPE: 0.5308 +/- 0.0159
INTERCEPT: 0.0134 +/- 0.0021
C: 40.63
Vm: 1.84 cm^3/g
CORRELATION COEFFICIENT 0.9991

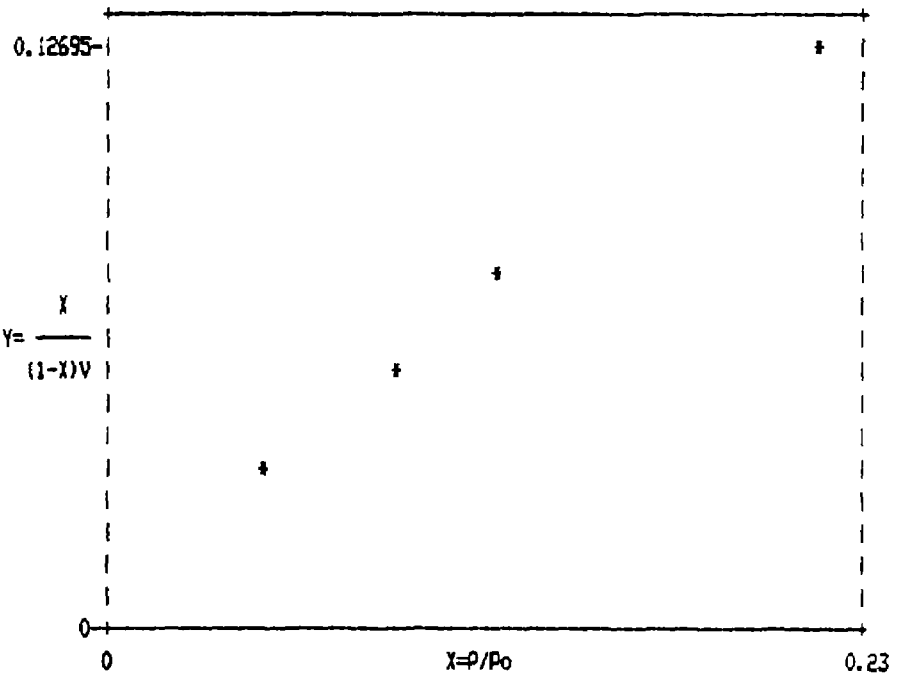

Figure C-2. Plot of BET equation versus relative pressure for MOD sample: Converter 219/0199-1-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/24/87

SAMPLE I.D.: A219/0199-2-A
SAMPLE WEIGHT: 1.4985 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.38	0.92	0.0490	0.05599
8.860	1.48	0.99	0.0869	0.09634
14.900	1.71	1.14	0.1461	0.14995
22.000	1.95	1.30	0.2157	0.21140

BET SURFACE AREA: 4.64 +/- 0.12 m^2/g
SLOPE: 0.9250 +/- 0.0242
INTERCEPT: 0.0133 +/- 0.0034
C: 70.47
Vm: 1.07 cm^3/g
CORRELATION COEFFICIENT 0.9993

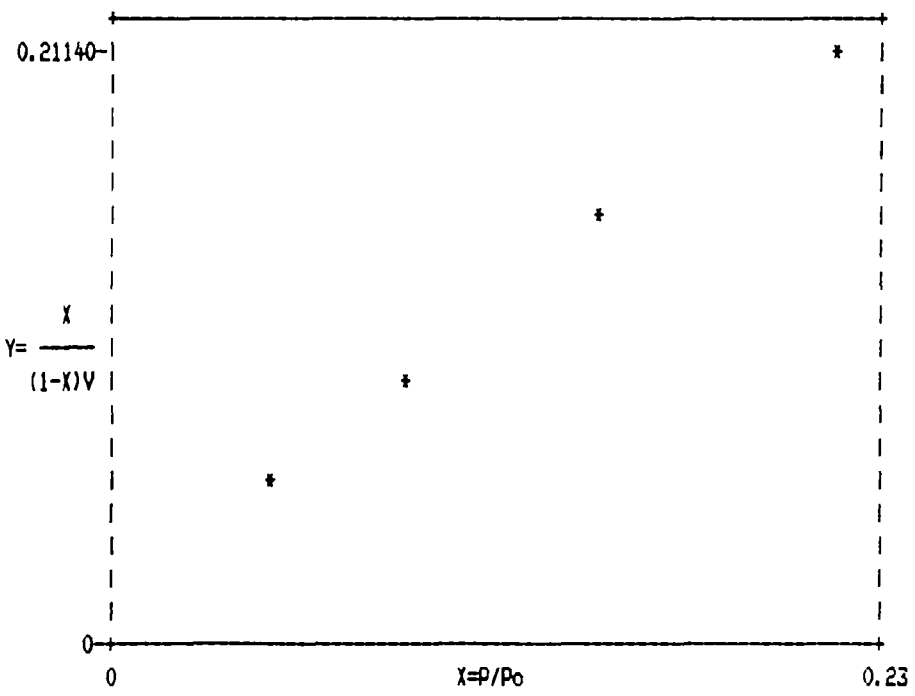

Figure C-3. Plot of BET equation versus relative pressure for MOD sample: Converter 219/0199-2-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/23/87

SAMPLE I.D.: 219/0199-2B
SAMPLE WEIGHT: 1.5593 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.61	1.03	0.0490	0.04994
8.860	1.79	1.15	0.0869	0.08289
14.900	2.05	1.31	0.1461	0.13016
22.000	2.52	1.62	0.2157	0.17022

BET SURFACE AREA: 5.88 +/- 0.38 m^2/g
SLOPE: 0.7220 +/- 0.0479
INTERCEPT: 0.0184 +/- 0.0067
C: 40.14
Vm: 1.35 cm^3/g
CORRELATION COEFFICIENT 0.9956

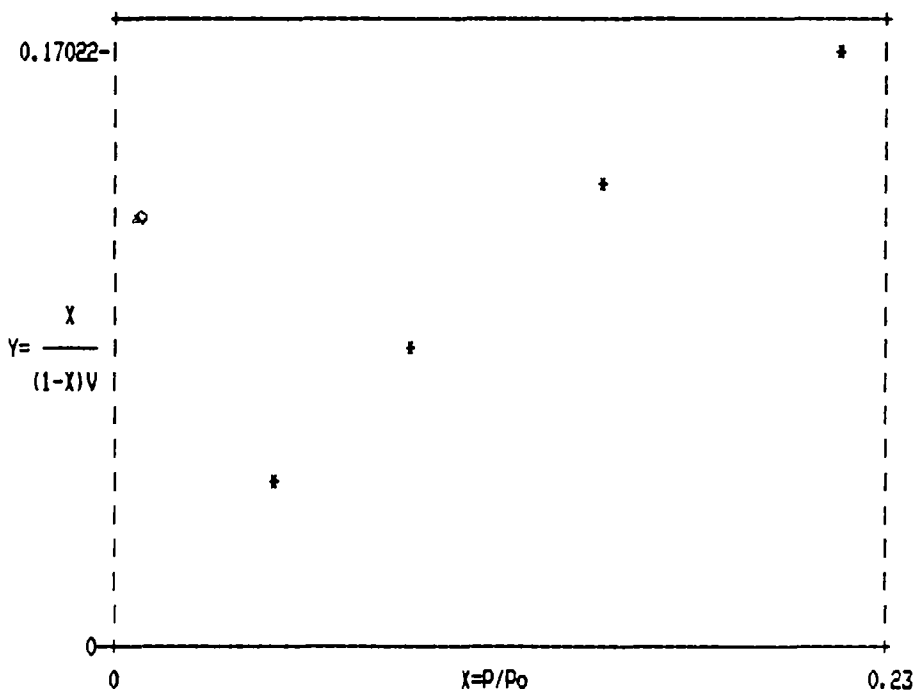

Figure C-4. Plot of BET equation versus relative pressure for MOD sample: Converter 219/0199-2-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/6/87

SAMPLE I.D.: A87/0131-1-A
SAMPLE WEIGHT: 1.1351 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.85	1.63	0.0490	0.03164
8.860	2.18	1.92	0.0869	0.04954
12.100	2.19	1.93	0.1187	0.06978
22.000	2.44	2.15	0.2157	0.12797

BET SURFACE AREA: 7.42 +/- 0.23 m^2/g
SLOPE: 0.5857 +/- 0.0181
INTERCEPT: 0.0009 +/- 0.0024
C: 675.62
Vm: 1.70 cm^3/g
CORRELATION COEFFICIENT 0.9990

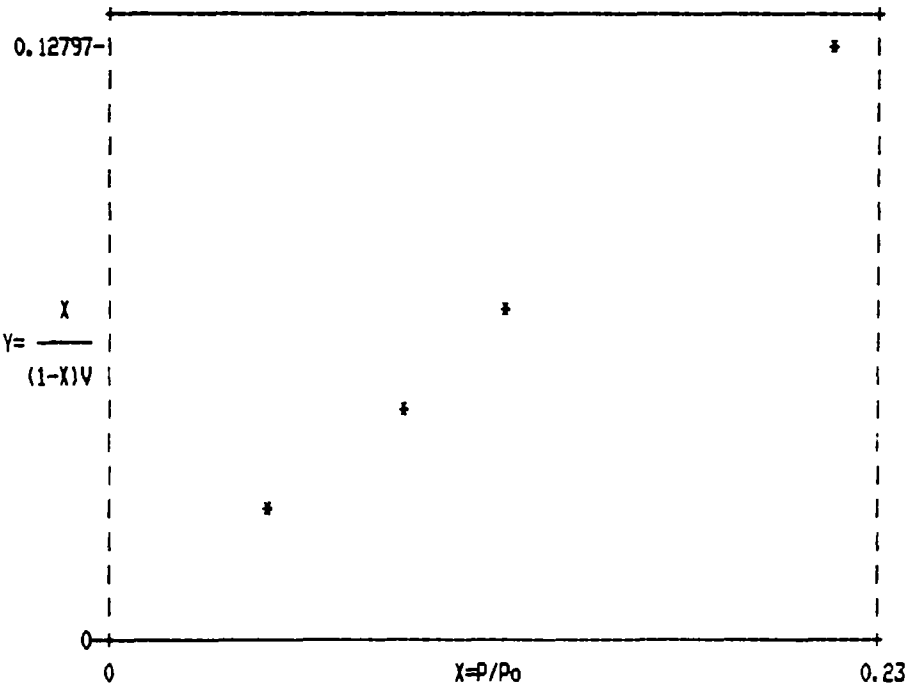

Figure C-5. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0131-1-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/6/87

SAMPLE I.D.: A87/0131-1-B
SAMPLE WEIGHT: 1.0352 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.81	1.75	0.0490	0.02949
8.860	1.96	1.89	0.0869	0.05026
12.100	2.19	2.12	0.1187	0.06364
22.000	2.73	2.64	0.2157	0.10431

BET SURFACE AREA: 9.64 +/- 0.40 m^2/g
SLOPE: 0.4414 +/- 0.0187
INTERCEPT: 0.0100 +/- 0.0025
C: 45.06
Vm: 2.22 cm^3/g
CORRELATION COEFFICIENT 0.9982

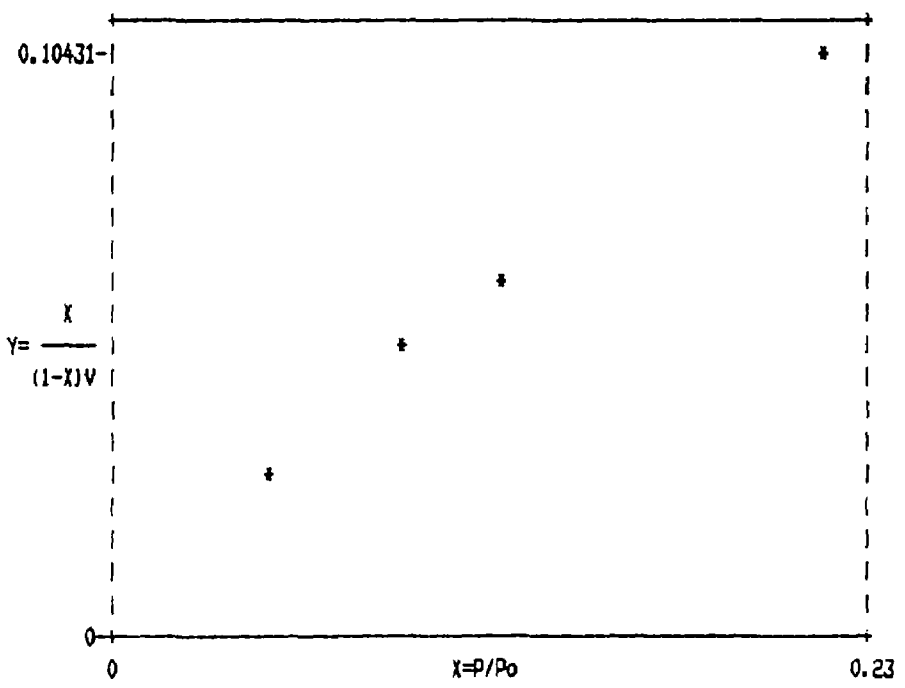

Figure C-6. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0131-1-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/6/87

SAMPLE I.D.: A87/0131-2-A
SAMPLE WEIGHT: 1.3262 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.98	0.74	0.0490	0.06977
8.860	1.10	0.83	0.0869	0.11472
12.100	1.14	0.86	0.1187	0.15662
22.000	1.41	1.06	0.2157	0.25874

BET SURFACE AREA: 3.80 +/- 0.12 m^2/g
SLOPE: 1.1300 +/- 0.0371
INTERCEPT: 0.0171 +/- 0.0049
C: 67.07
Vm: 0.87 cm^3/g
CORRELATION COEFFICIENT 0.9989

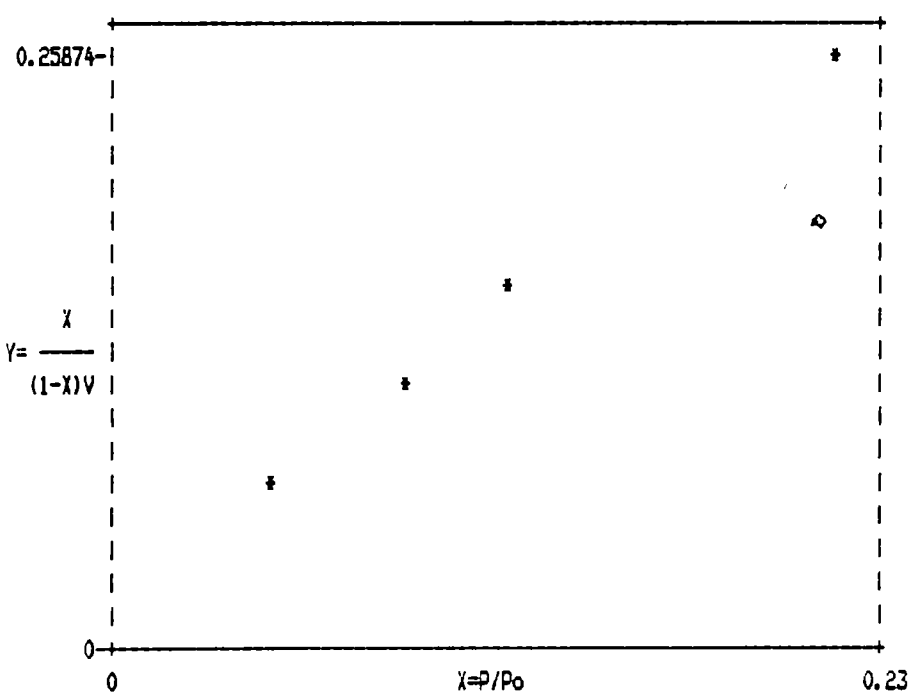

Figure C-7. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0131-2-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/7/87

SAMPLE I.D.: A87/0131-2-B
SAMPLE WEIGHT: 1.1824 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.77	0.65	0.0490	0.07918
8.860	0.83	0.70	0.0869	0.13555
12.100	0.89	0.75	0.1187	0.17887
22.000	1.16	0.98	0.2157	0.28040

BET SURFACE AREA: 3.58 +/- 0.23 m^2/g
SLOPE: 1.1867 +/- 0.0766
INTERCEPT: 0.0290 +/- 0.0102
C: 41.96
Vm: 0.82 cm^3/g
CORRELATION COEFFICIENT 0.9959

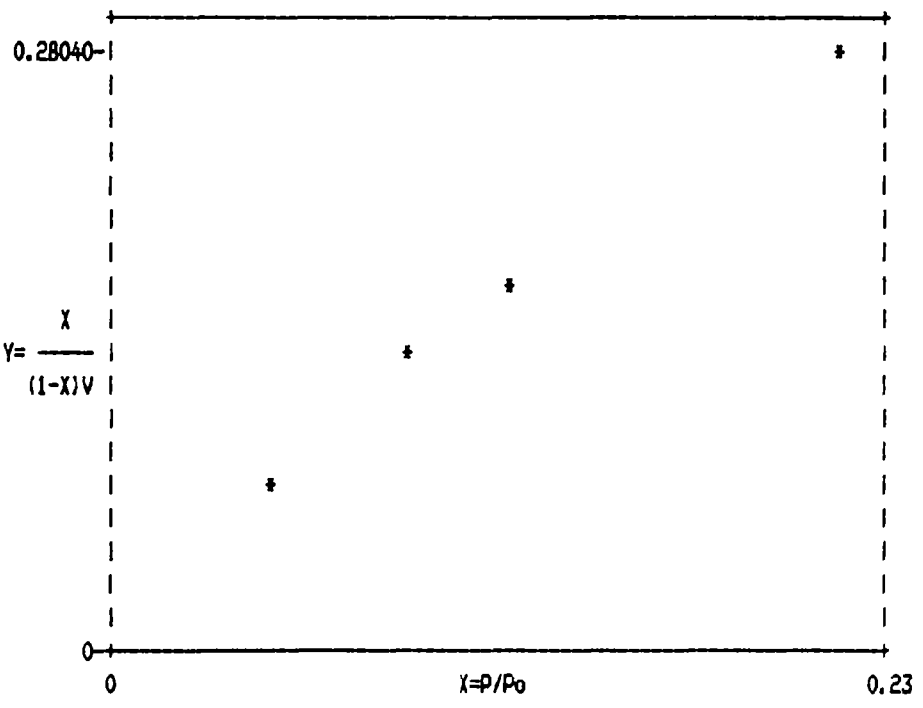

Figure C-8. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0131-2-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/6/87

SAMPLE I.D.: A87/0228-1-B
SAMPLE WEIGHT: 1.2646 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.16	0.13	0.0490	0.40752
8.860	0.19	0.15	0.0869	0.63331
12.100	0.20	0.16	0.1187	0.85129
22.000	0.23	0.18	0.2157	1.51252

BET SURFACE AREA: 0.65 +/- 0.01 m^2/g
SLOPE: 6.6775 +/- 0.1213
INTERCEPT: 0.0660 +/- 0.0161
C: 102.13
Vm: 0.15 cm^3/g
CORRELATION COEFFICIENT 0.9997

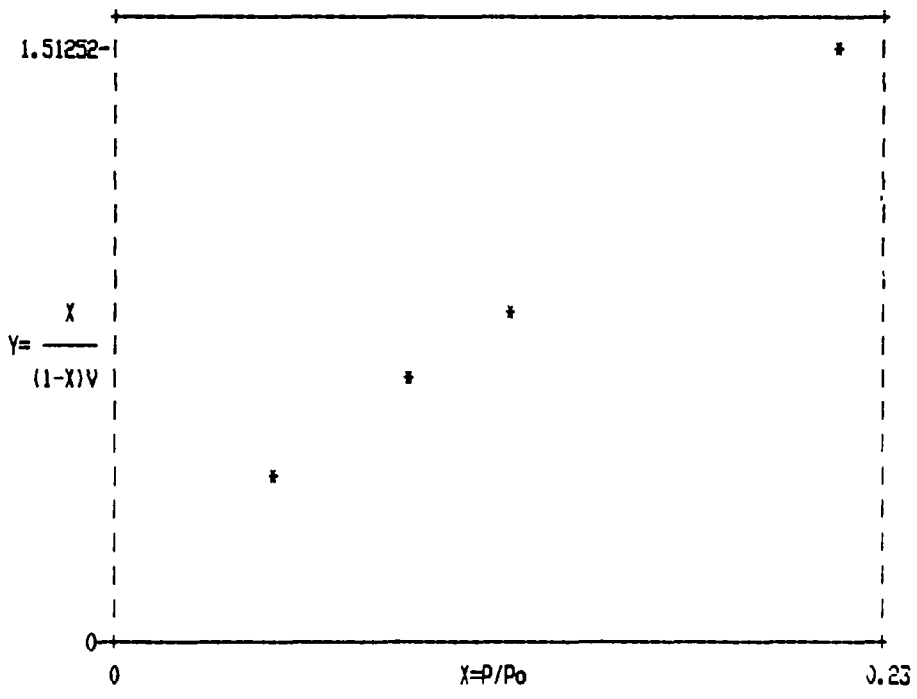

Figure C-9. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0228-1-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/2/87

SAMPLE I.D.: A87/0228-2-A
SAMPLE WEIGHT: 1.6160 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.82	0.51	0.0490	0.10161
8.860	0.89	0.55	0.0869	0.17277
12.100	1.01	0.62	0.1187	0.21541
22.000	1.12	0.69	0.2157	0.39692

BET SURFACE AREA: 2.45 +/- 0.08 m^2/g
SLOPE: 1.7624 +/- 0.0570
INTERCEPT: 0.0145 +/- 0.0076
C: 122.96
Vm: 0.56 cm^3/g
CORRELATION COEFFICIENT 0.9990

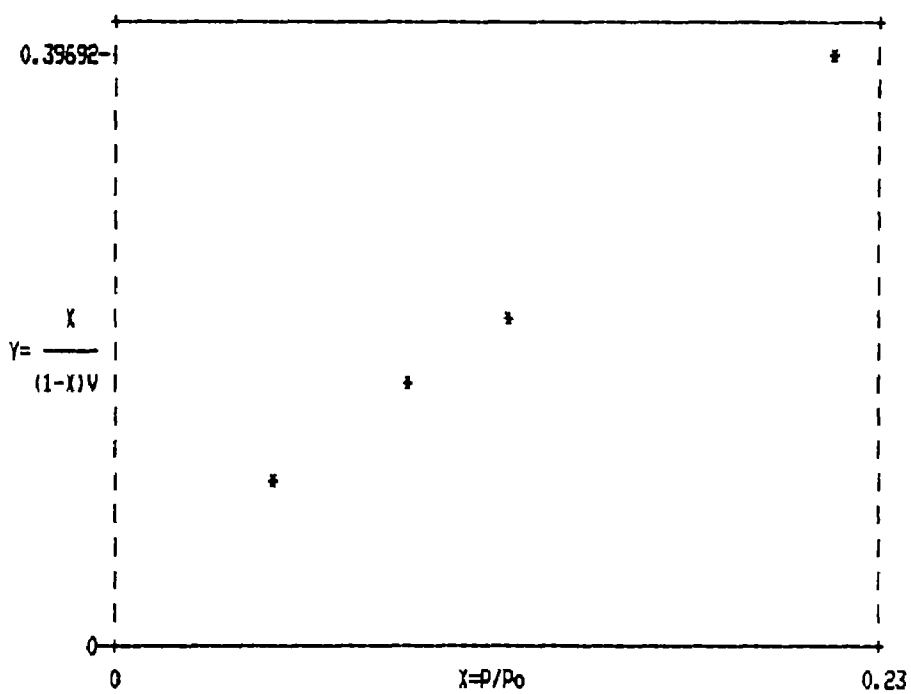

Figure C-10. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0228-2-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/6/87

SAMPLE I.D.: A87/0228-2-B
SAMPLE WEIGHT: 1.8447 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.54	0.29	0.0490	0.17614
8.860	0.64	0.35	0.0869	0.27426
12.100	0.66	0.36	0.1187	0.37630
22.000	0.75	0.41	0.2157	0.67661

BET SURFACE AREA: 1.43 +/- 0.03 m^2/g
SLOPE: 3.0326 +/- 0.0715
INTERCEPT: 0.0193 +/- 0.0095
C: 158.51
Vm: 0.33 cm^3/g
CORRELATION COEFFICIENT 0.9994

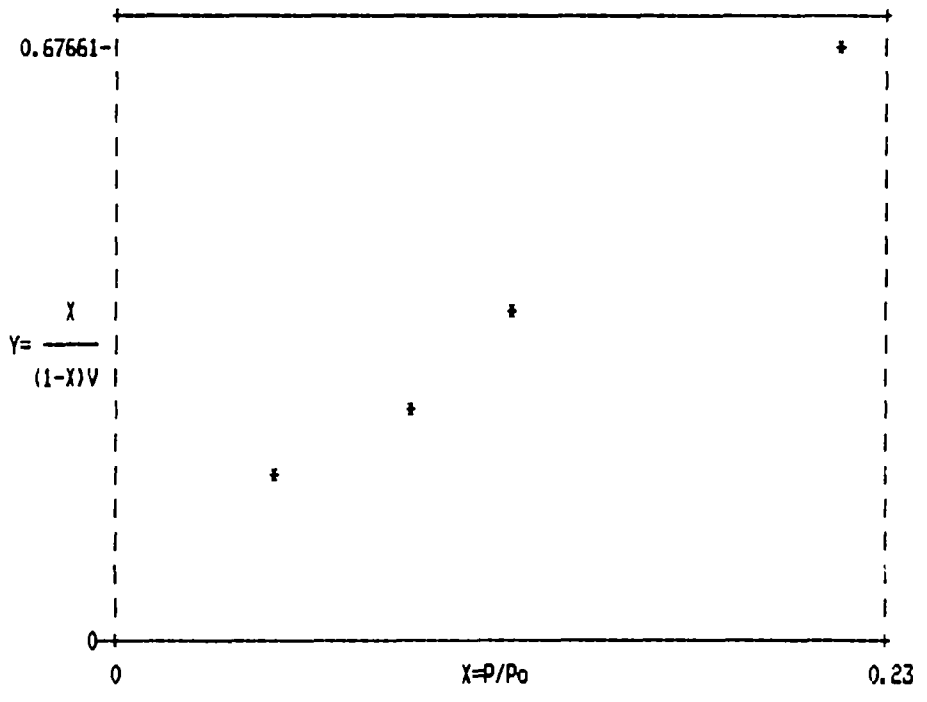

Figure C-11. Plot of BET equation versus relative pressure for MOD Sample: Converter A87/0228-2-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/7/87

SAMPLE I.D.: A87/0345-1-A
SAMPLE WEIGHT: 1.4242 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.64	0.45	0.0490	0.11474
8.860	0.72	0.51	0.0869	0.18822
12.100	0.88	0.62	0.1187	0.21789
22.000	1.00	0.70	0.2157	0.39178

BET SURFACE AREA: 2.60 +/- 0.14 m^2/g
SLOPE: 1.6397 +/- 0.0924
INTERCEPT: 0.0354 +/- 0.0123
C: 47.37
Vm: 0.60 cm^3/g
CORRELATION COEFFICIENT 0.9968

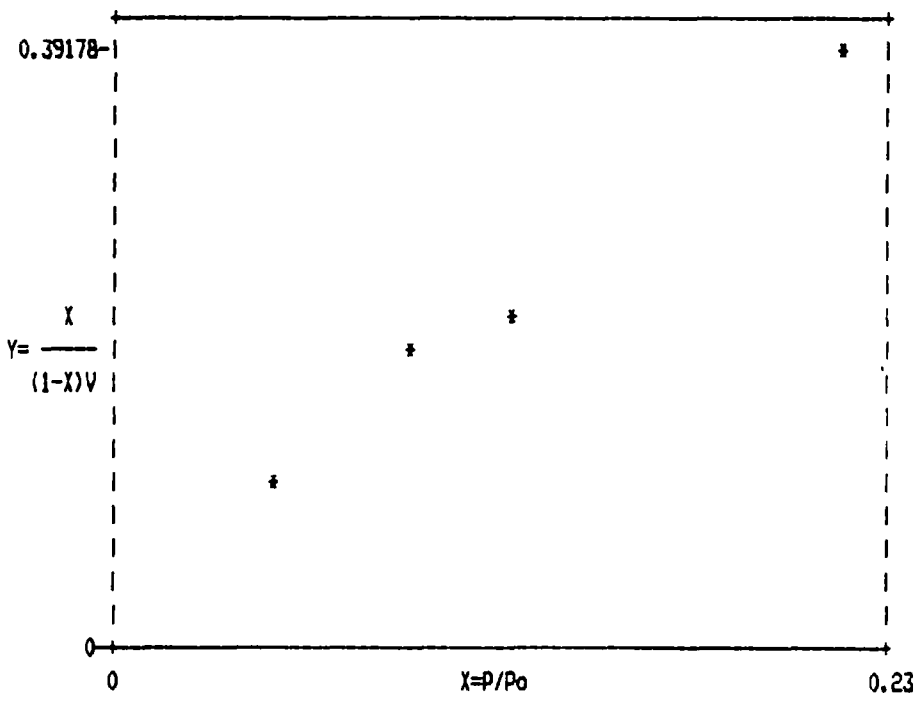

Figure C-12. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0345-1-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/8/87

SAMPLE I.D.: A87/0345-1-B
SAMPLE WEIGHT: 1.2927 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.03	0.80	0.0490	0.06471
8.860	1.20	0.93	0.0869	0.10250
12.100	1.36	1.05	0.1187	0.12797
22.000	1.46	1.13	0.2157	0.24357

BET SURFACE AREA: 4.01 +/- 0.20 m^2/g
SLOPE: 1.0777 +/- 0.0536
INTERCEPT: 0.0080 +/- 0.0071
C: 136.22
Vm: 0.92 cm^3/g
CORRELATION COEFFICIENT 0.9975

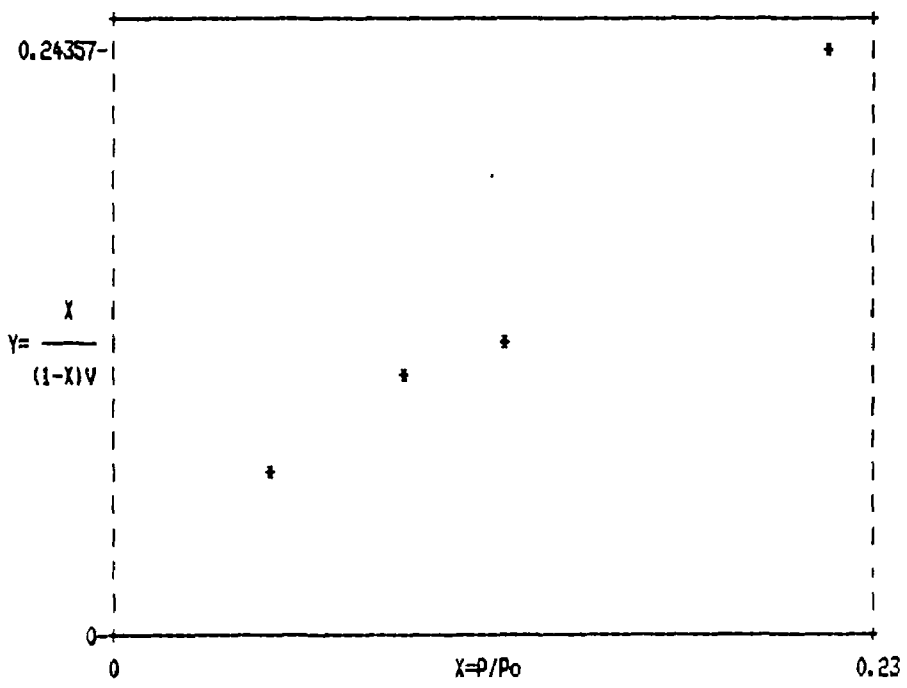

Figure C-13. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0345-1-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/9/87

SAMPLE I.D.: A87/0345-2-A
SAMPLE WEIGHT: 1.2710 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.61	0.48	0.0490	0.10743
8.860	0.73	0.57	0.0869	0.16567
12.100	0.82	0.65	0.1187	0.20868
22.000	1.08	0.85	0.2157	0.32374

BET SURFACE AREA: 3.27 +/- 0.14 m^2/g
SLOPE: 1.2800 +/- 0.0564
INTERCEPT: 0.0509 +/- 0.0075
C: 26.15
Vm: 0.75 cm^3/g
CORRELATION COEFFICIENT 0.9981

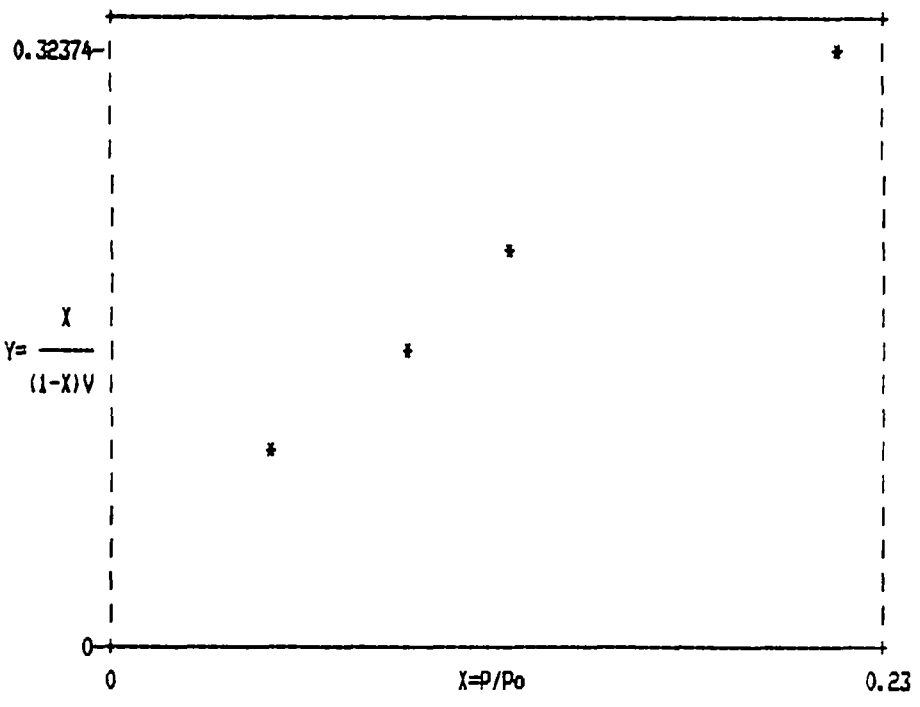

Figure C-14. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0345-2-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/8/87

SAMPLE I.D.: A87-0345-2-B
SAMPLE WEIGHT: 1.2010 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.99	0.82	0.0490	0.06255
8.860	1.14	0.95	0.0869	0.10024
12.100	1.29	1.07	0.1187	0.12534
22.000	1.48	1.23	0.2157	0.22323

BET SURFACE AREA: 4.46 +/- 0.11 m^2/g
SLOPE: 0.9611 +/- 0.0240
INTERCEPT: 0.0148 +/- 0.0032
C: 65.78
Vm: 1.02 cm^3/g
CORRELATION COEFFICIENT 0.9994

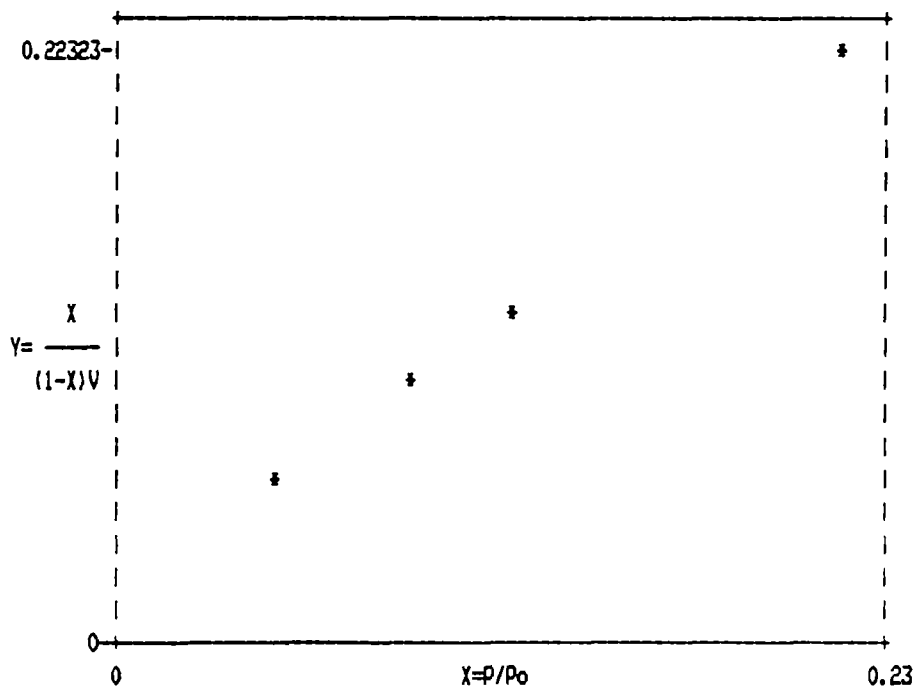

Figure C-15. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0345-2-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/8/87

SAMPLE I.D.: A87/0479-1-A
SAMPLE WEIGHT: 1.3866 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.47	1.06	0.0490	0.04864
8.860	1.60	1.15	0.0869	0.08246
12.100	1.67	1.20	0.1187	0.11179
22.000	2.07	1.49	0.2157	0.18427

BET SURFACE AREA: 5.31 +/- 0.20 m^2/g
SLOPE: 0.8080 +/- 0.0304
INTERCEPT: 0.0118 +/- 0.0040
C: 69.55
Vm: 1.22 cm^3/g
CORRELATION COEFFICIENT 0.9986

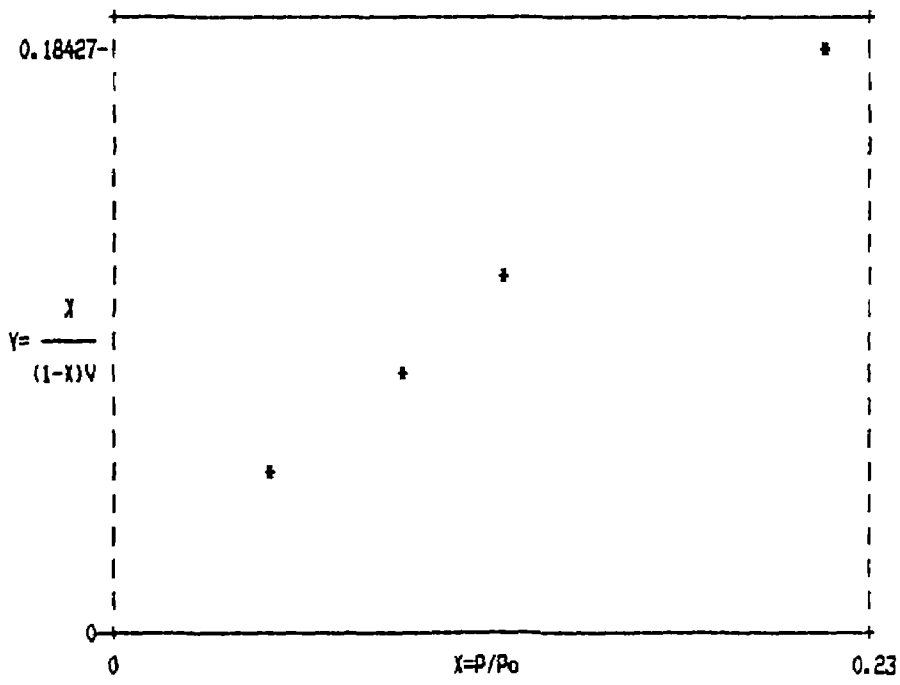

Figure C-16. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0479-1-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 7/9/87

SAMPLE I.D.: A87/0479-1-B
SAMPLE WEIGHT: 1.0156 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.06	1.04	0.0490	0.04940
8.860	1.24	1.22	0.0869	0.07793
12.100	1.33	1.31	0.1187	0.10281
22.000	1.76	1.73	0.2157	0.15874

BET SURFACE AREA: 6.50 +/- 0.35 m^2/g
SLOPE: 0.6490 +/- 0.0363
INTERCEPT: 0.0209 +/- 0.0048
C: 32.03
Vm: 1.49 cm^3/g
CORRELATION COEFFICIENT 0.9969

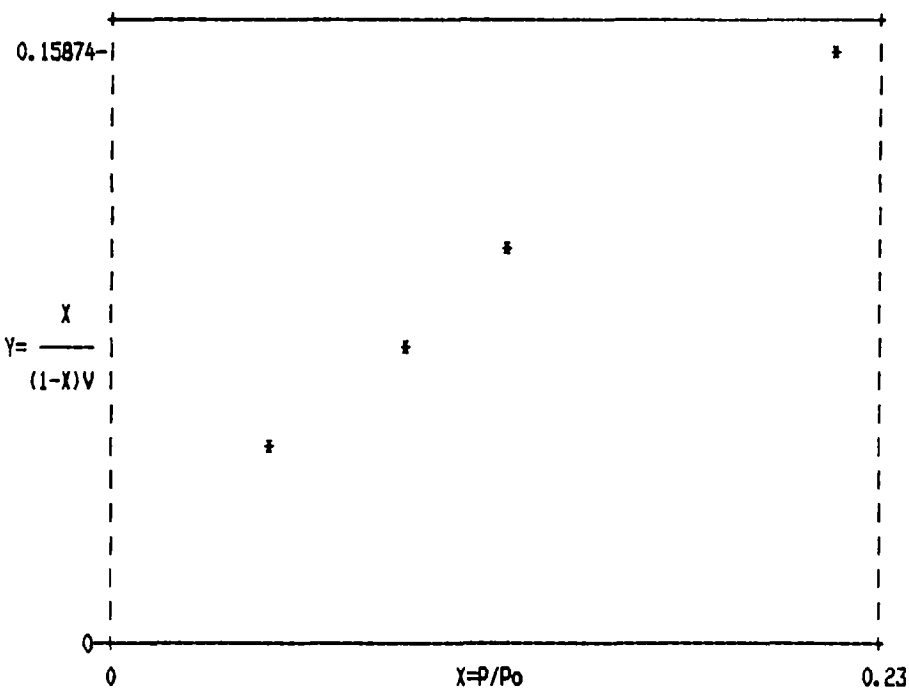

Figure C-17. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0479-1-B

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/25/87

SAMPLE I.D.: A87/0479-2-A (100 MESH) ADSORBATE: Nitrogen
SAMPLE WEIGHT: 1.4351 g BAROMETRIC PRESSURE: 760 mmHg
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2 SATURATION PRESSURE: 775 mmHg
SAMPLE TEMPERATURE: 0.00 C

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.74	0.52	0.0490	0.09999
8.860	0.86	0.60	0.0869	0.15878
14.900	0.95	0.66	0.1461	0.25850
22.000	1.06	0.74	0.2157	0.37244

BET SURFACE AREA: 2.62 +/- 0.02 m^2/g
SLOPE: 1.6413 +/- 0.0138
INTERCEPT: 0.0182 +/- 0.0019
C: 91.28
Vm: 0.60 cm^3/g
CORRELATION COEFFICIENT 0.9999

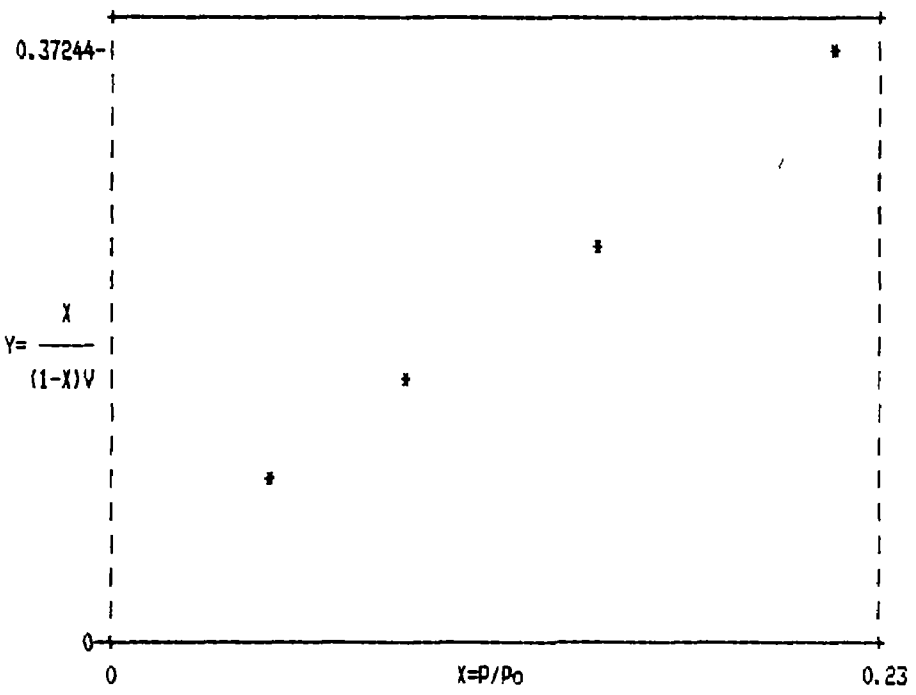

Figure C-18. Plot of BET equation versus relative pressure for MOD sample: Converter A87/0479-2-A

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/24/87

SAMPLE I.D.: A87-0479-2-B
SAMPLE WEIGHT: 1.8887 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXRERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	1.39	0.74	0.0490	0.07006
8.860	1.62	0.86	0.0869	0.11093
14.900	1.85	0.98	0.1461	0.17470
22.000	1.99	1.05	0.2157	0.26109

BET SURFACE AREA: 3.77 +/- 0.10 m^2/g
SLOPE: 1.1428 +/- 0.0302
INTERCEPT: 0.0120 +/- 0.0042
C: 96.36
Vm: 0.87 cm^3/g
CORRELATION COEFFICIENT 0.9993

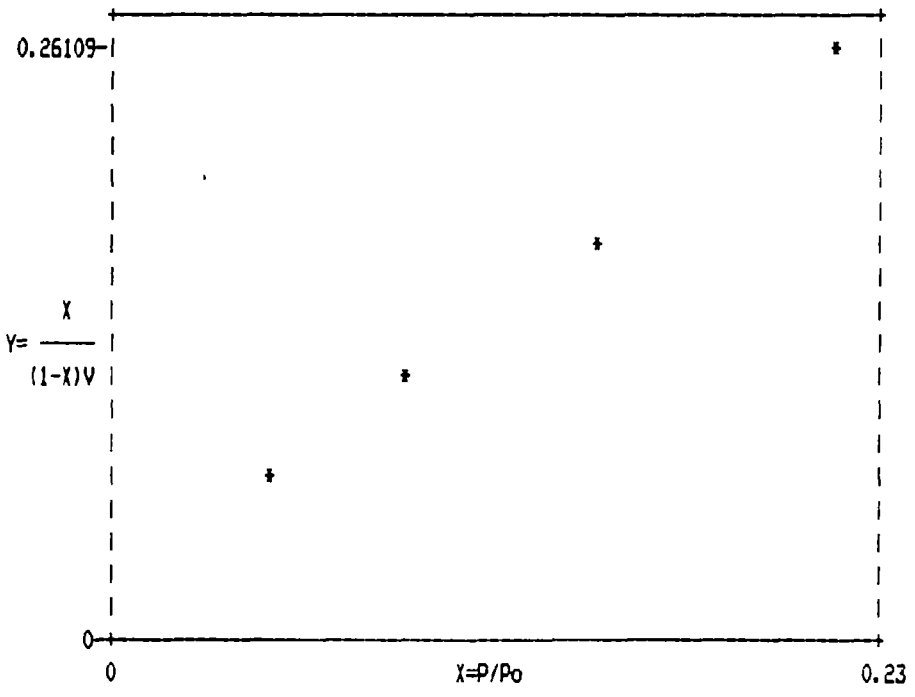

Figure C-19. Plot of BET equation versus relative pressure for MOD sample: Covnerter A87/0479-2-B

APPENDIX D

SCANNING ELECTRON MICROGRAPHS WITH SPECTRUM

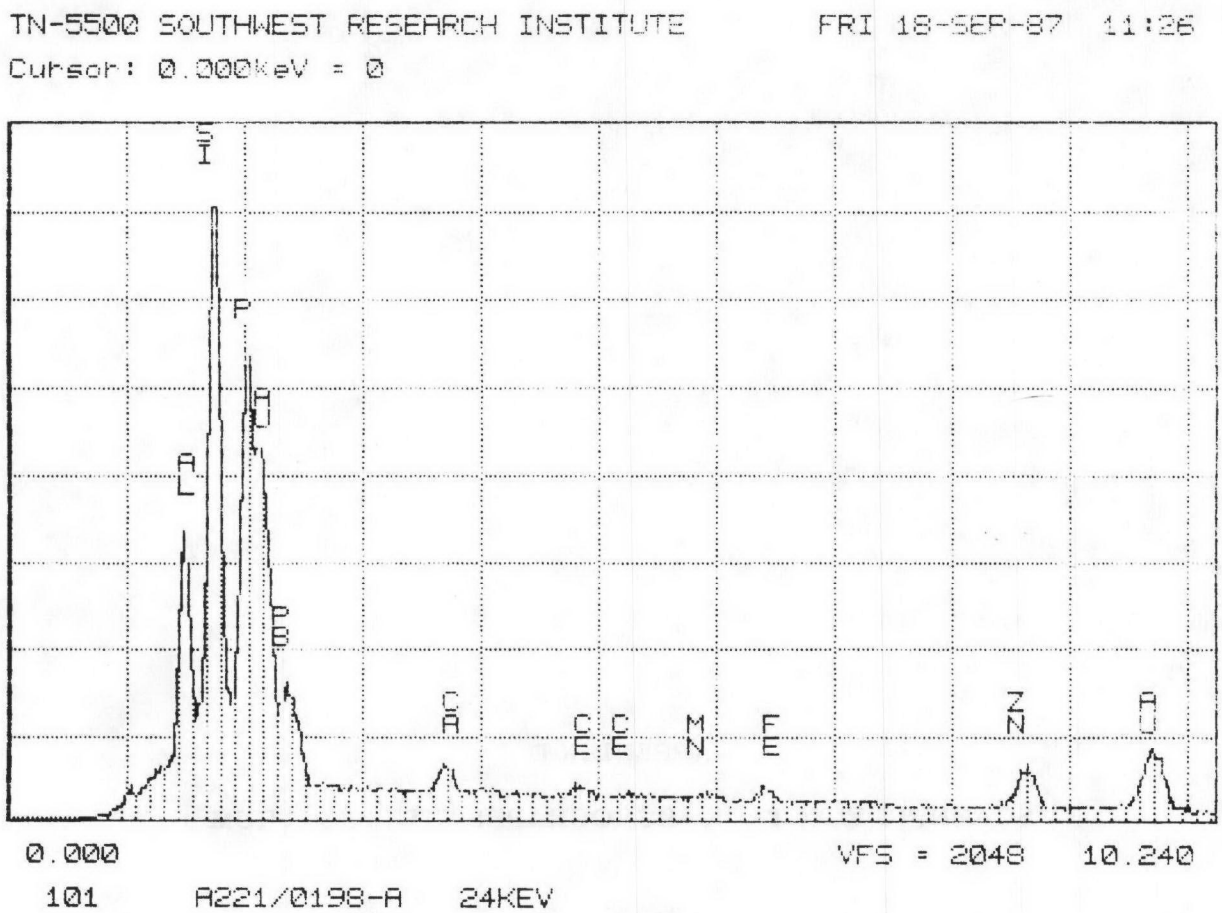

Figure D-1. SEM/EDX Spectrum of Converter A221/0198

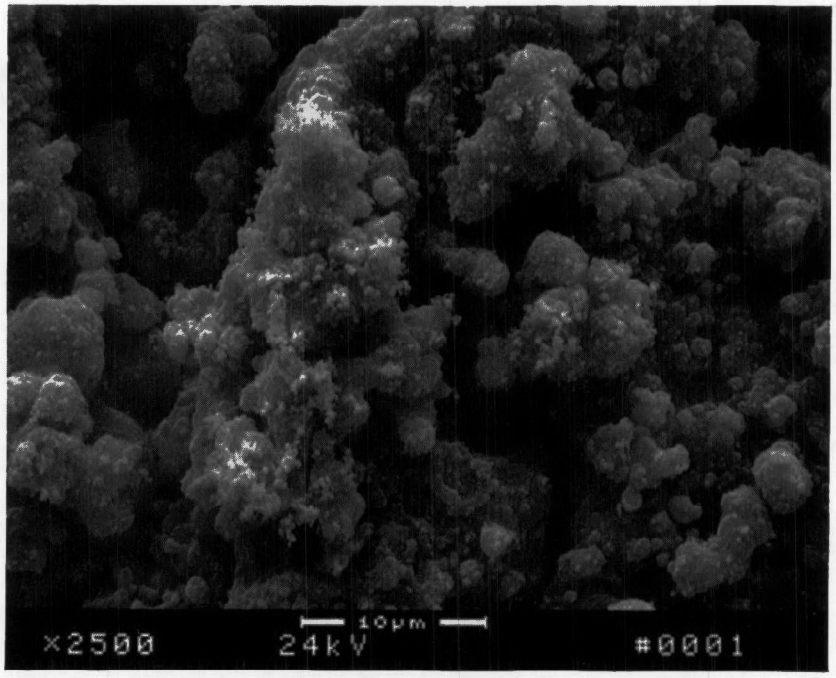

Figure D-2. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A221/0198

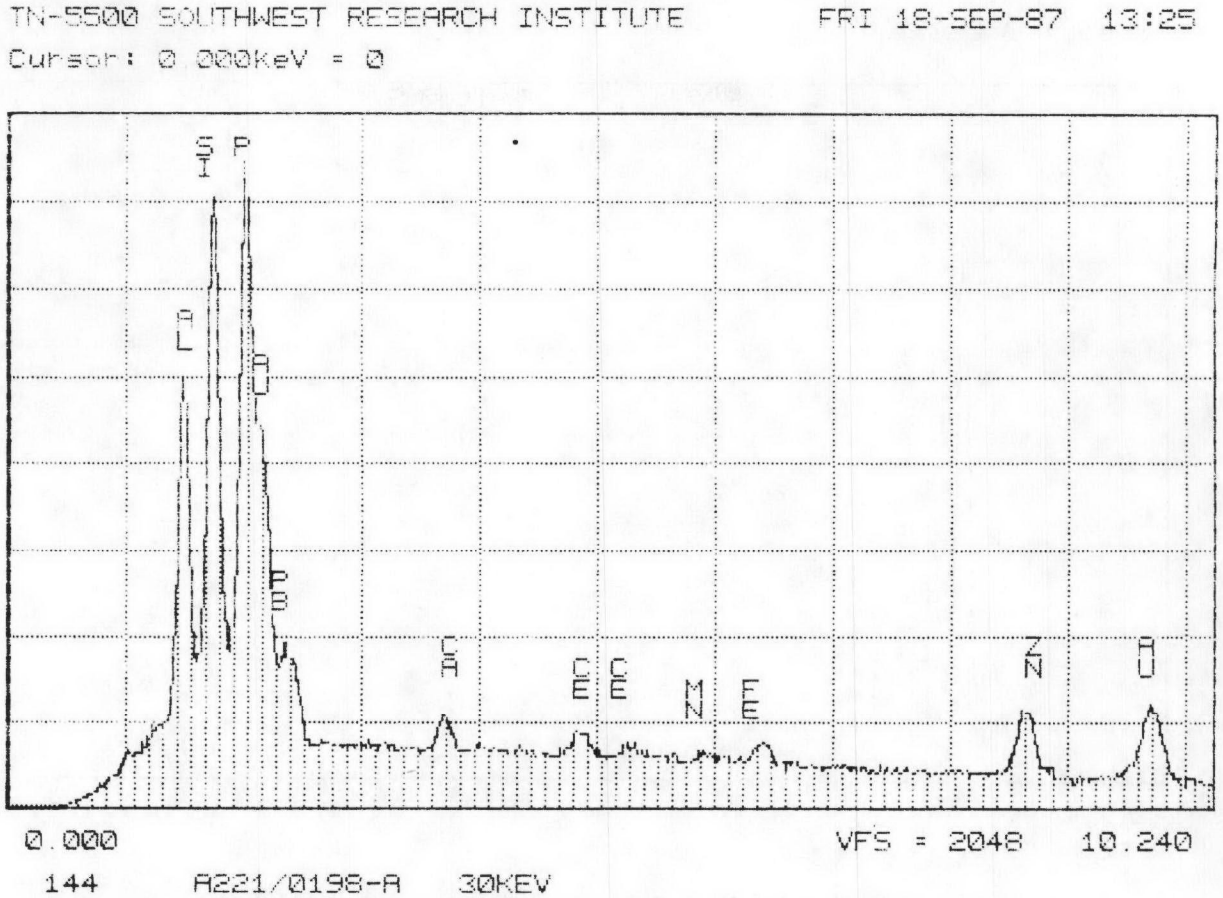

Figure D-3. SEM/EDX Spectrum of Converter A221/0198

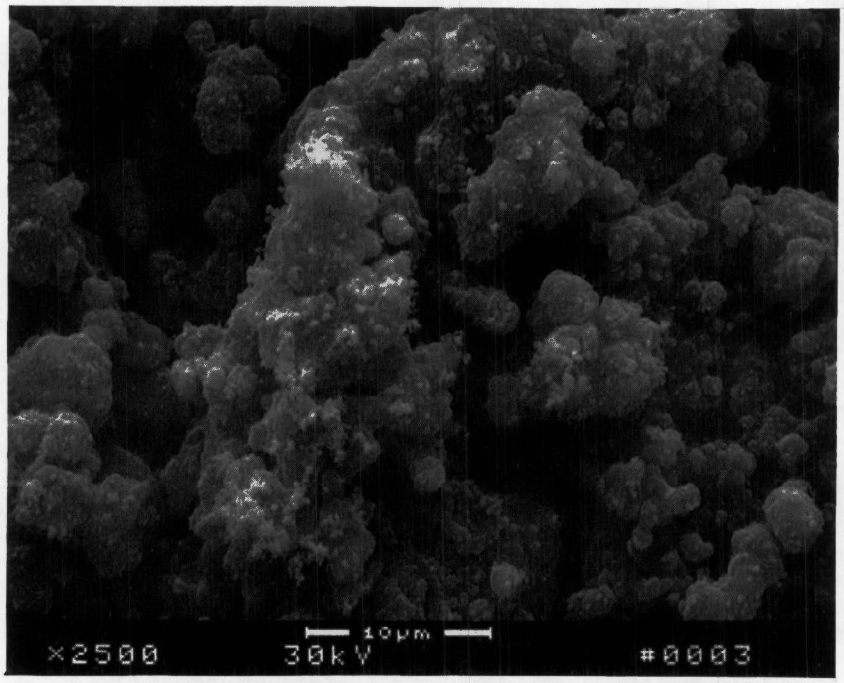

Figure D-4. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A221/0198

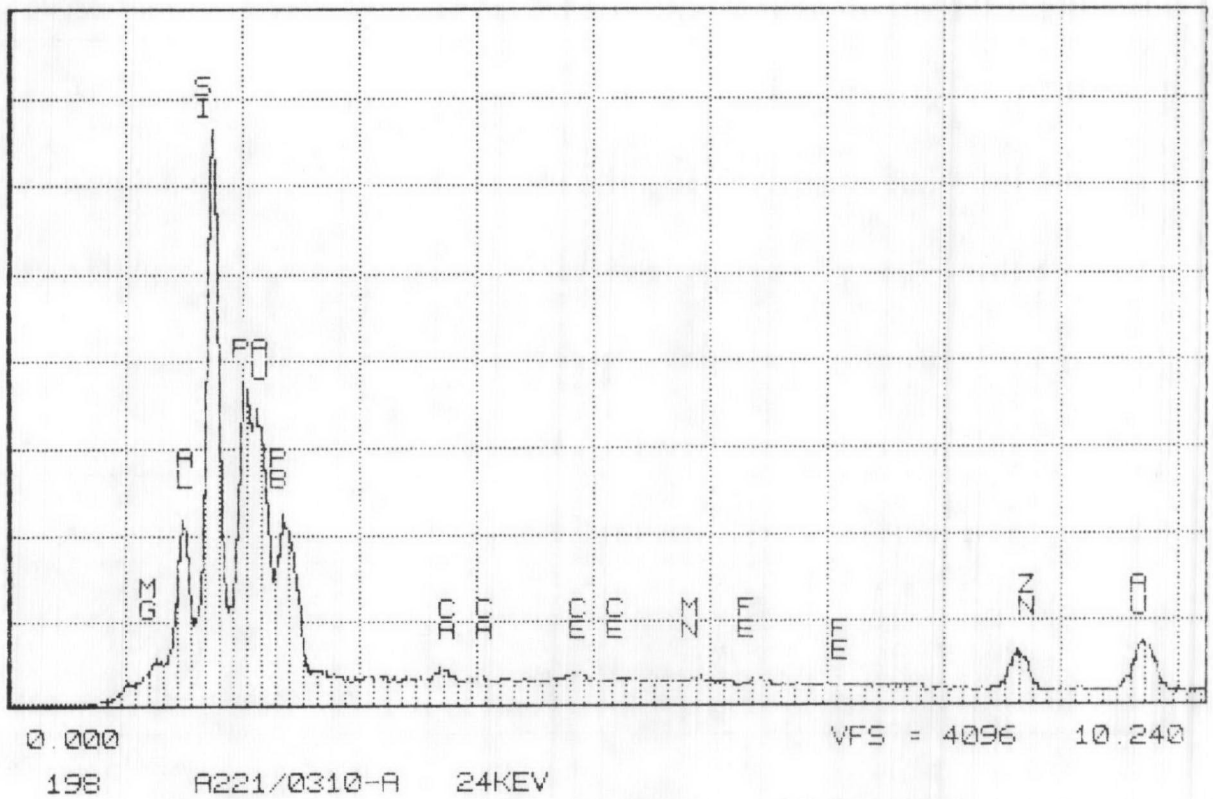

Figure D-5. SEM/EDX Spectrum of Converter A221/0310

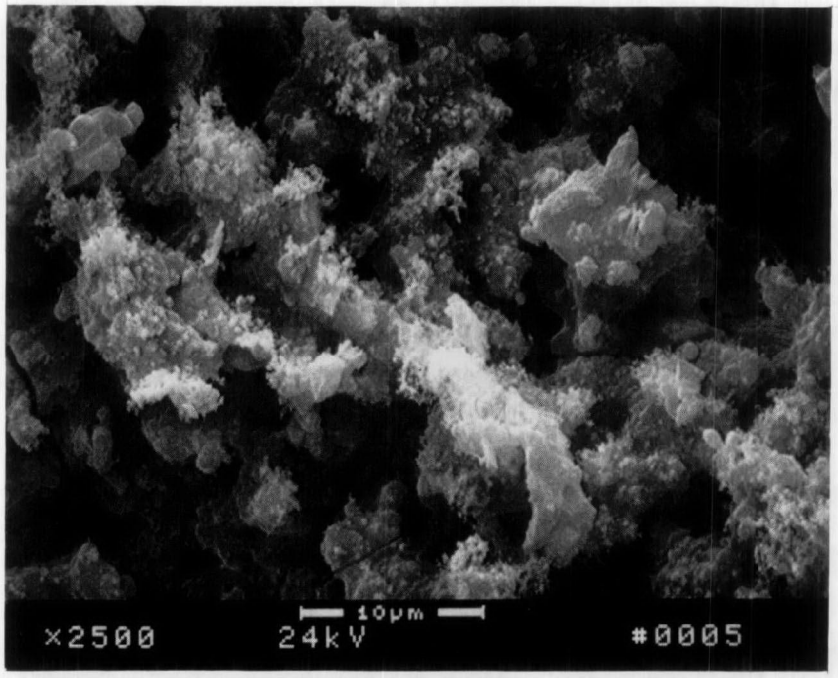

Figure D-6. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A221/0310

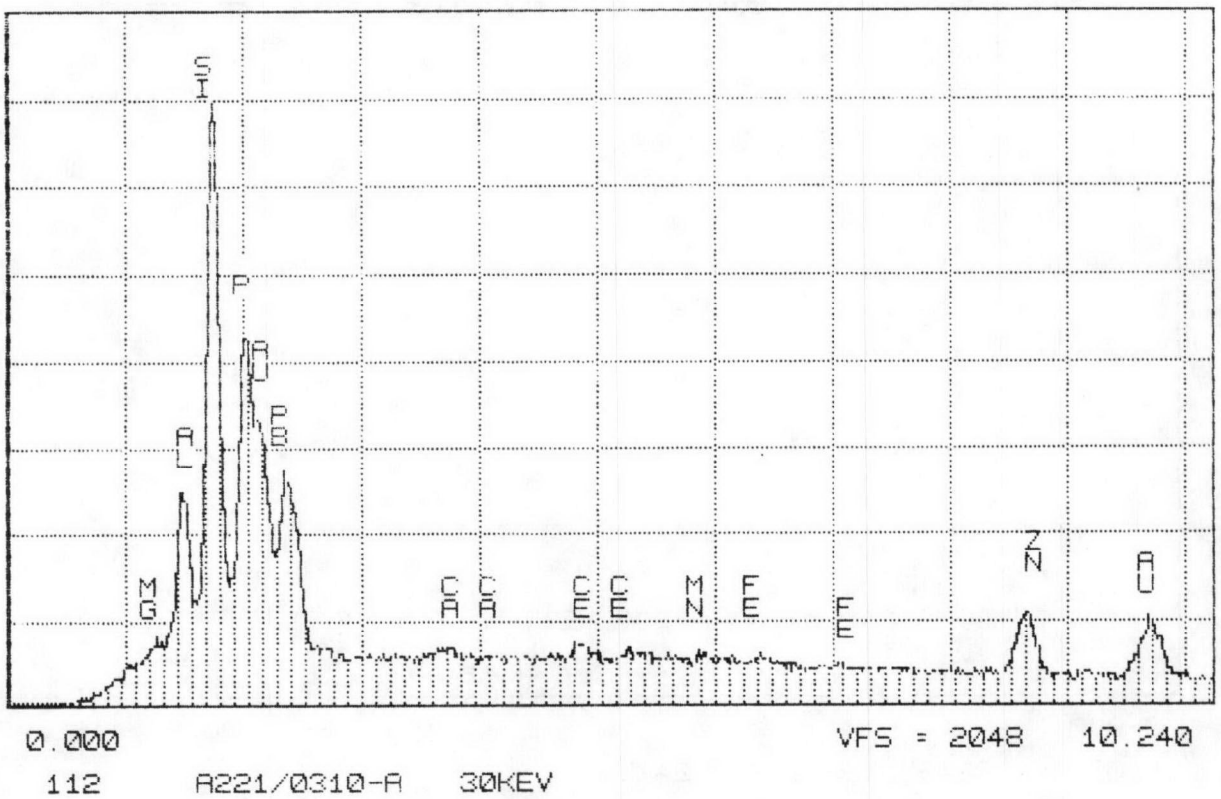

Figure D-7. SEM/EDX Spectrum of Converter A221/0310

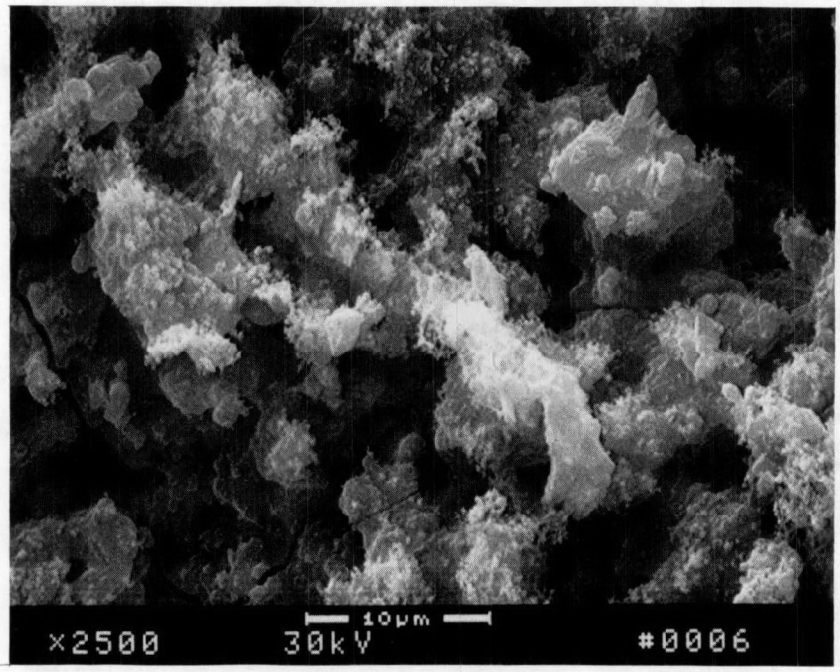

Figure D-8. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A221/0310

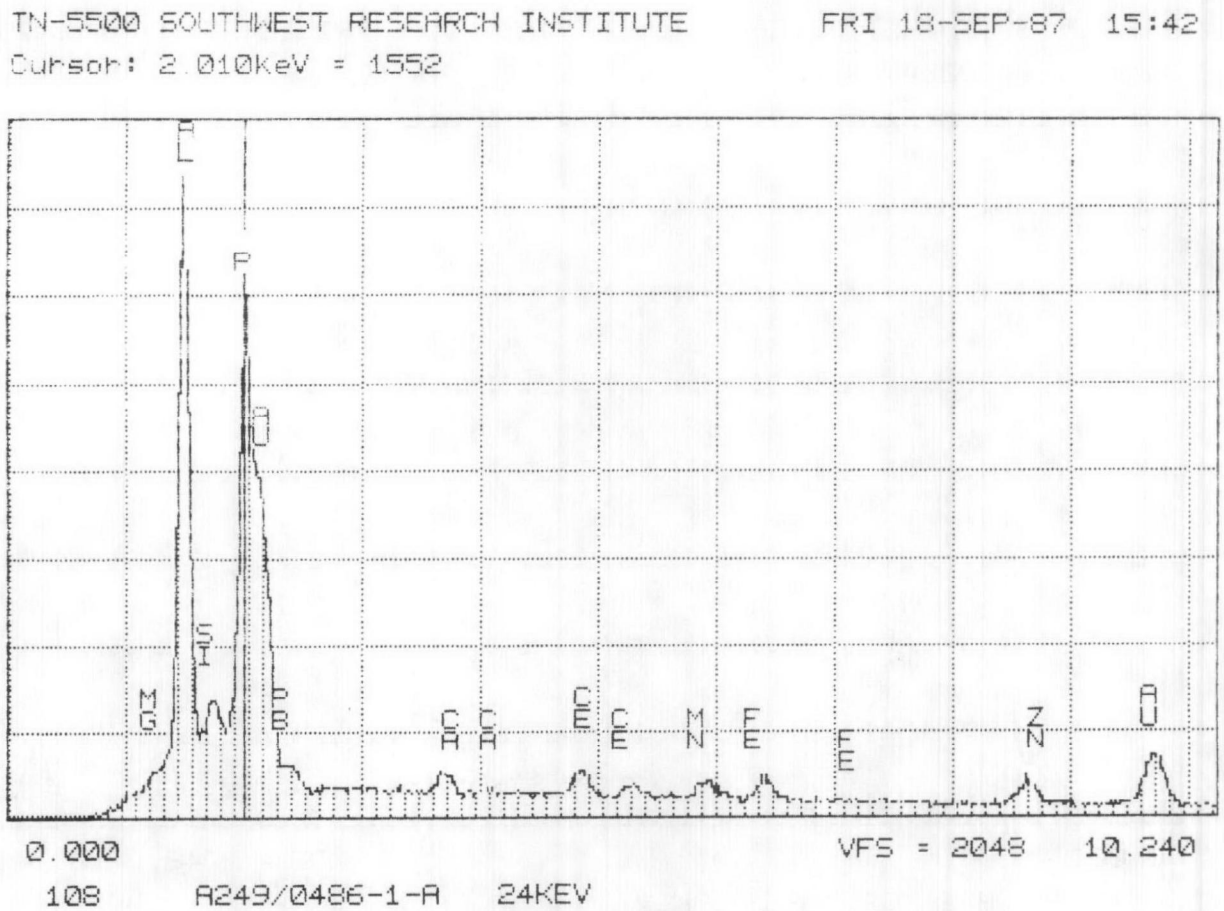

Figure D-9. SEM/EDX Spectrum of Converter A249/0486-1

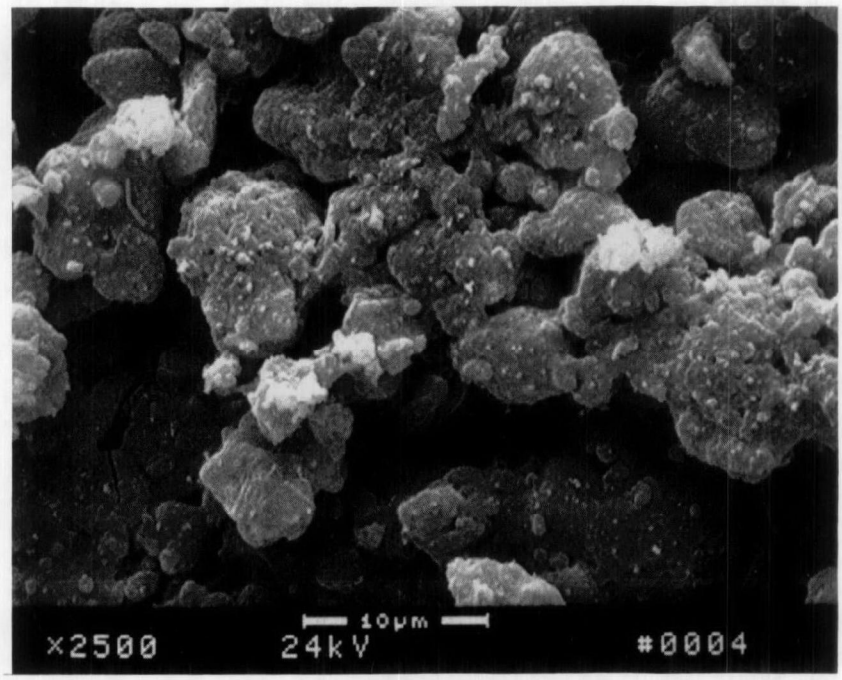

Figure D-10. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A249/0486-1

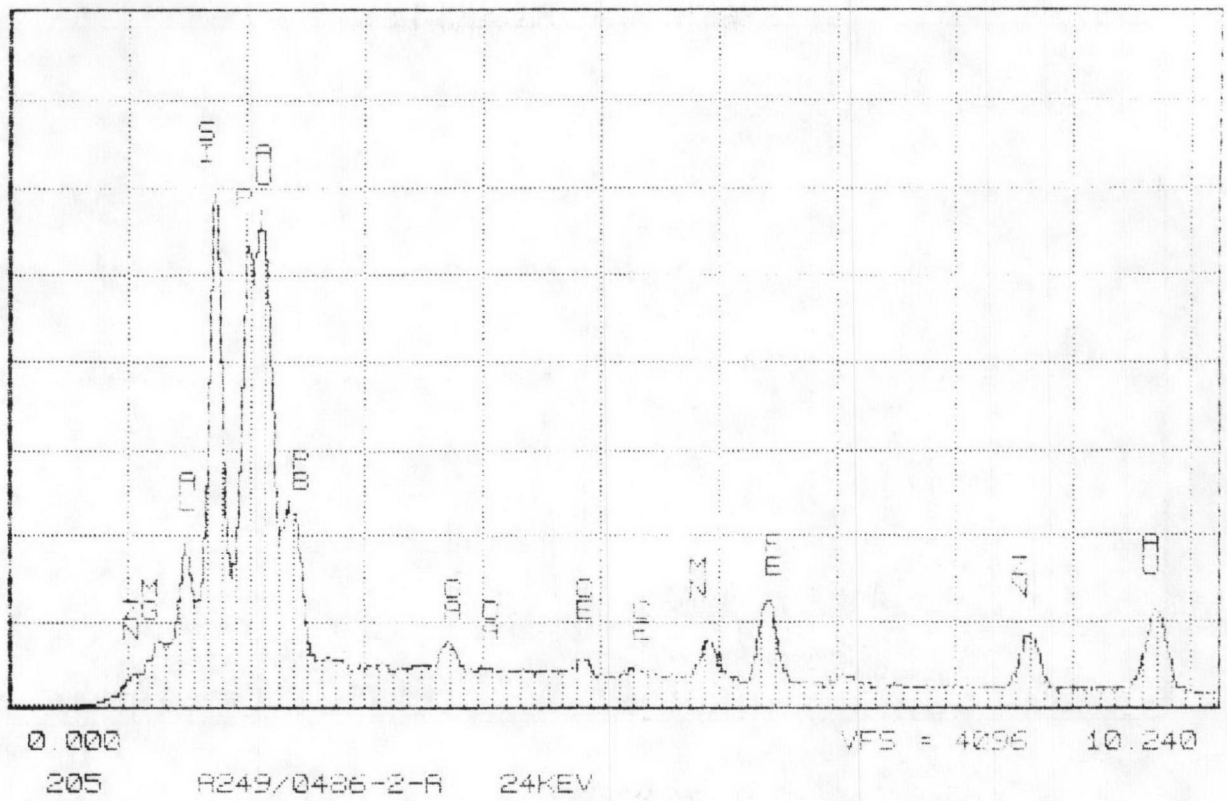

Figure D-11. SEM/EDX Spectrum of Converter A249/0486-2

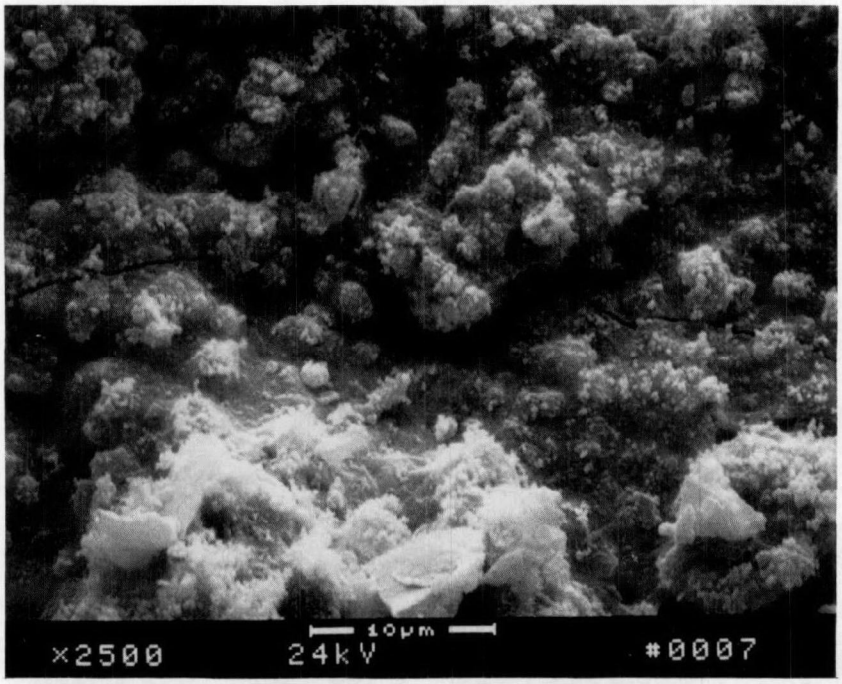

Figure D-12. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A249/0486-2

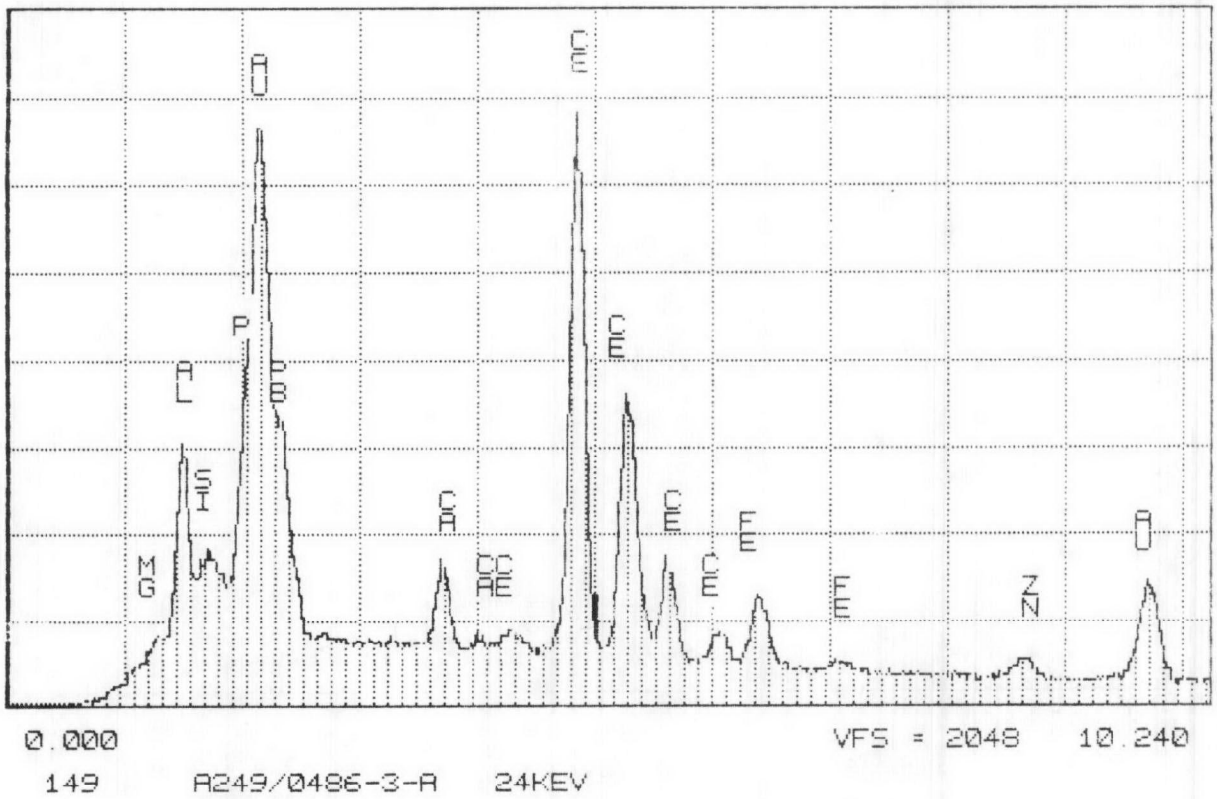

Figure D-13. SEM/EDX Spectrum of Converter A249/0486-3

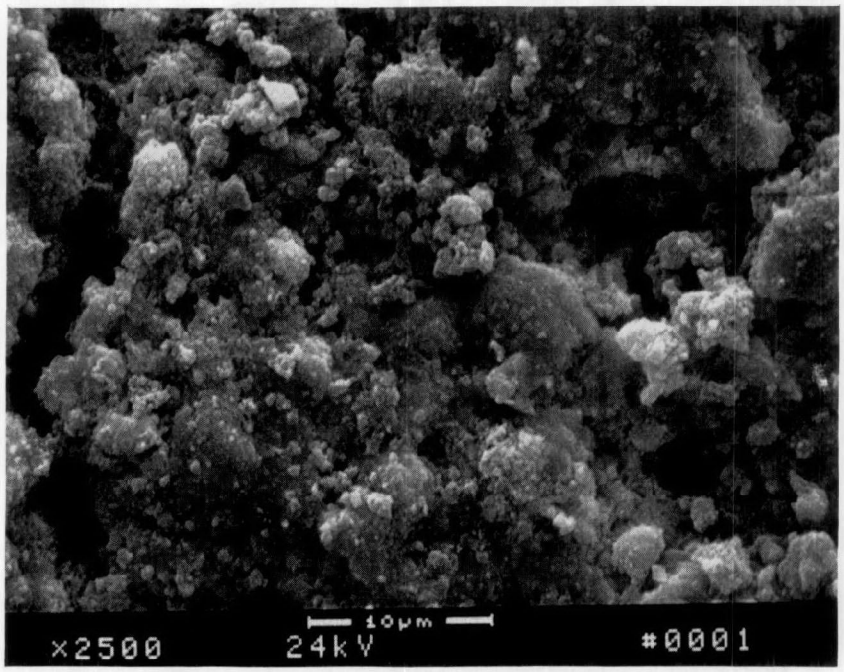

Figure D-14. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A249/0486-3

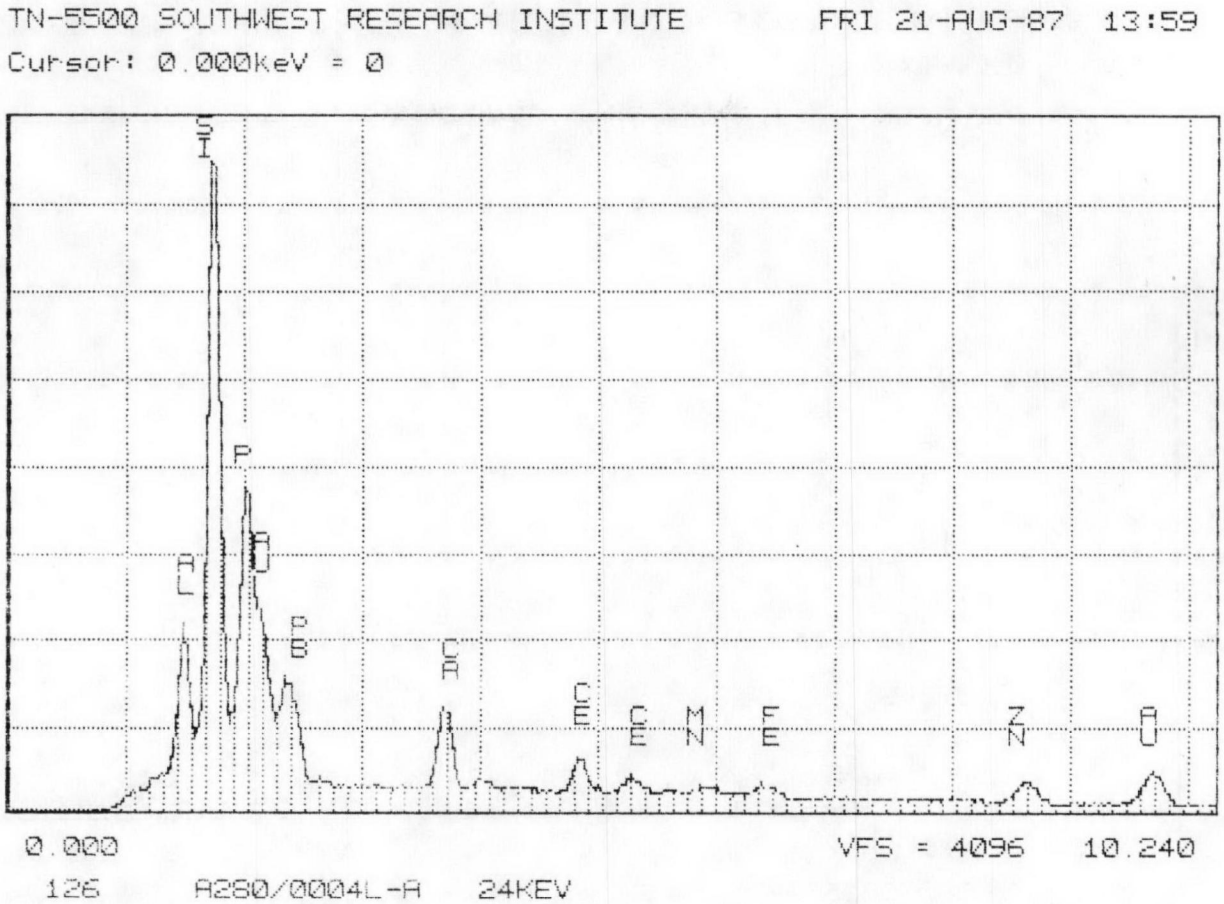

Figure D-15. SEM/EDX Spectrum of Converter A280/0004L

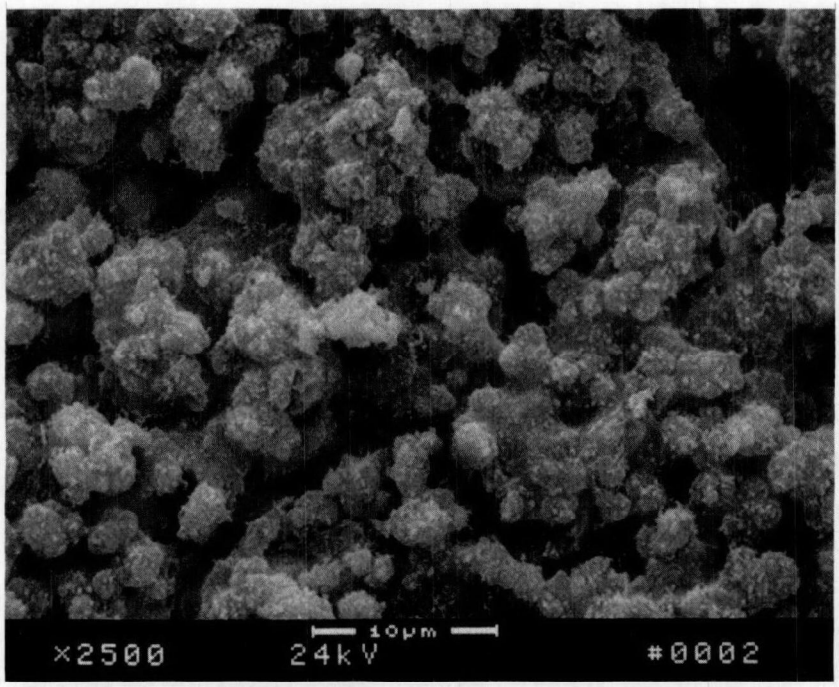

Figure D-16. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A280/0004L

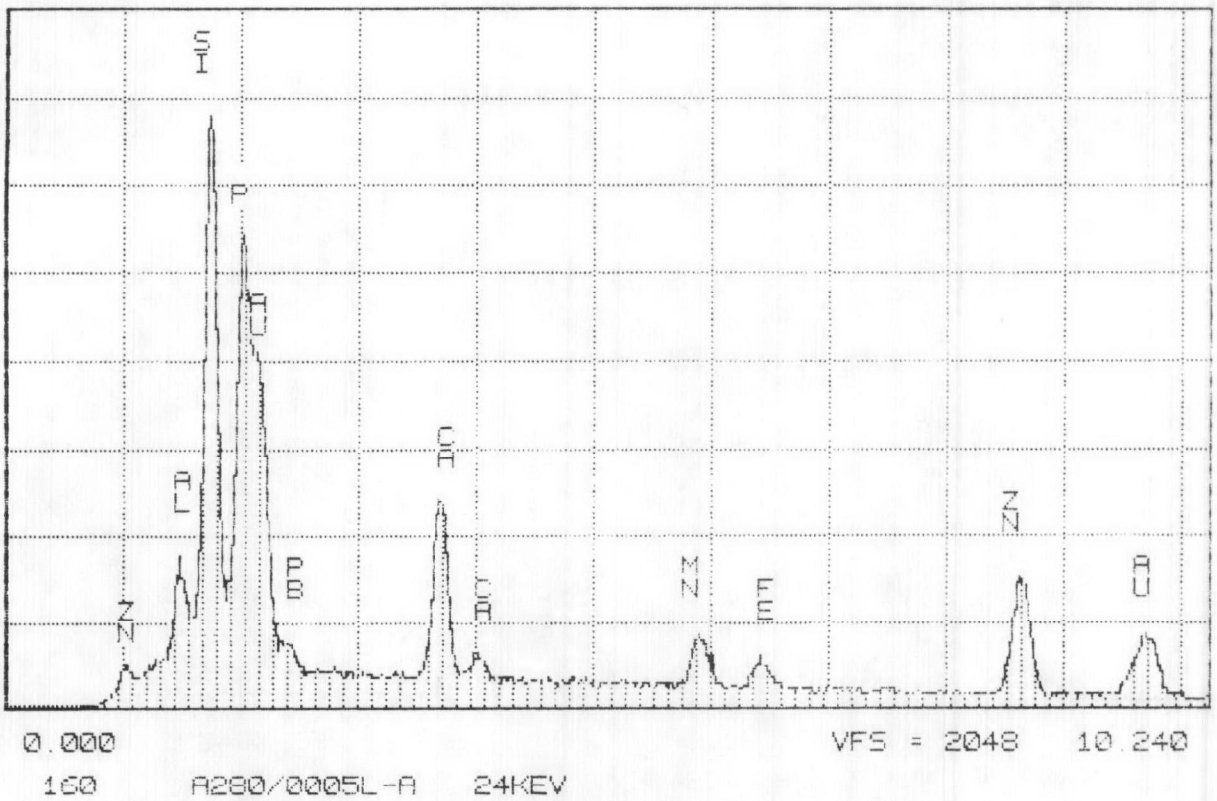

Figure D-17. SEM/EDX Spectrum of Converter A280/0005L

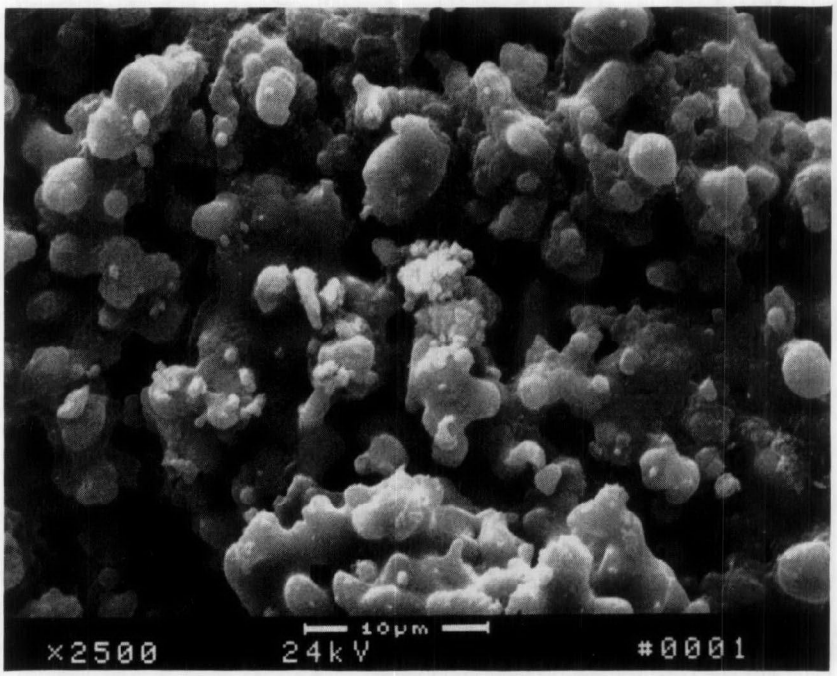

Figure D-18. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A280/0005L

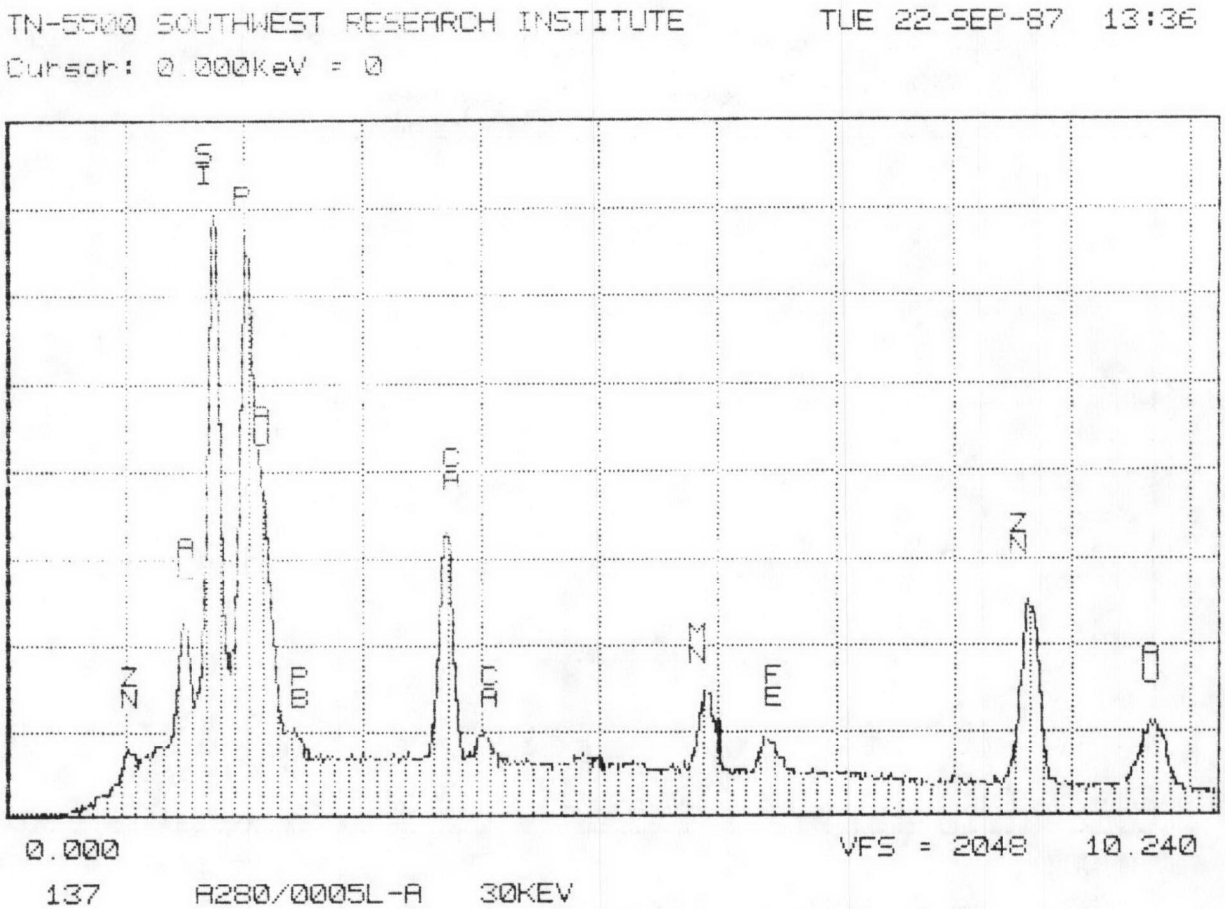

Figure D-19. SEM/EDX Spectrum of Converter A280/0005L

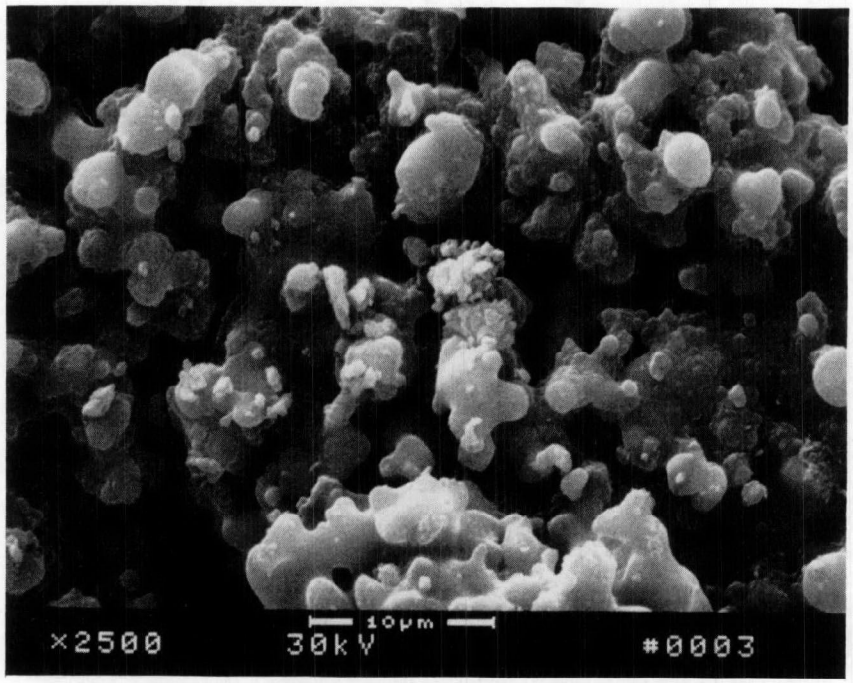

Figure D-20. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A280/0005L

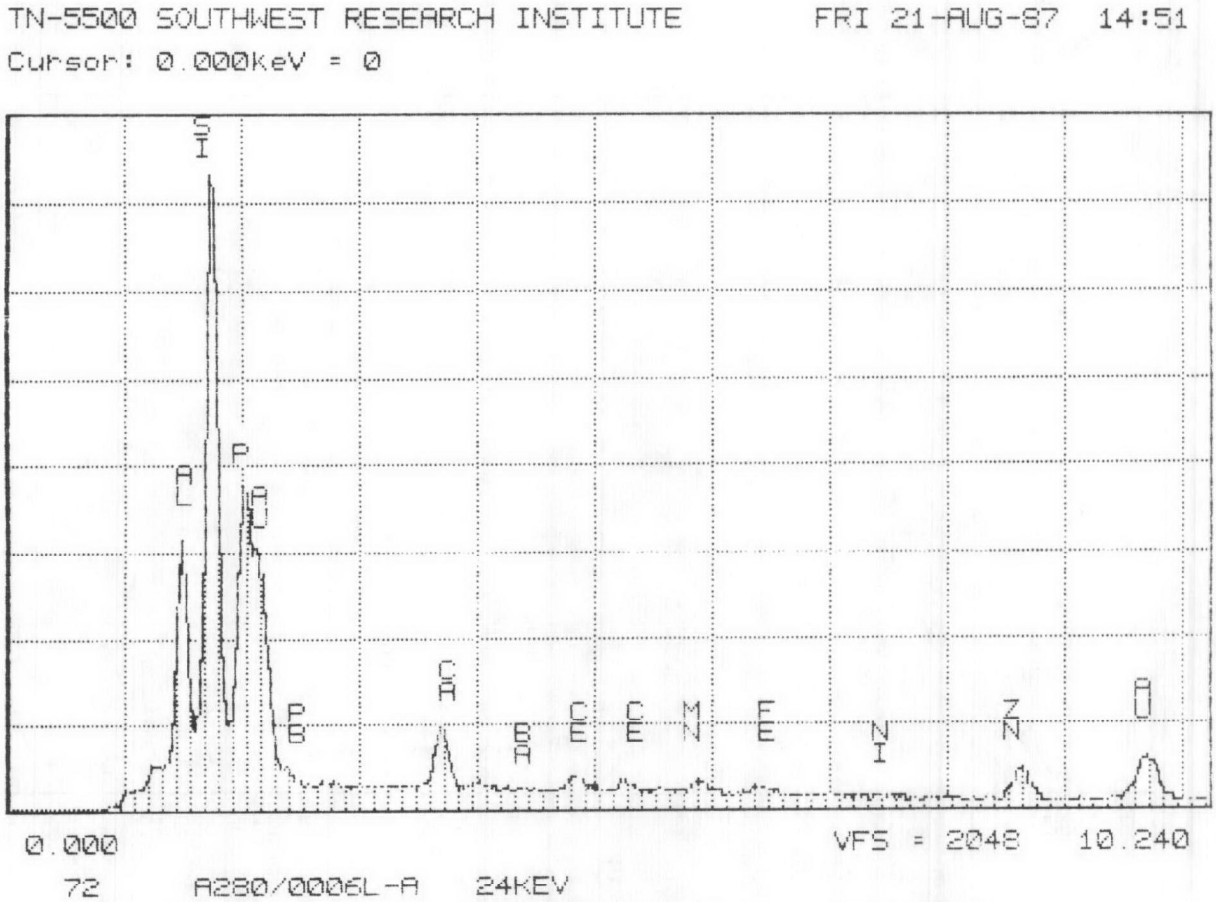

Figure D-21. SEM/EDX Spectrum of Converter A280/0006L

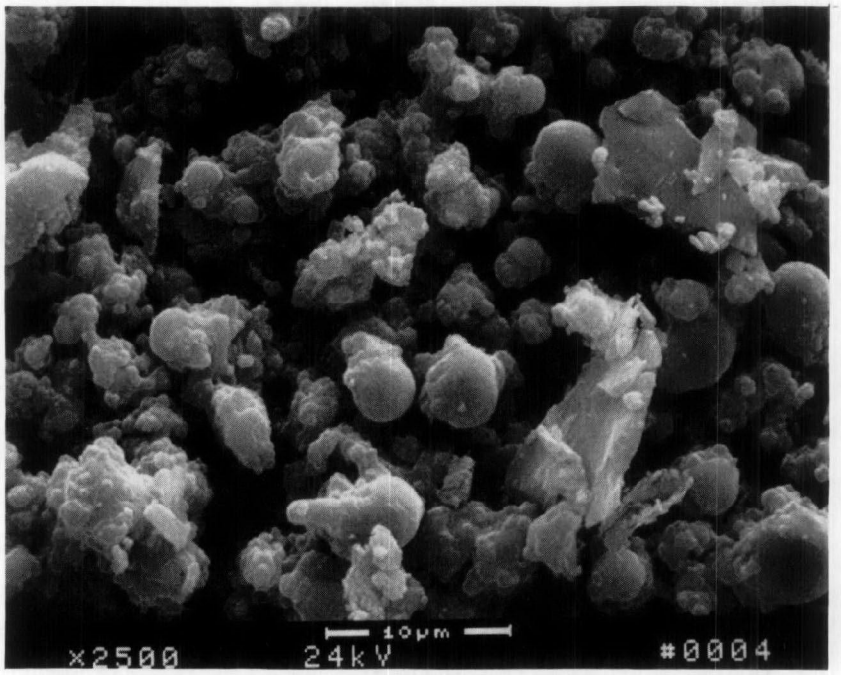

Figure D-22. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A280/0006L

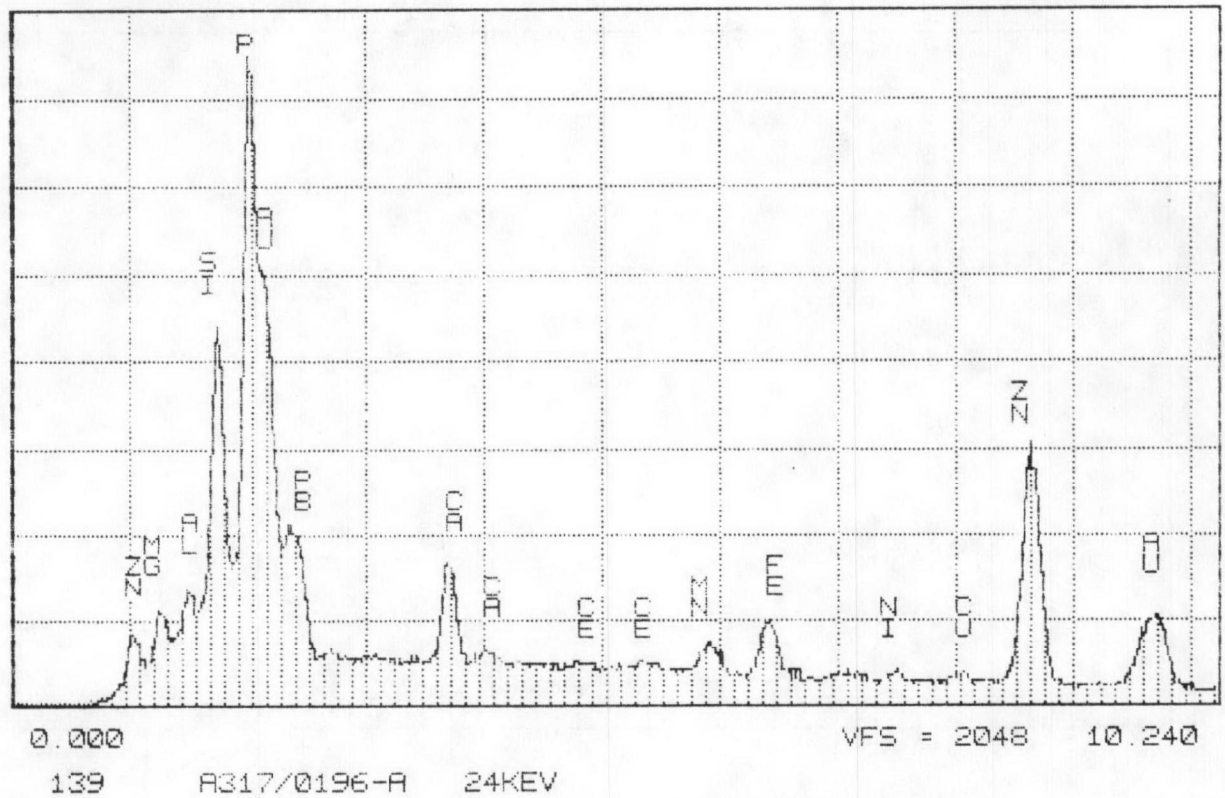

Figure D-23. SEM/EDX Spectrum of Converter A317/0196

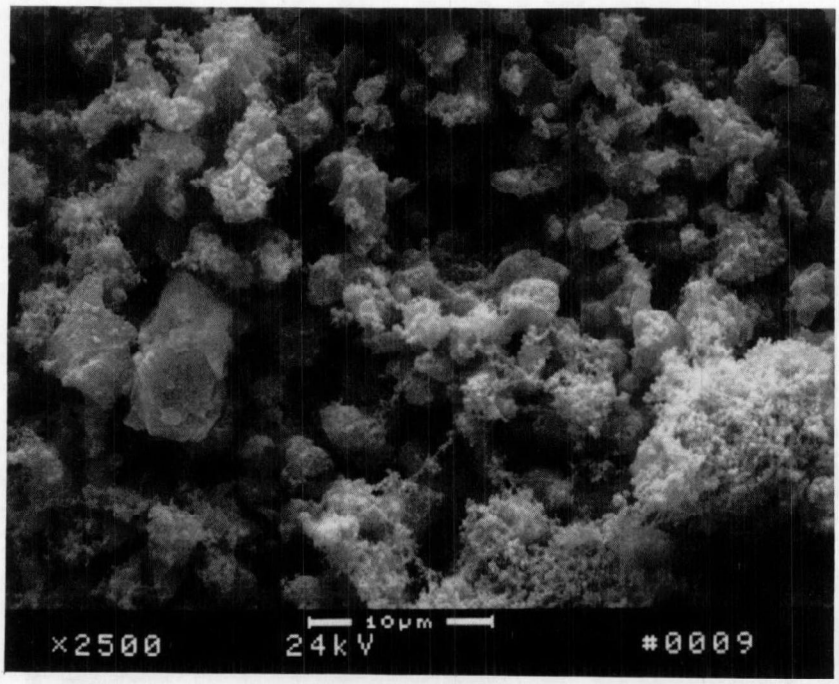

Figure D-24. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A317/0196

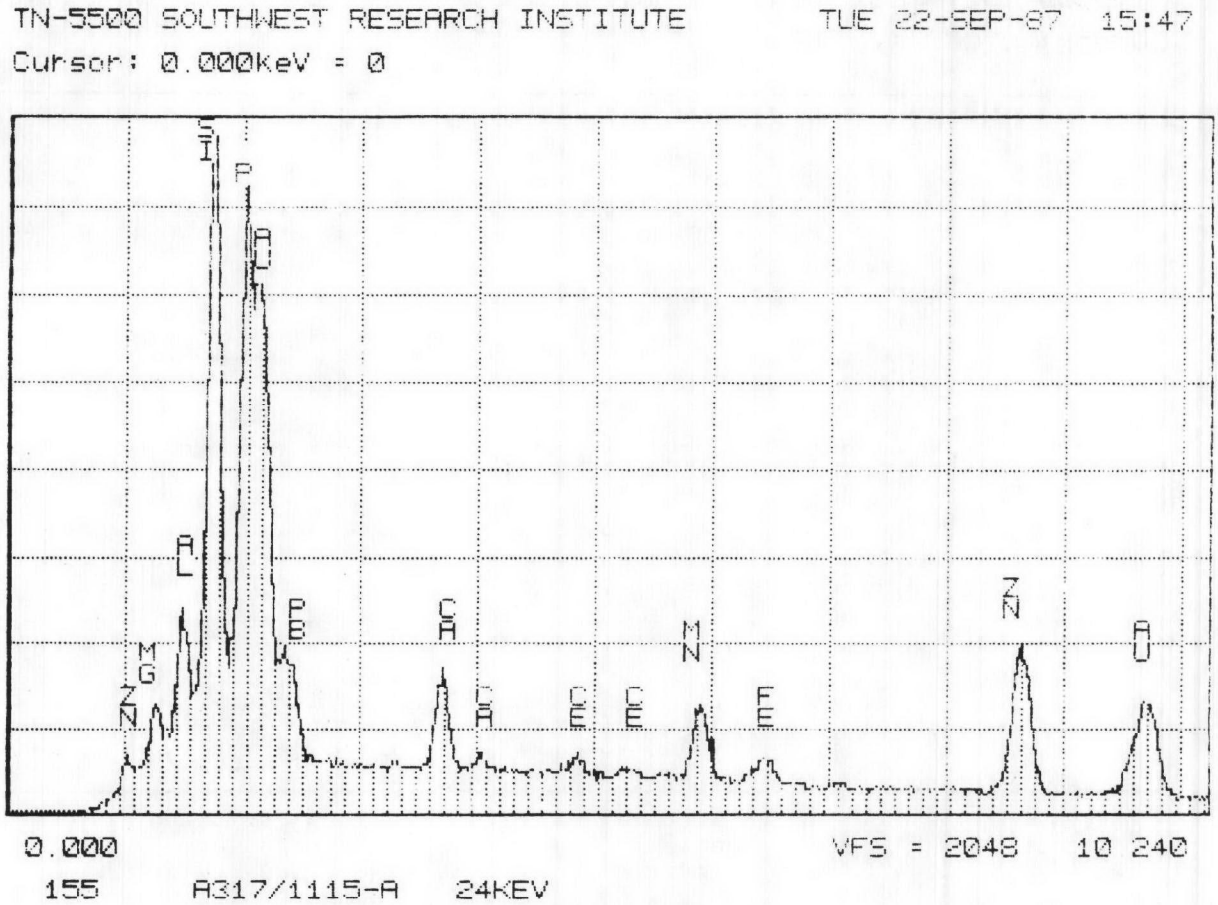

Figure D-25. SEM/EDX Spectrum of Converter A317/1115

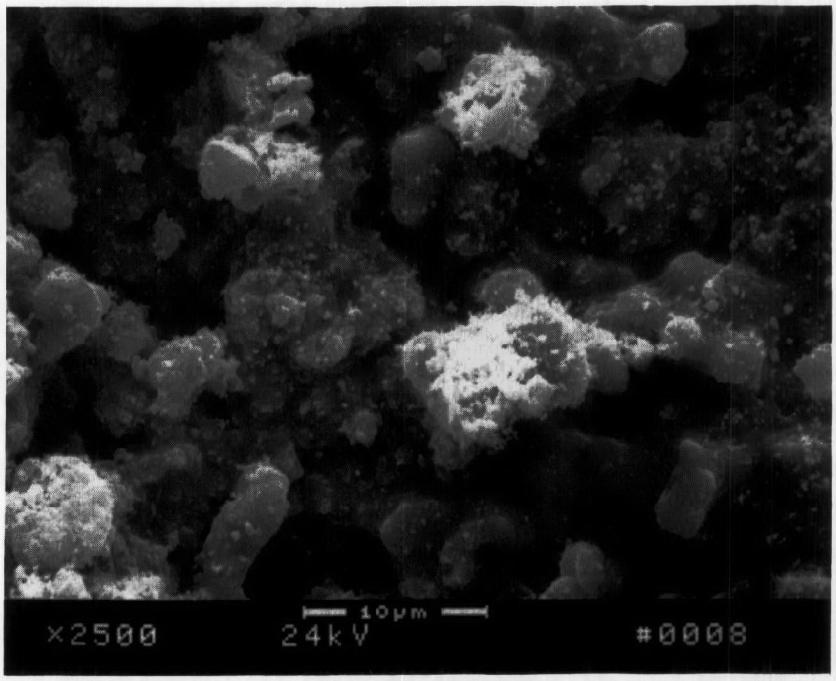

Figure D-26. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A317/1115

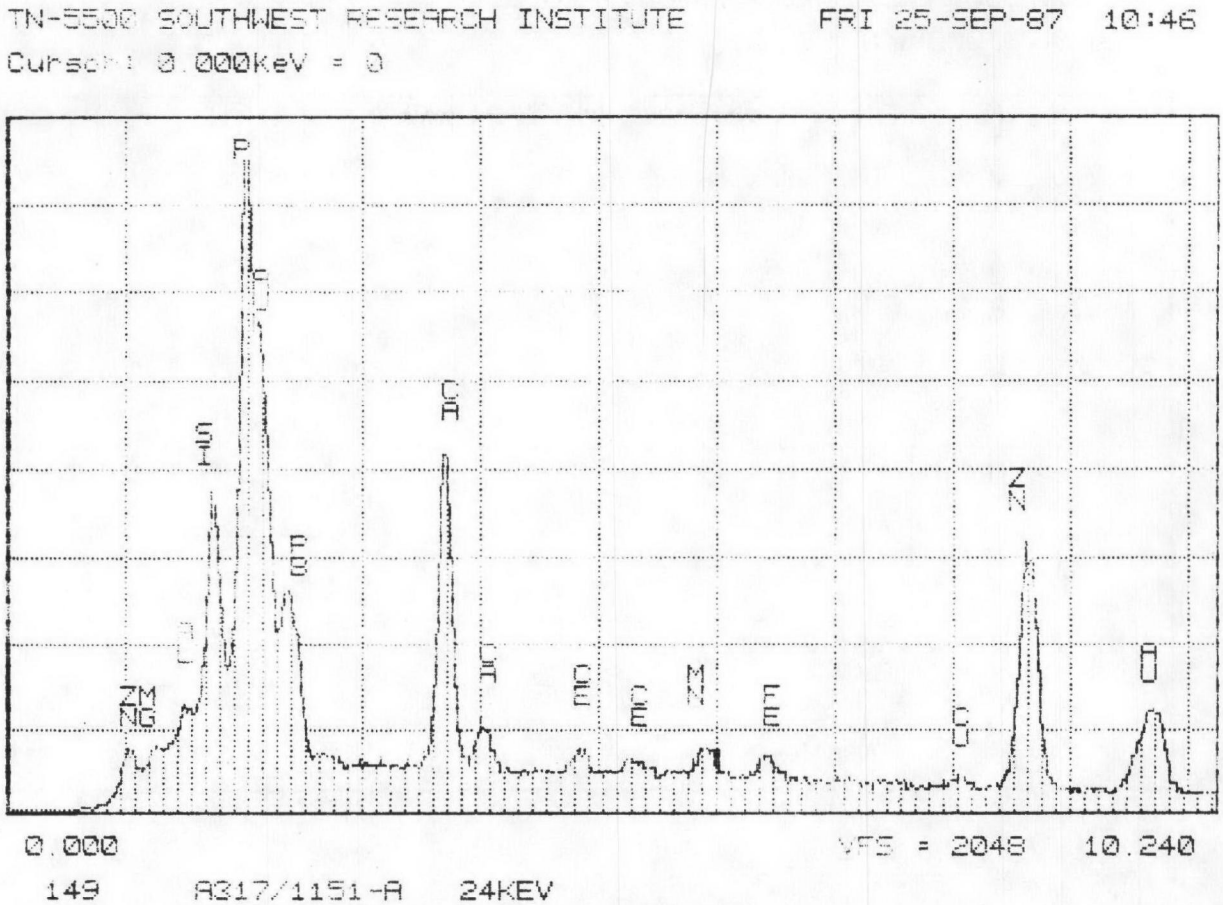

Figure D-27. SEM/EDX Spectrum of Converter A317/1151

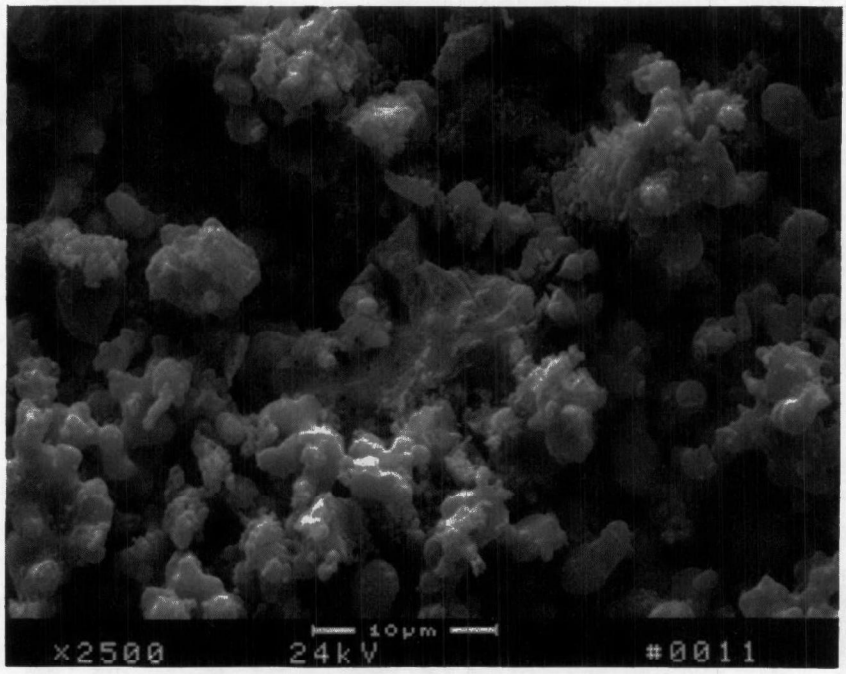

Figure D-28. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A317/1151

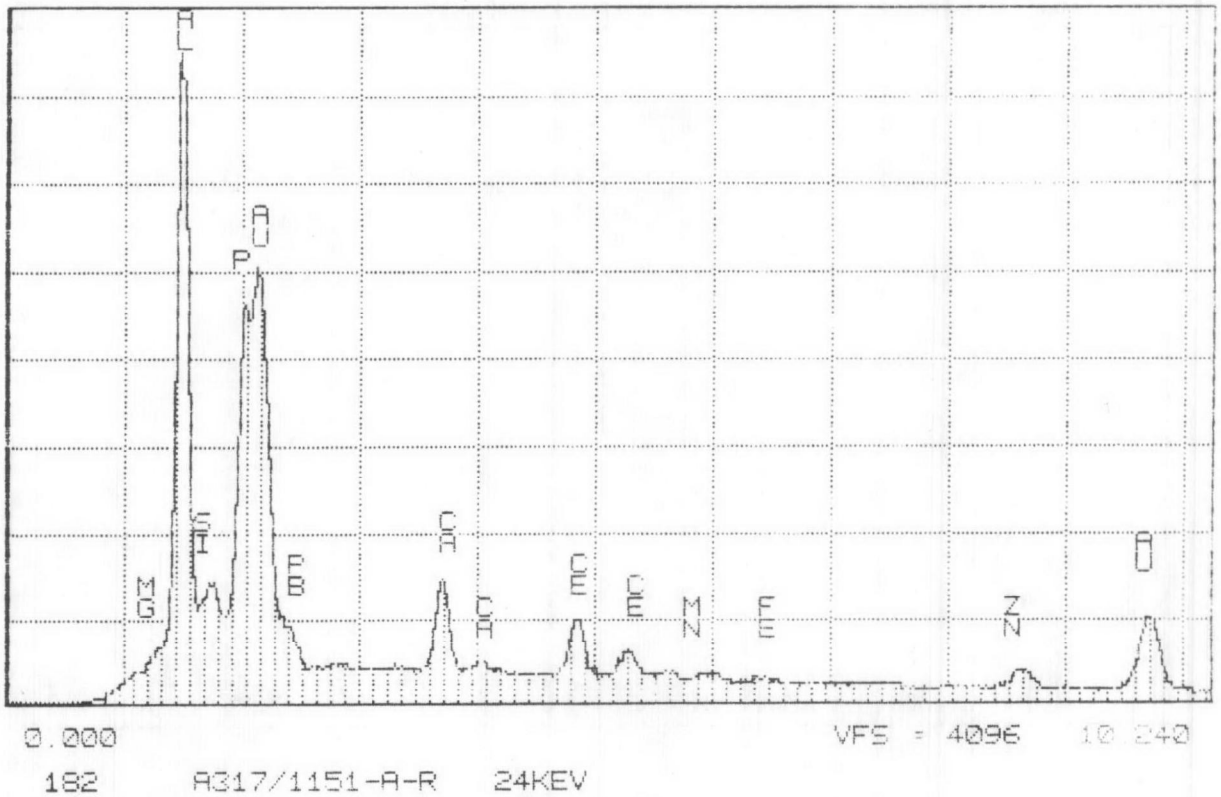

Figure D-29. SEM/EDX Spectrum of Converter A317/1151-Rear Face

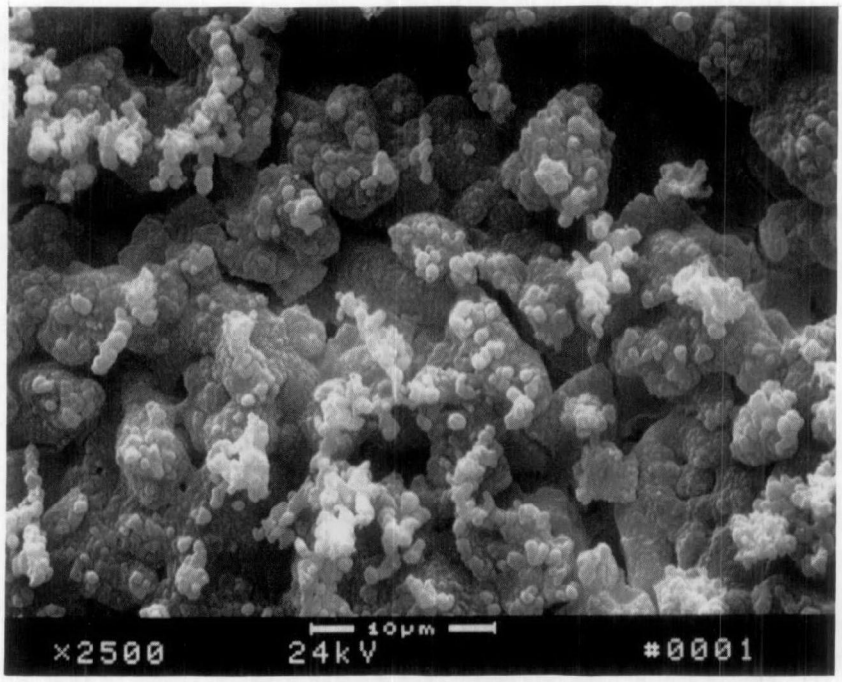

Figure D-30. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A317/1151-Rear Face

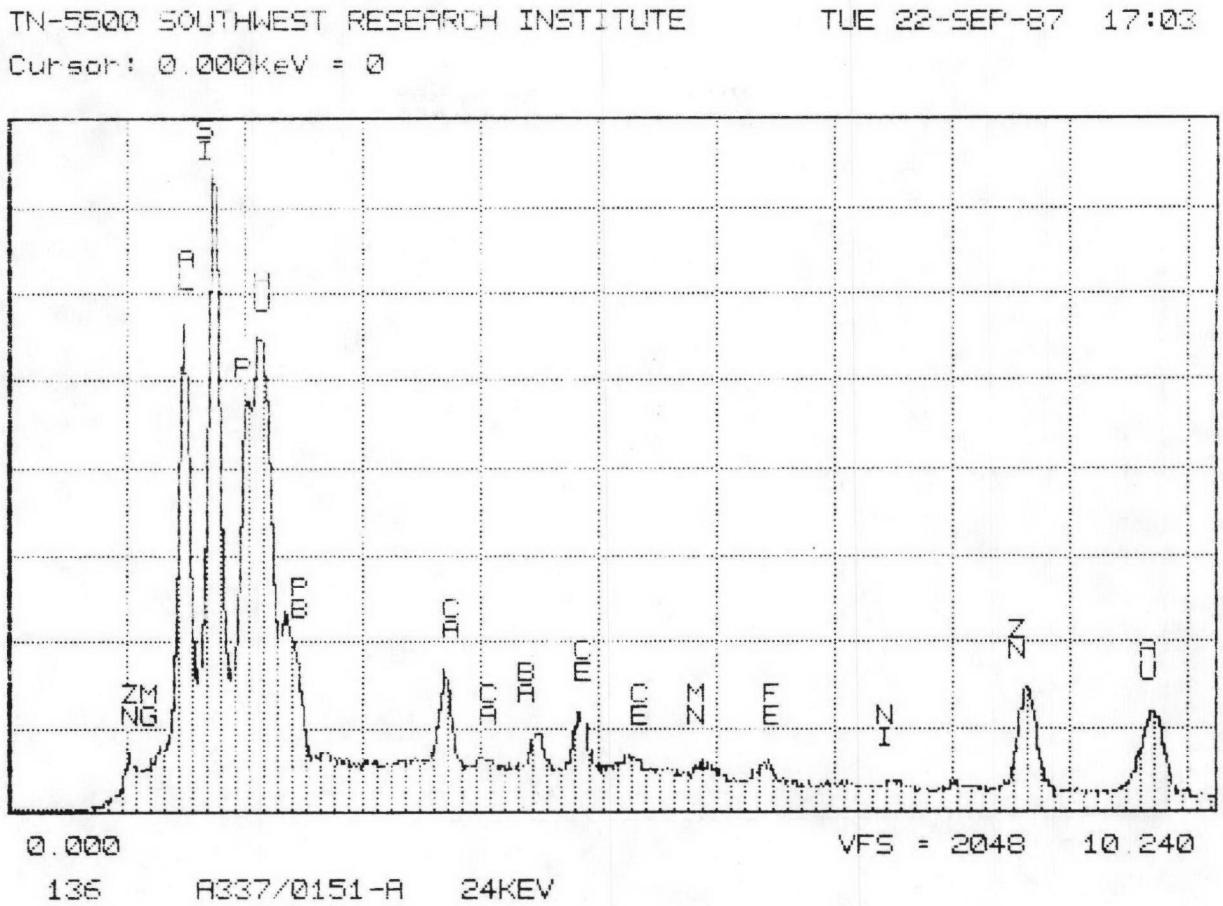

Figure D-31. SEM/EDX Spectrum of Converter A337/0151

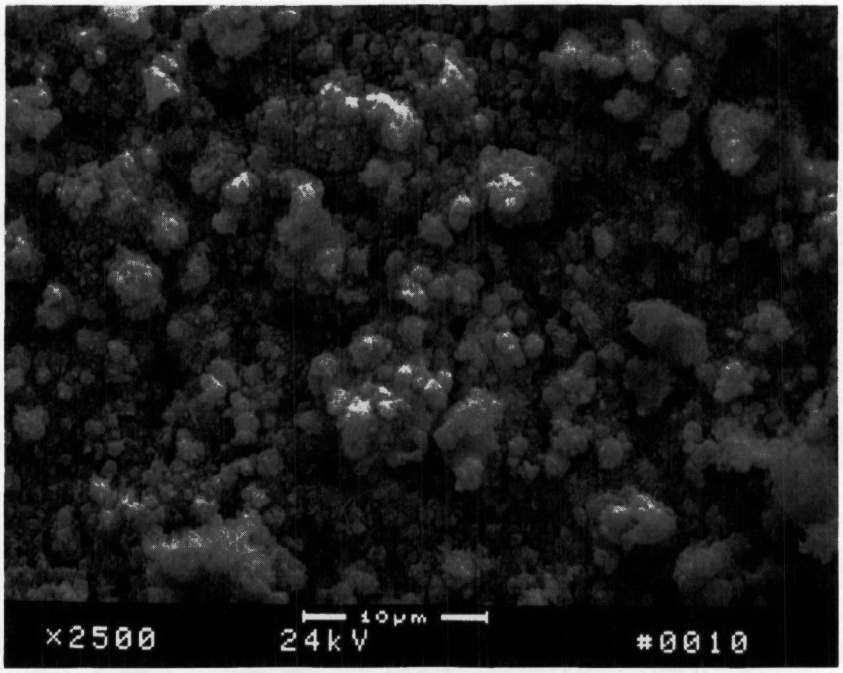

Figure D-32. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A337/0151

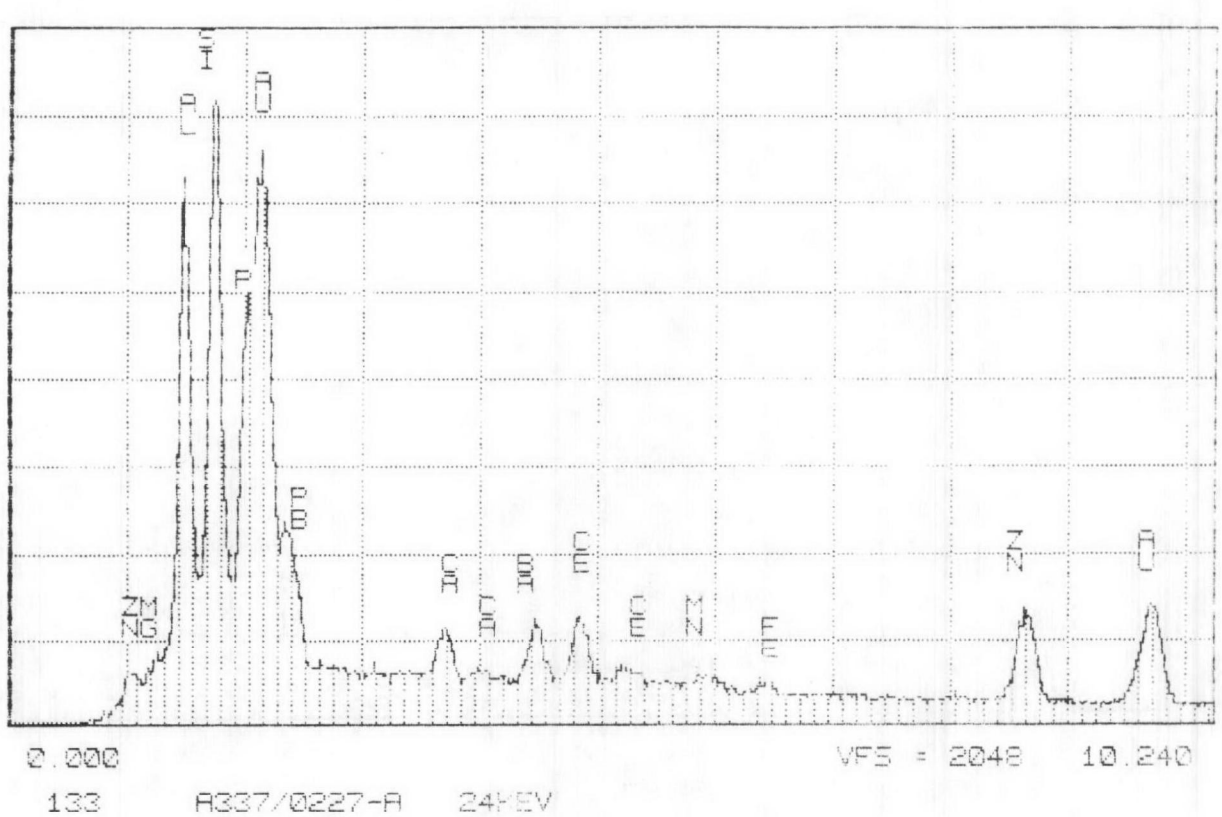

Figure D-33. SEM/EDX Spectrum of Converter A337/0227

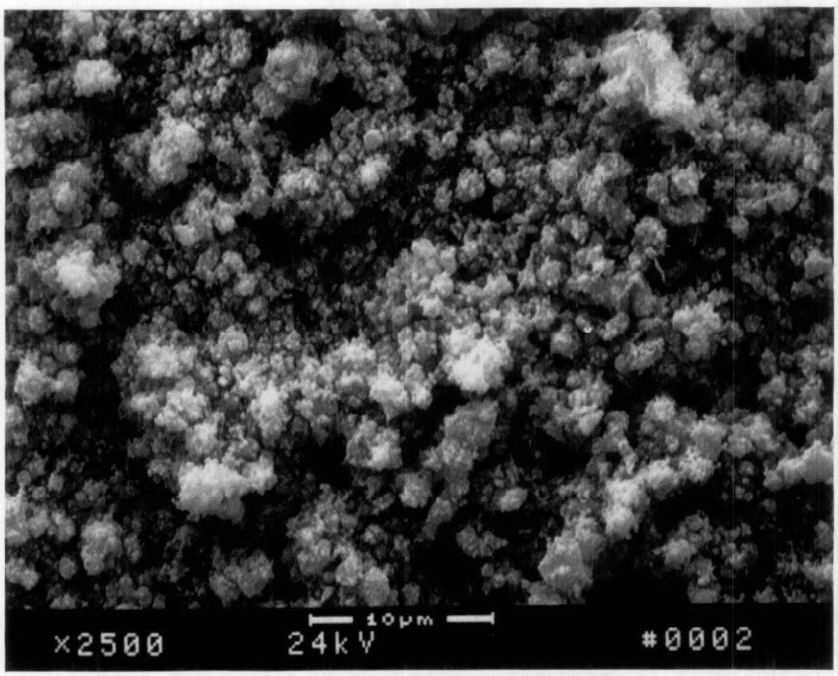

Figure D-34. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A337/0227

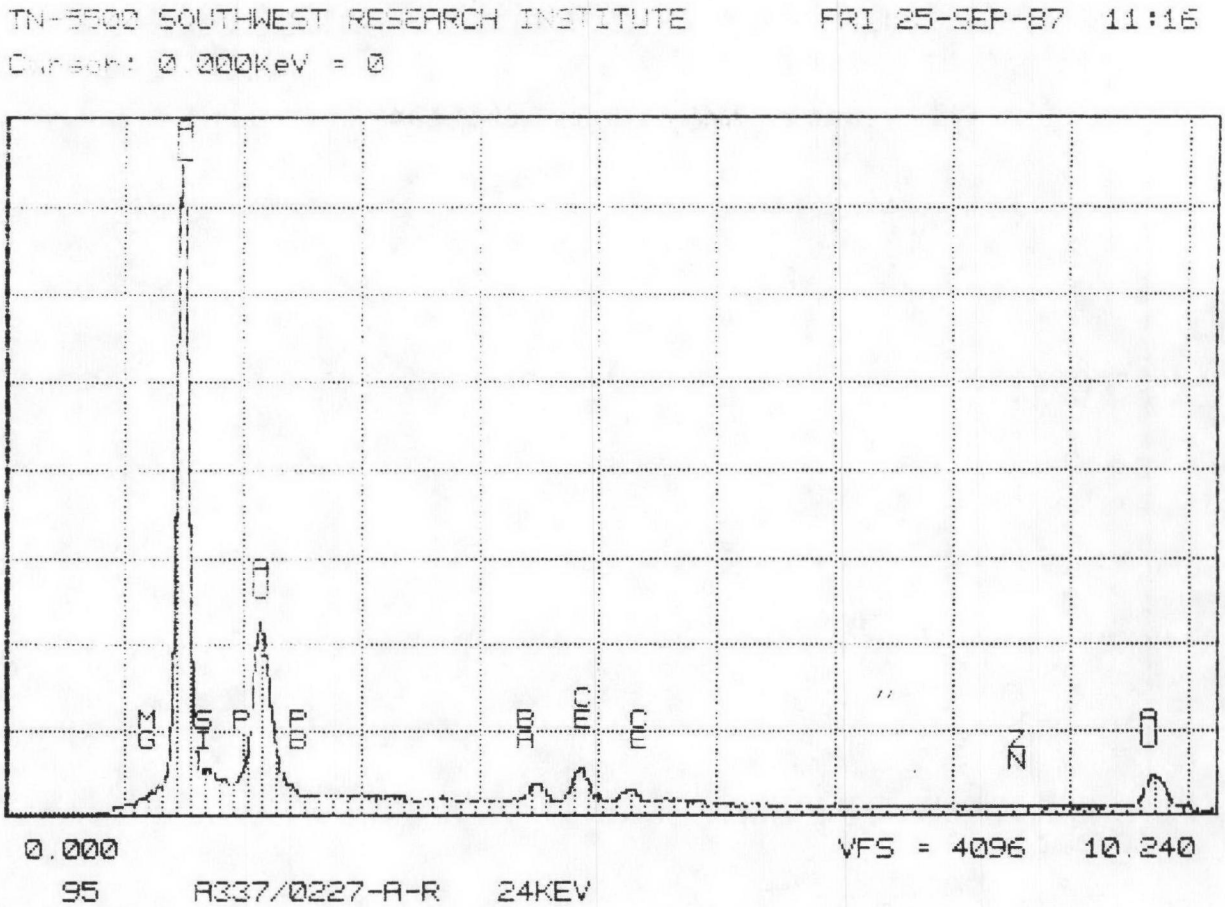

Figure D-35. SEM/EDX Spectrum of Converter A337/0227-Rear Face

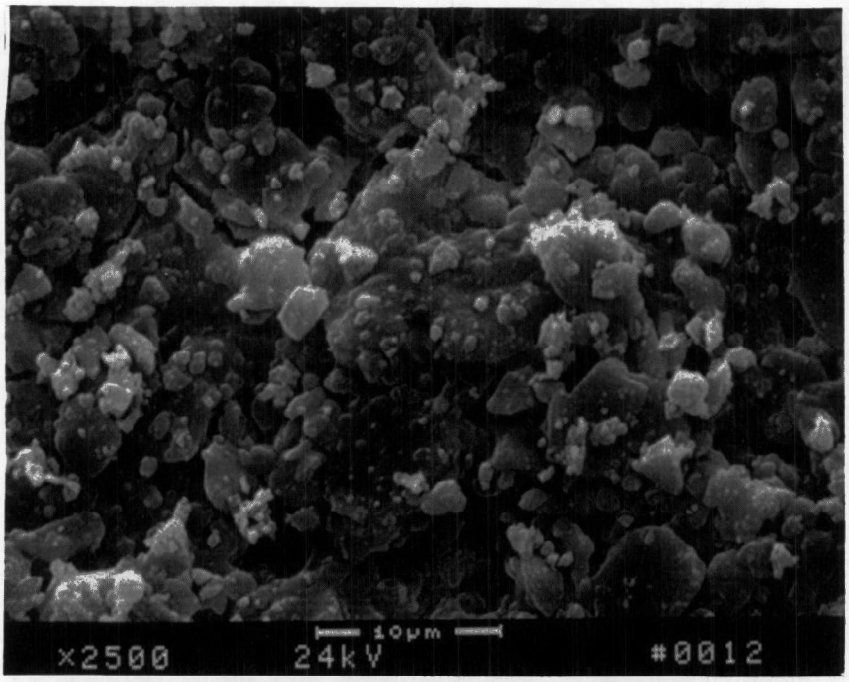

Figure D-36. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A337/0227-Rear Face

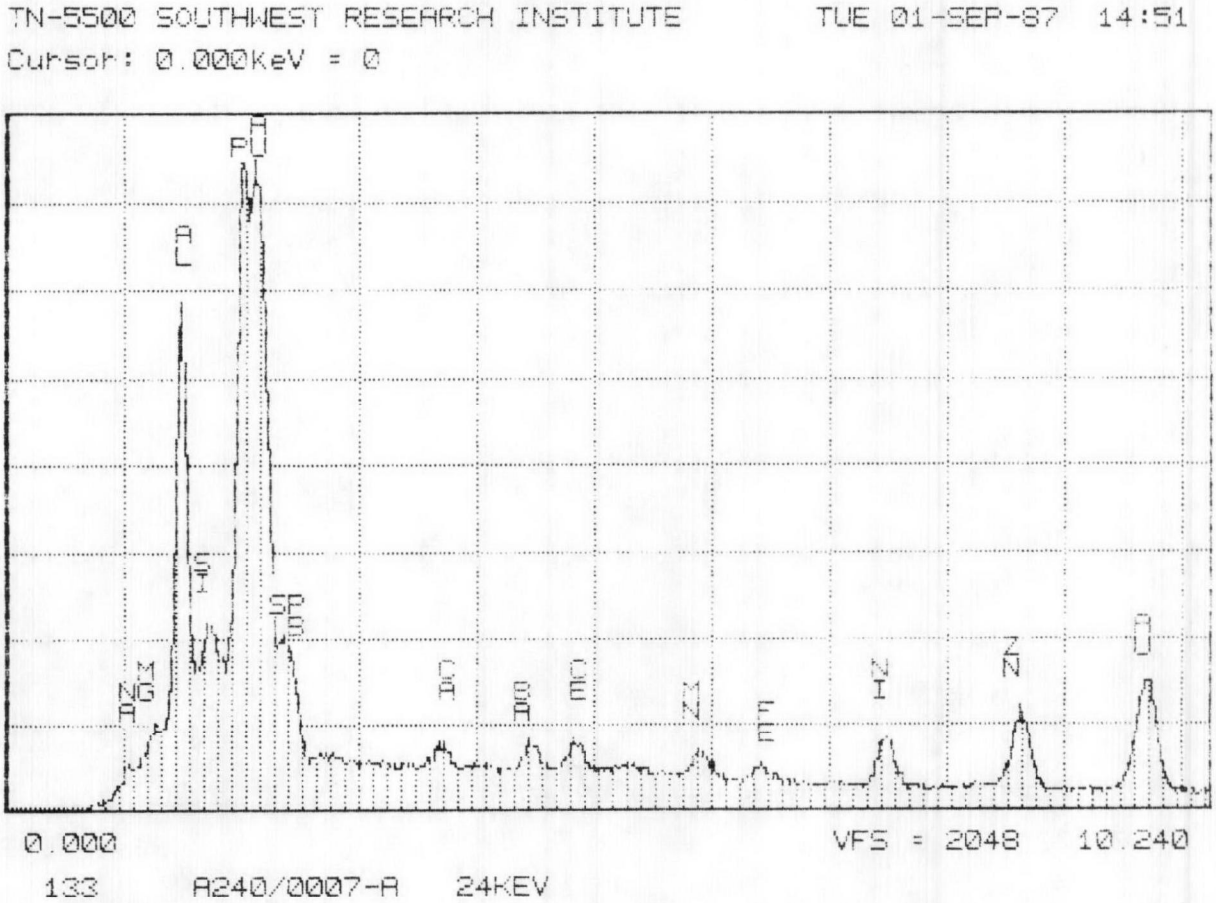

Figure D-37. SEM/EDX Spectrum of Converter A240/0007

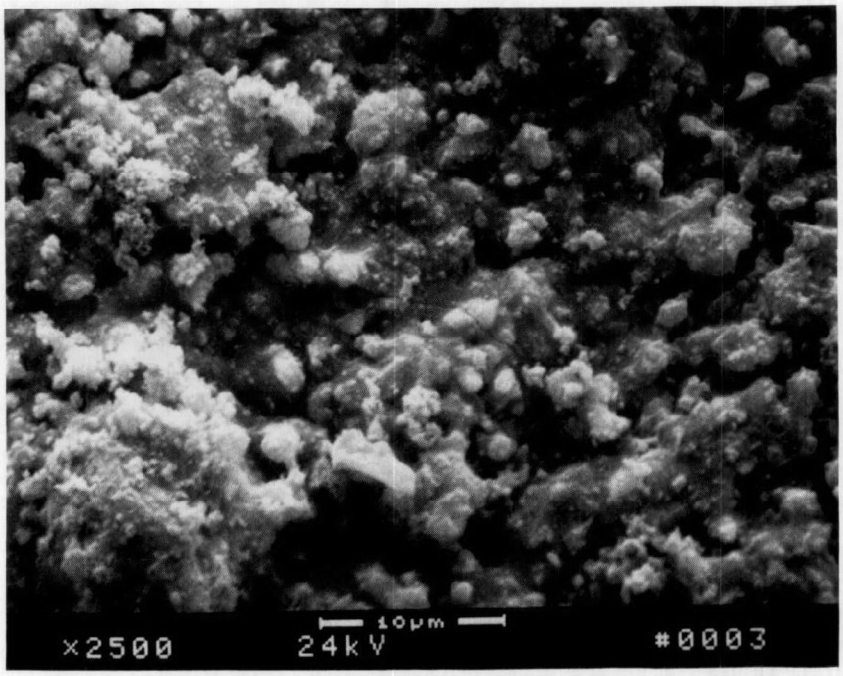

Figure D-38. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A240/0007

TN-5500 SOUTHWEST RESEARCH INSTITUTE MON 21-SEP-87 11:20

Cursor: 0.000keV = 0

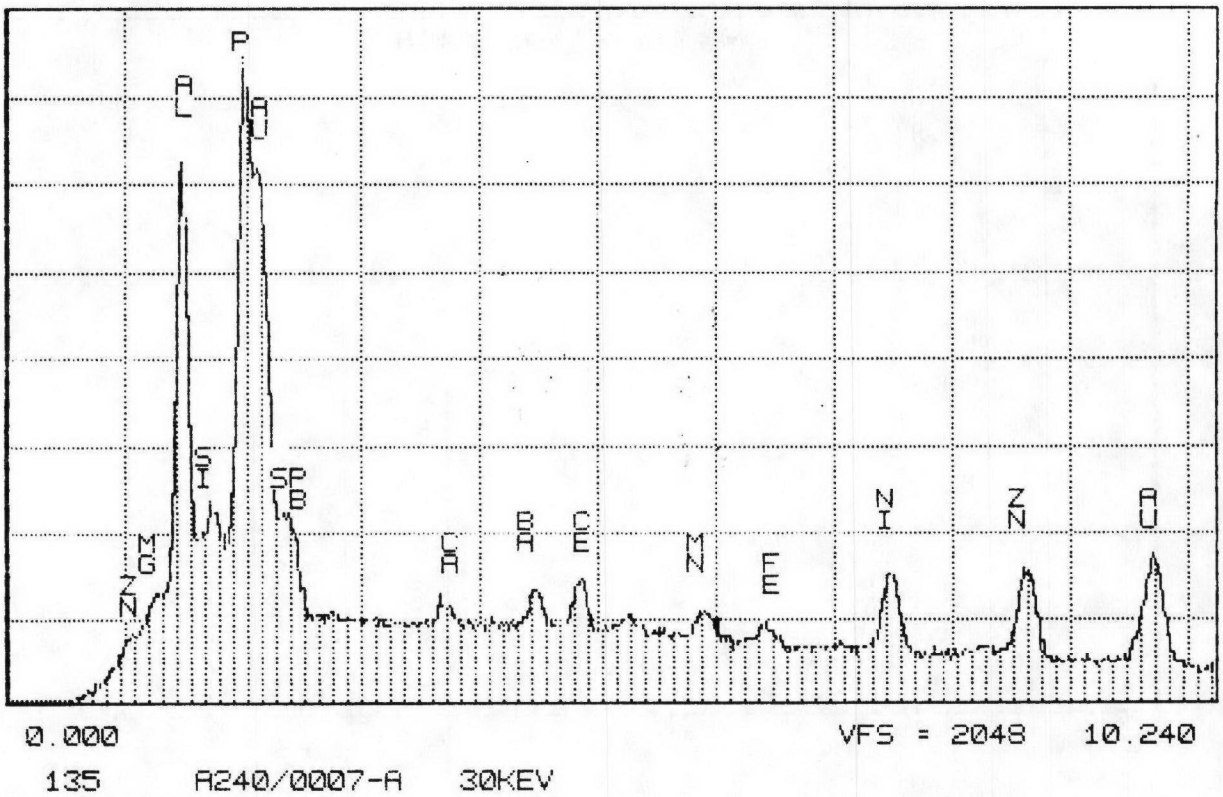

Figure D-39. SEM/EDX Spectrum of Converter A240/0007A

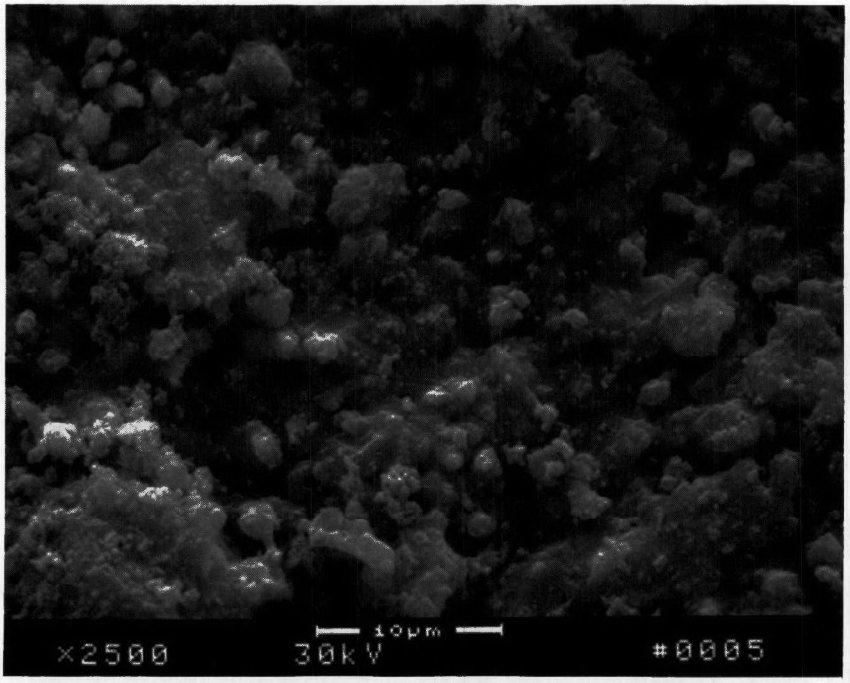

Figure D-40. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A240/0007

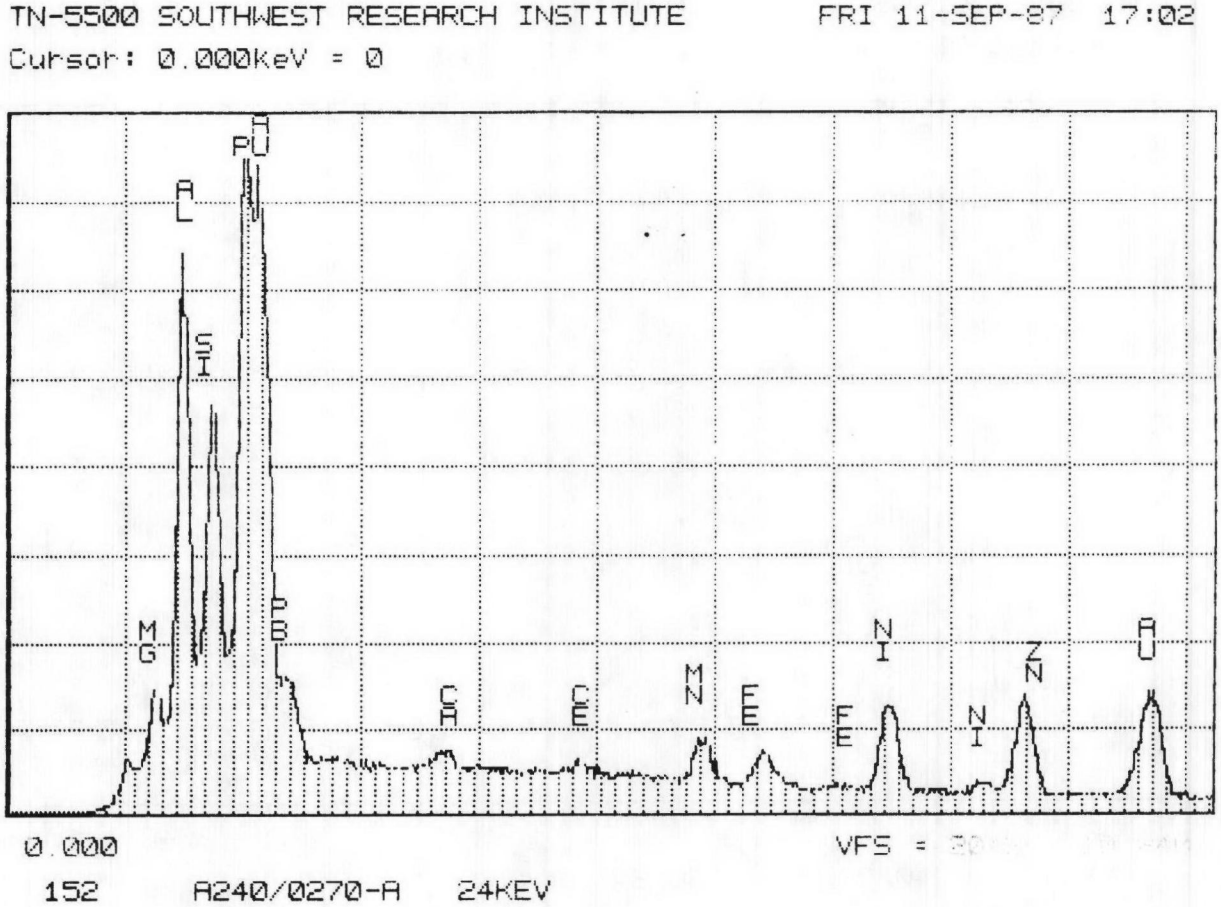

Figure D-41. SEM/EDX Spectrum of Converter A240/0270

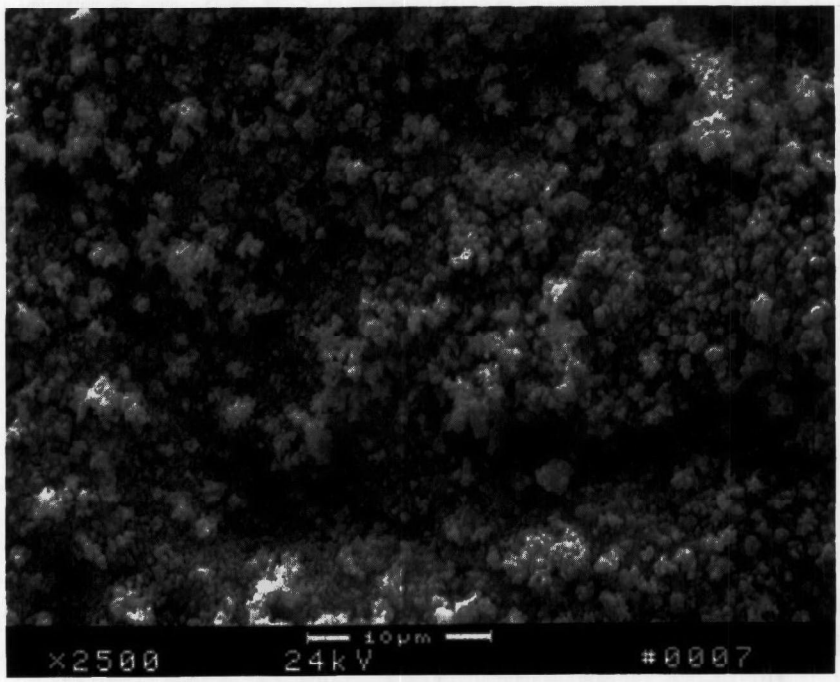

Figure D-42. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A240/0270

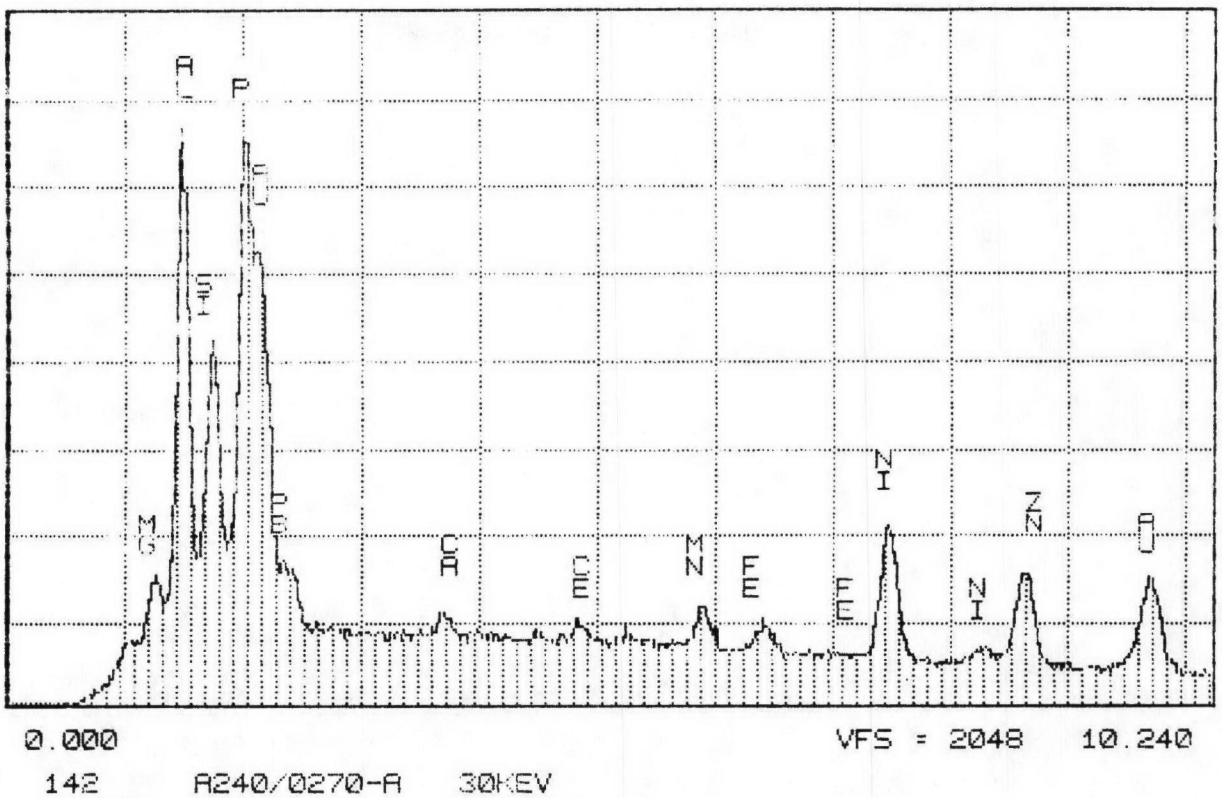

Figure D-43. SEM/EDX Spectrum of Converter A240/0270

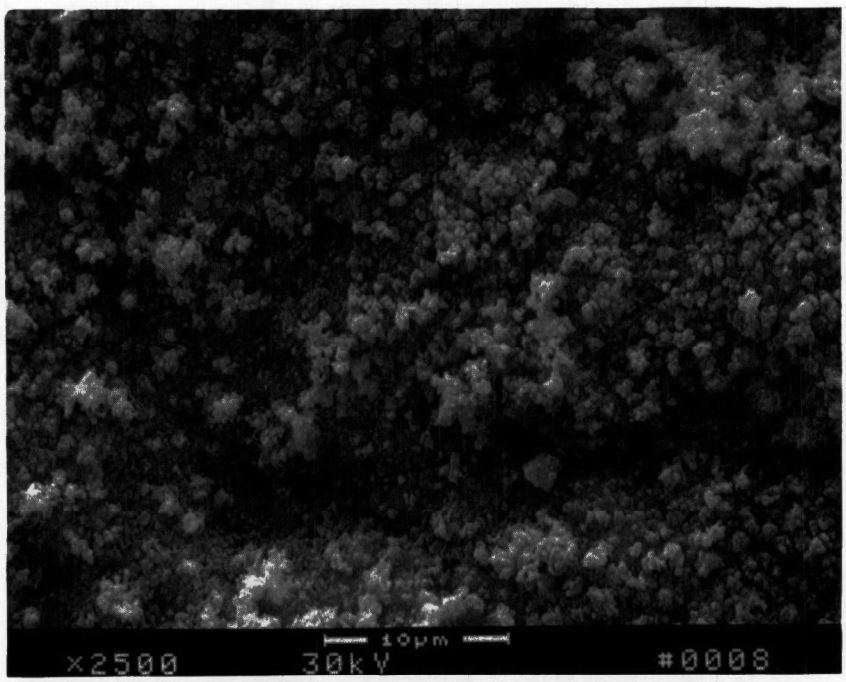

Figure D-44. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A240/0270

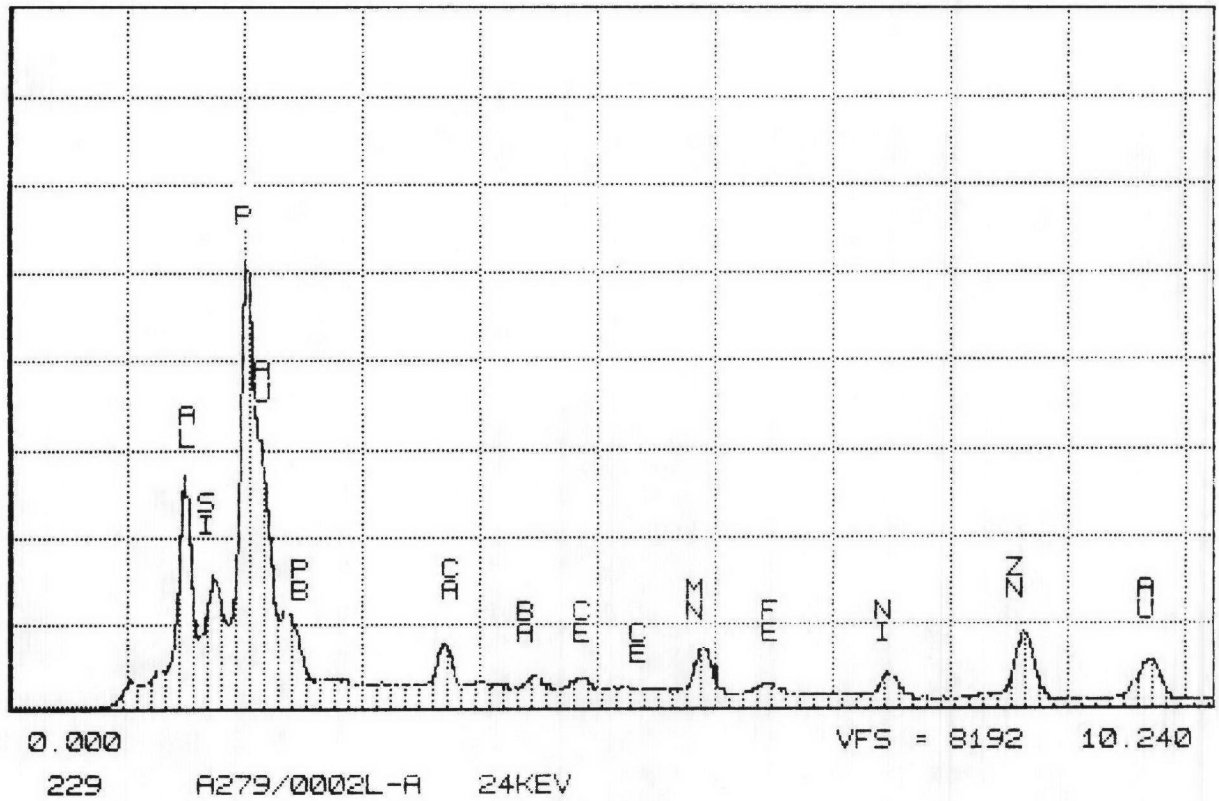

Figure D-45. SEM/EDX Spectrum of Converter A279/0002L

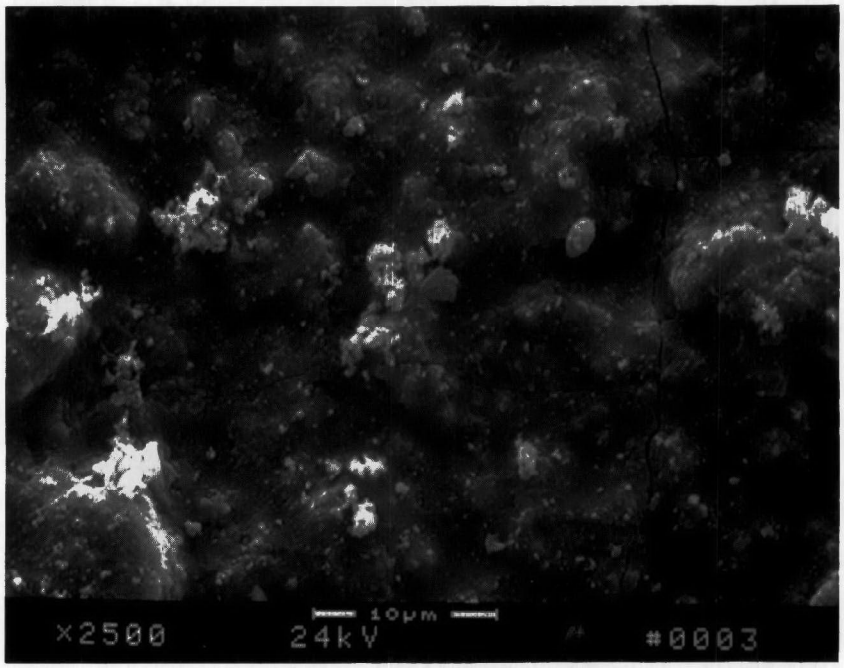

Figure D-46. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A279/0002L

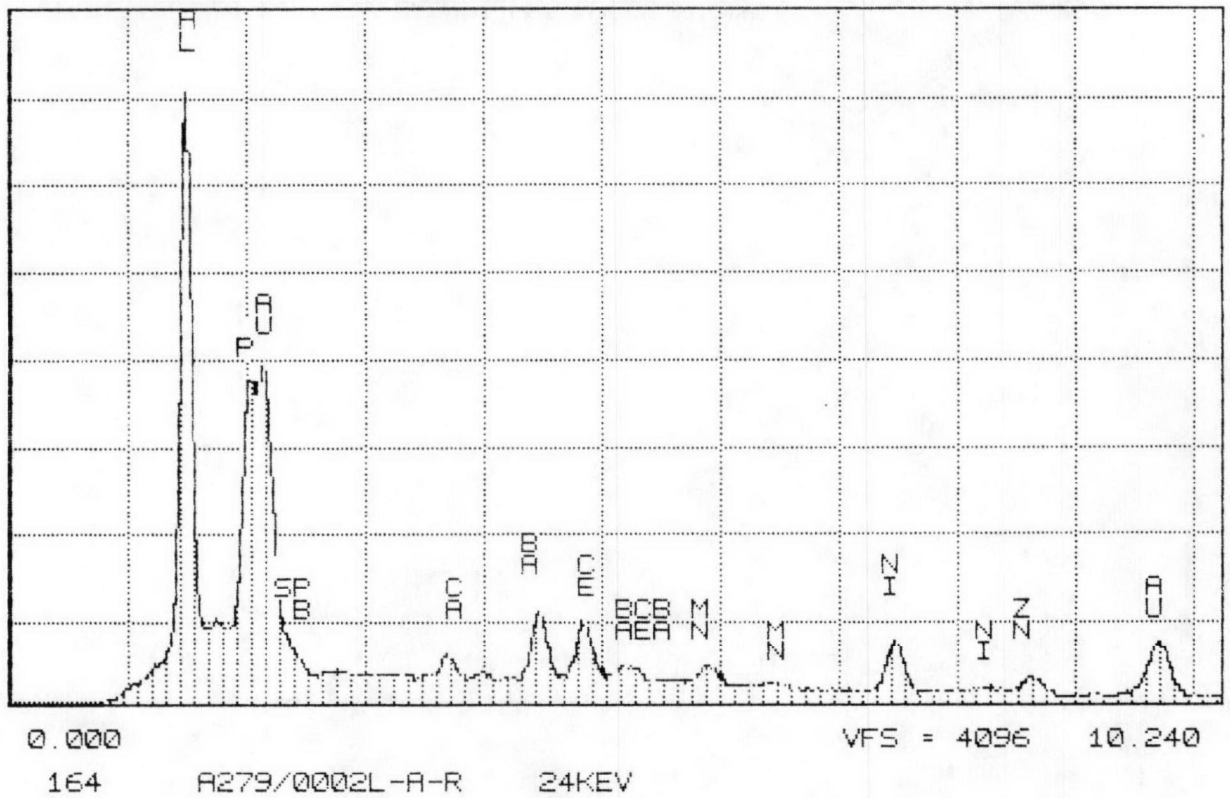

Figure D-47. SEM/EDX Spectrum of Converter 279/0002L-Rear Face

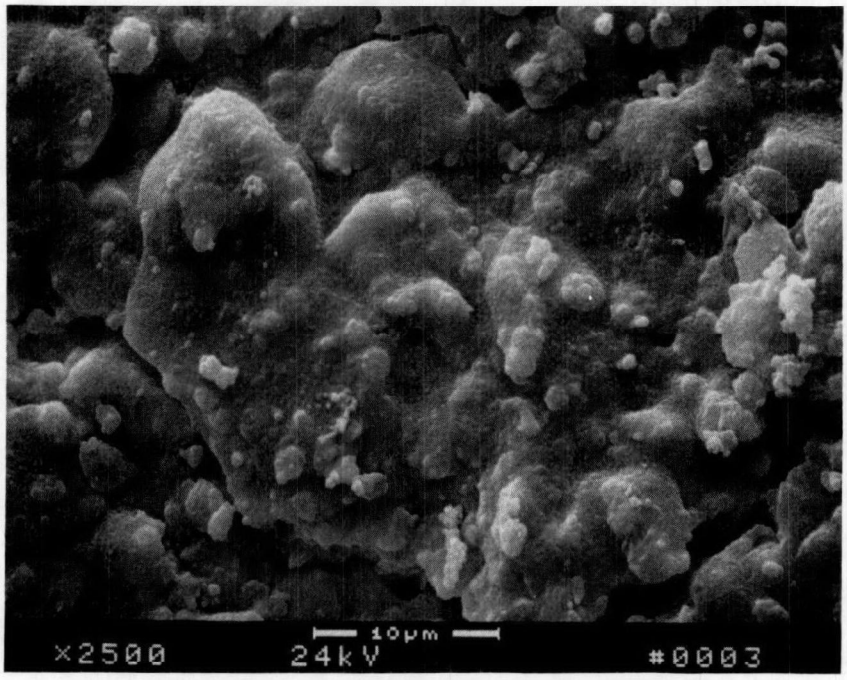

Figure D-48. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A279/0002L-Rear Face

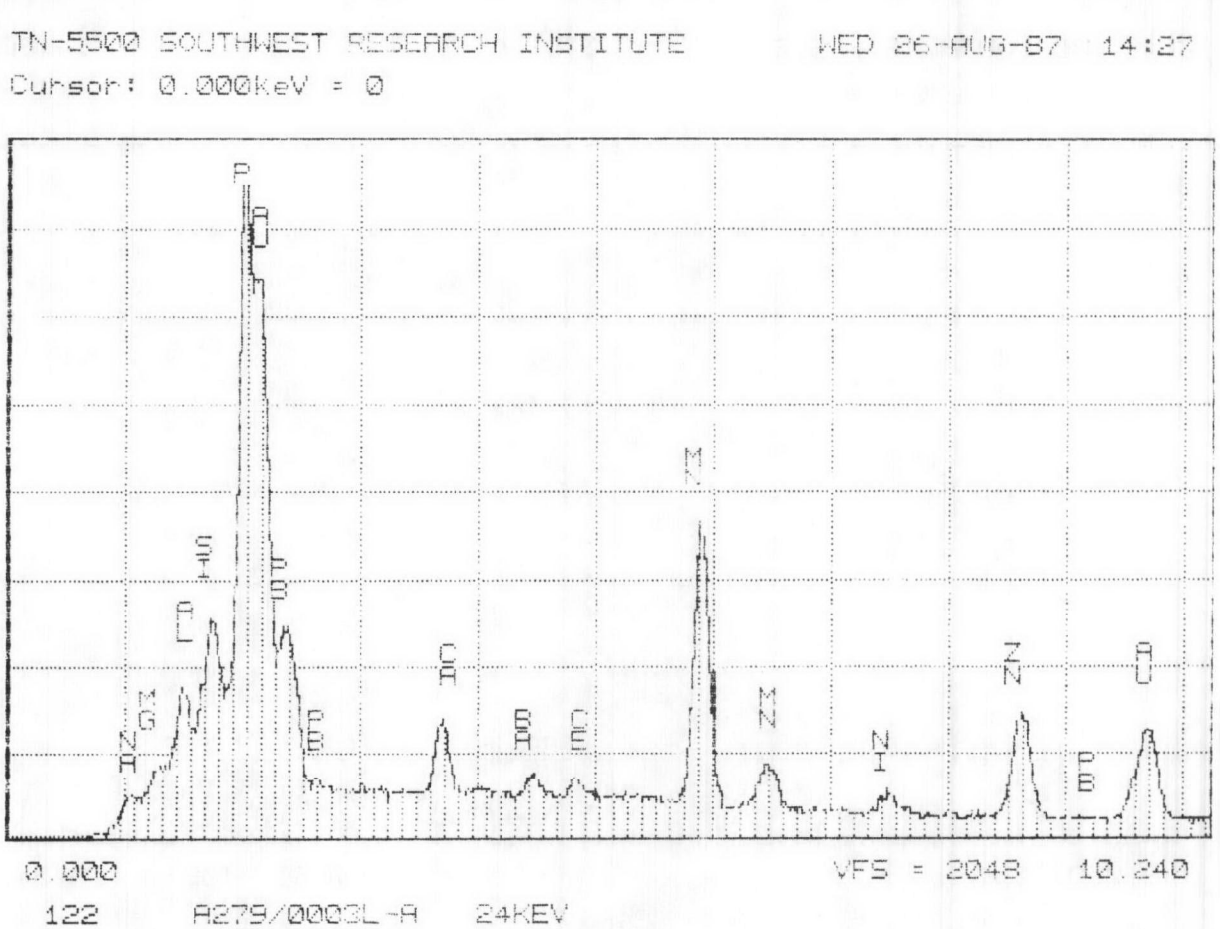

Figure D-49. SEM/EDX Spectrum of Converter A279/0003L

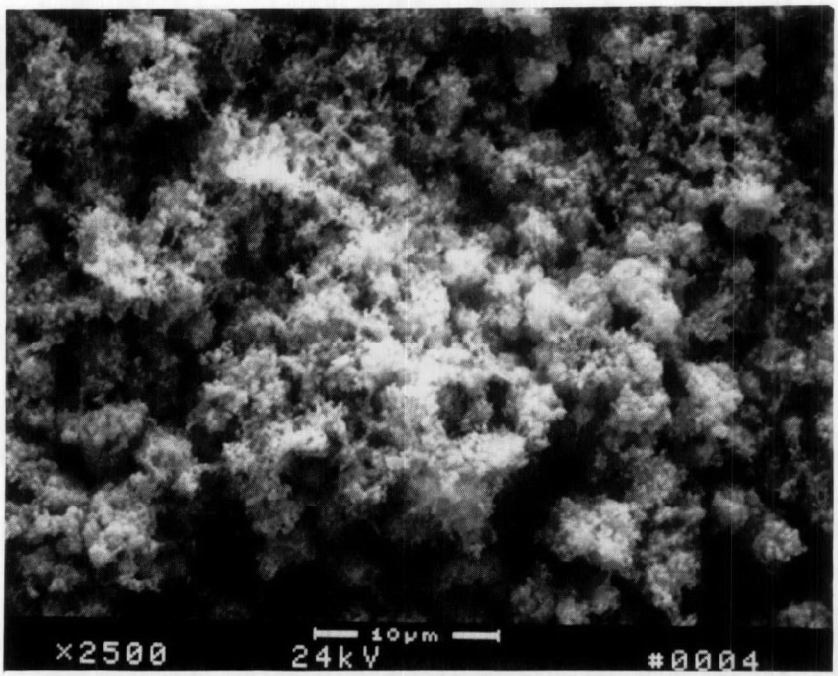

Figure D-50. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A279/0003L

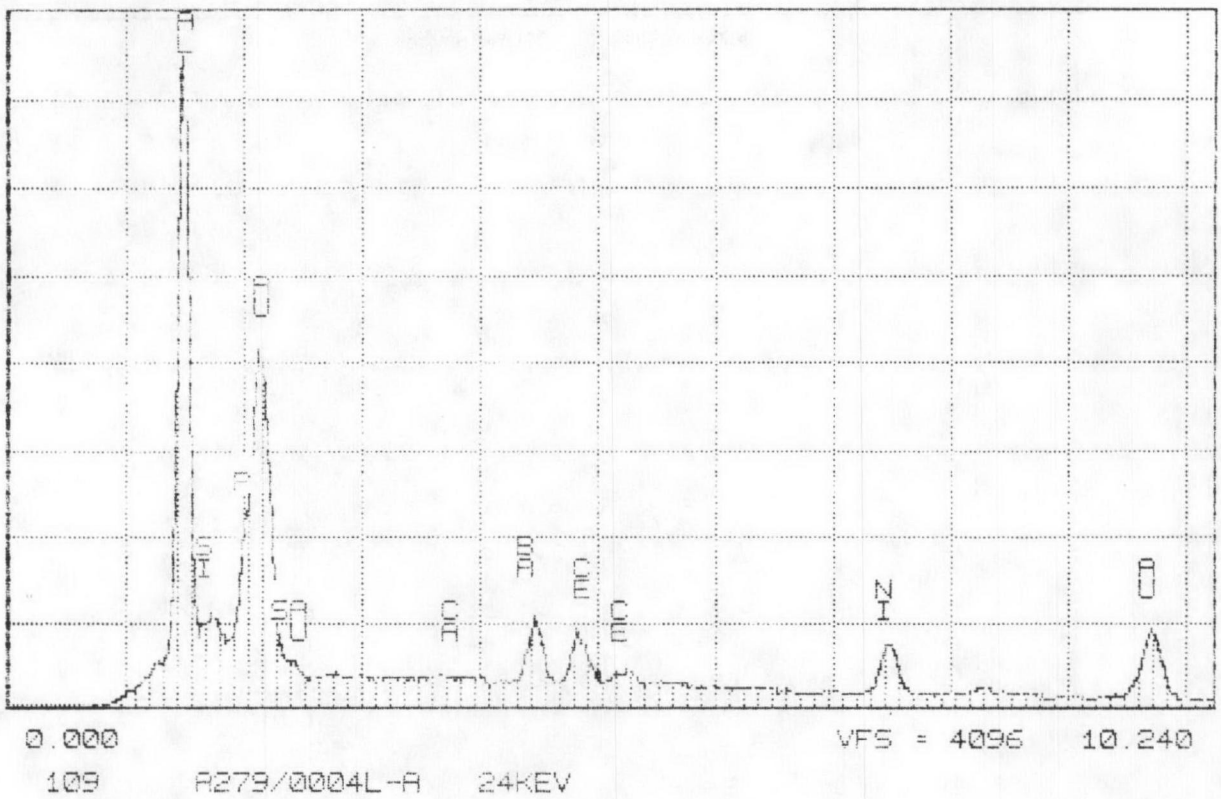

Figure D-51. SEM/EDX Spectrum of Converter A279/0004L

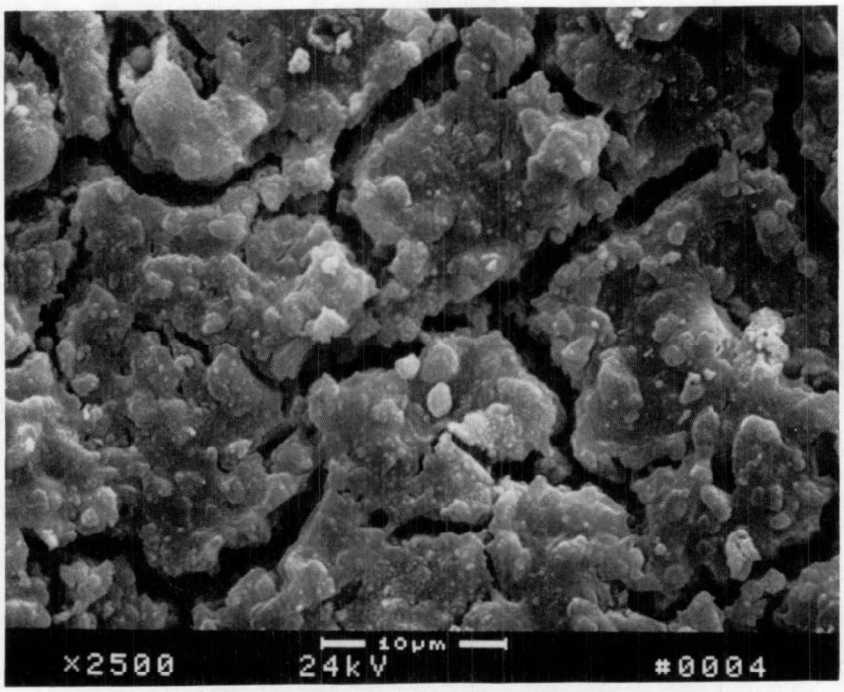

Figure D-52. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A279/0004L

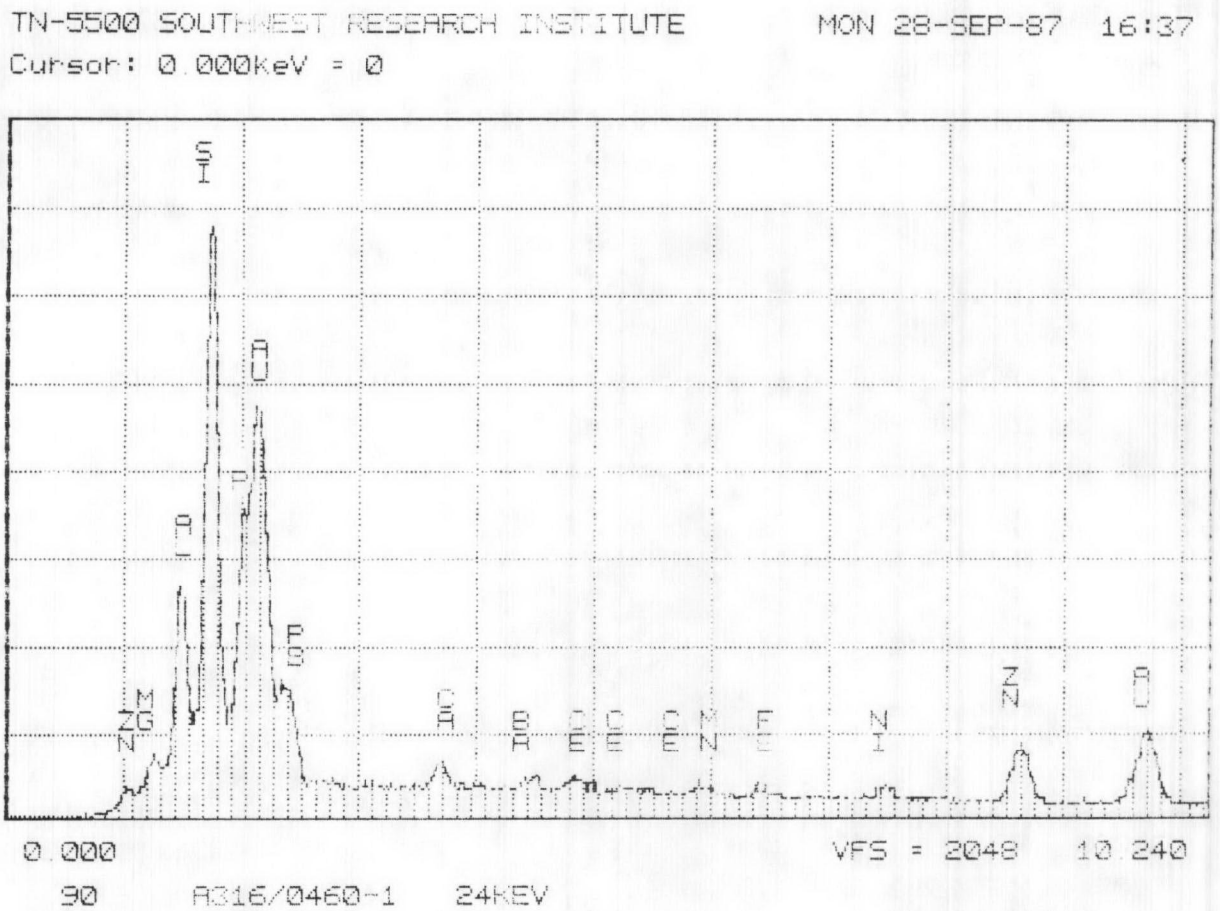

Figure D-53. SEM/EDX Spectrum of Converter A316/0460-1

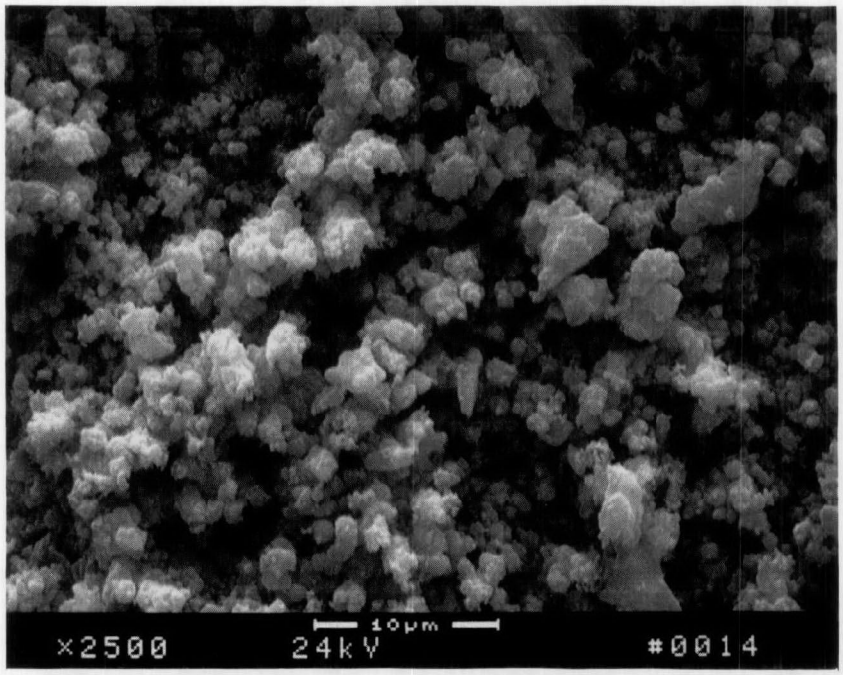

Figure D-54. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A316/0460-1

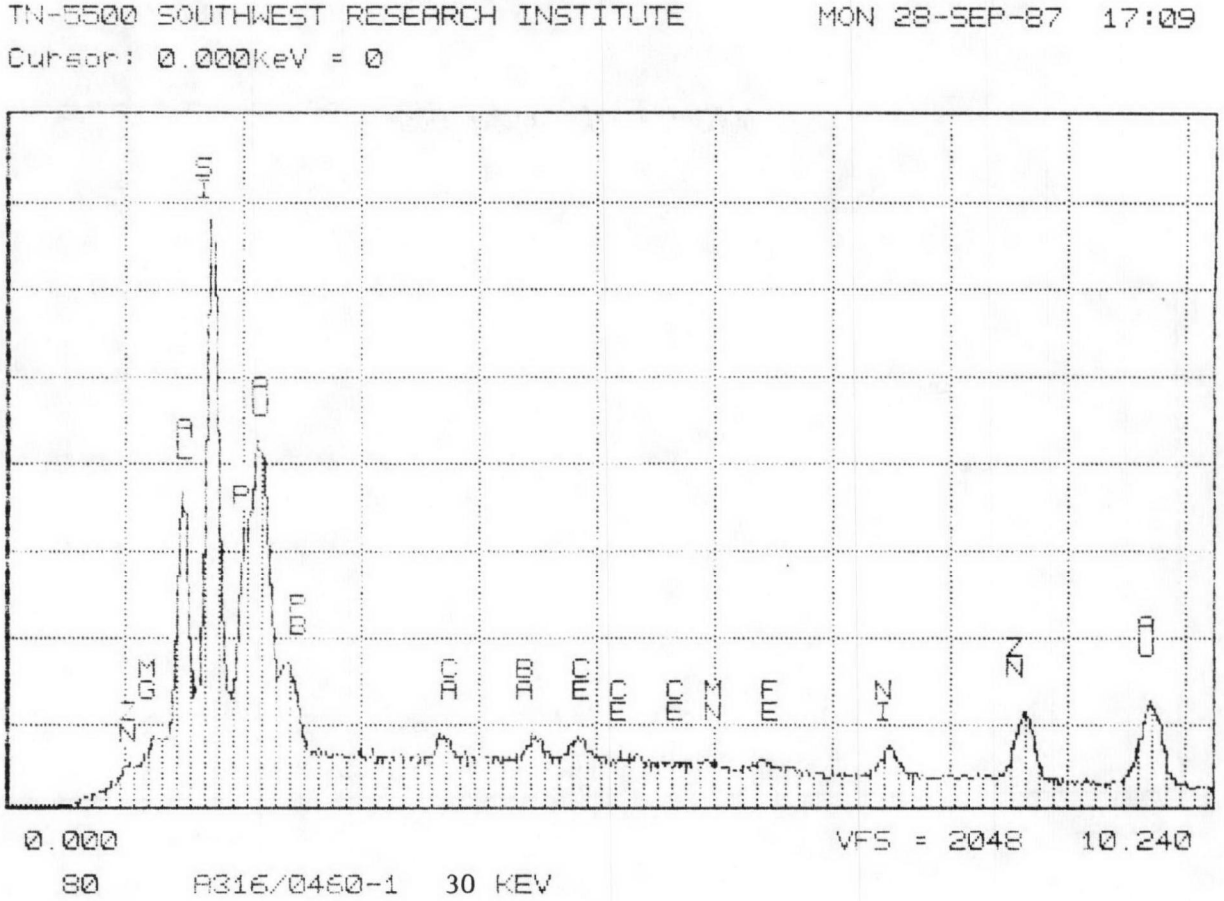

Figure D-55. SEM/EDX Spectrum of Converter A316/0460-1

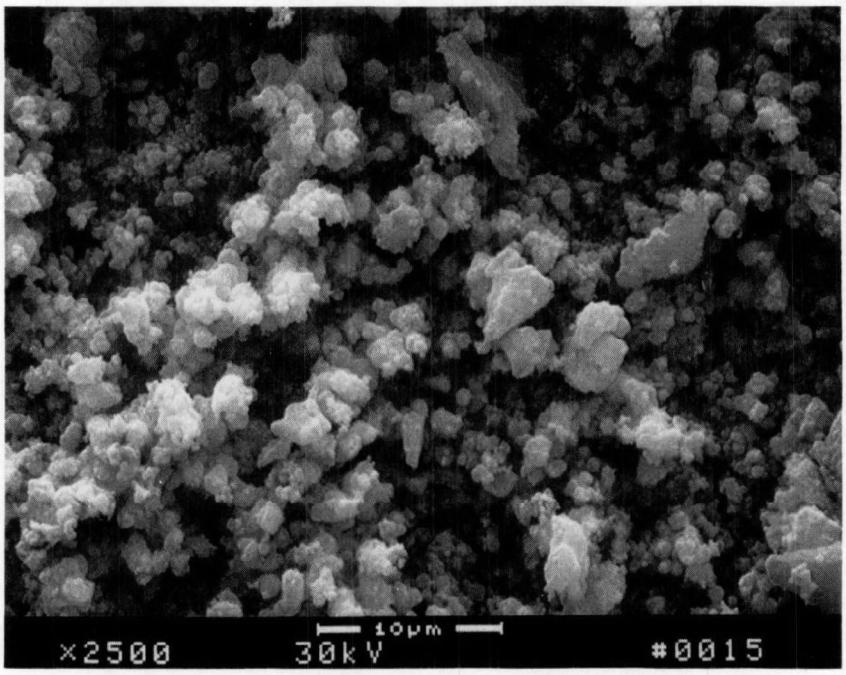

Figure D-56. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A316/0460-1

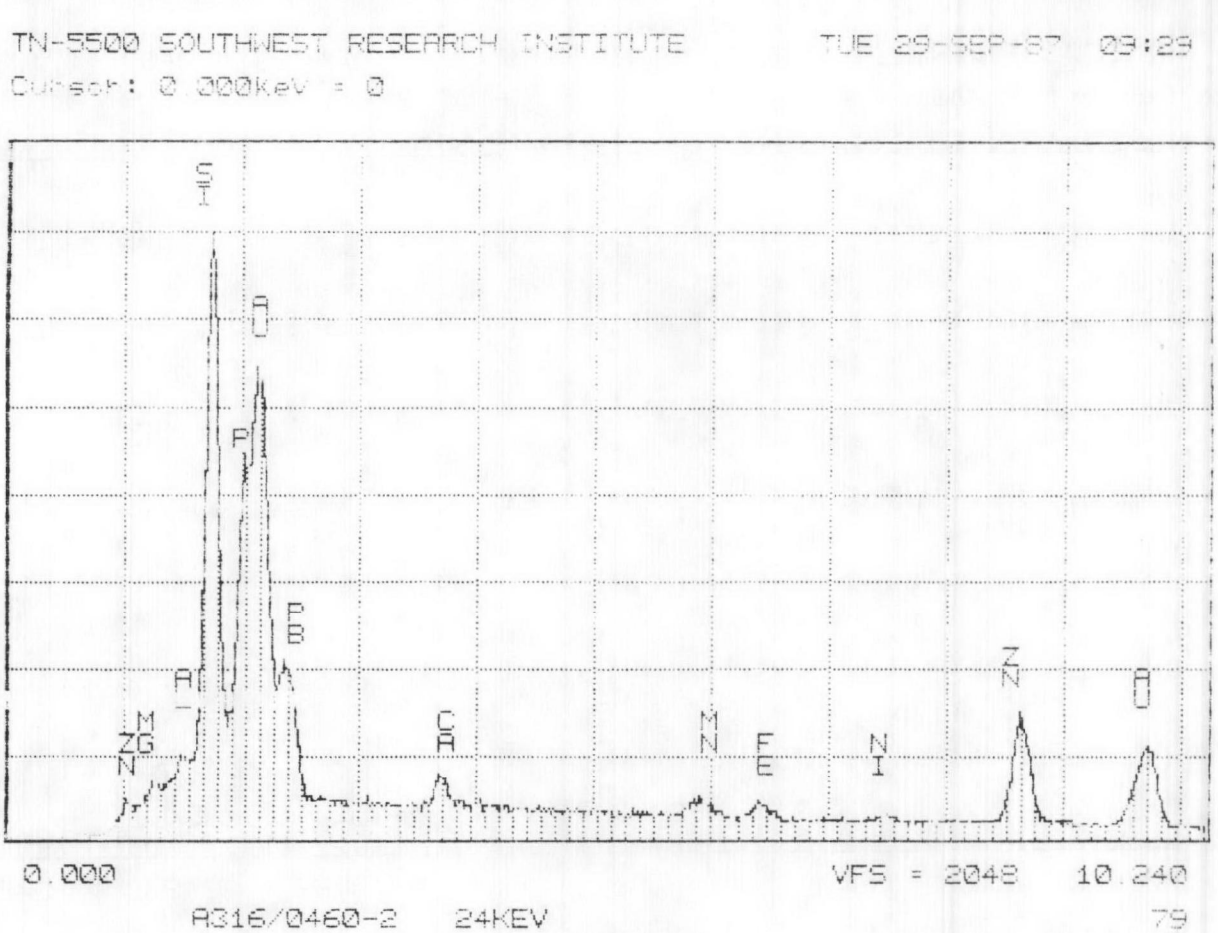

Figure D-57. SEM/EDX Spectrum of Converter A316/0360-2

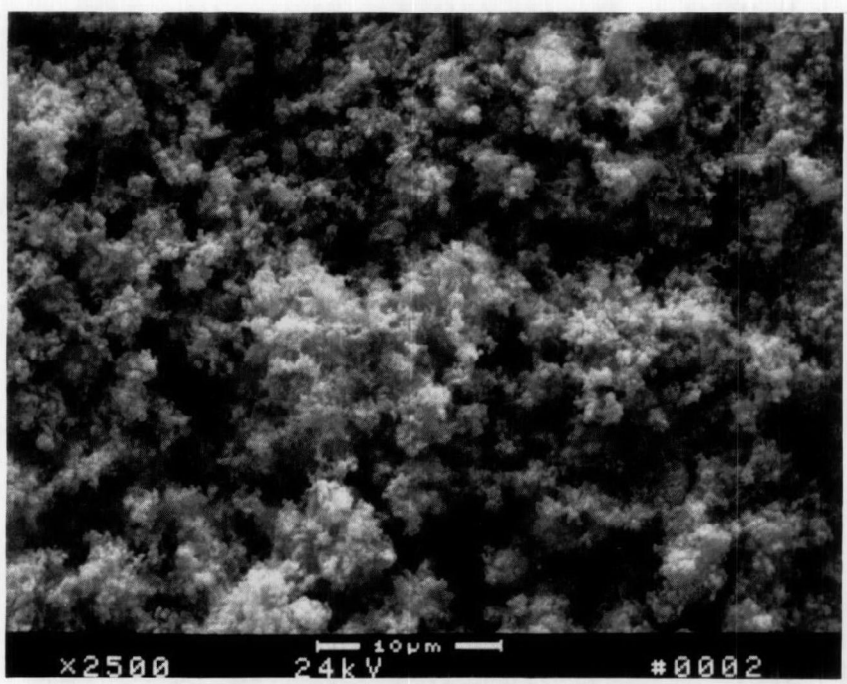

Figure D-58. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A316/0460-2

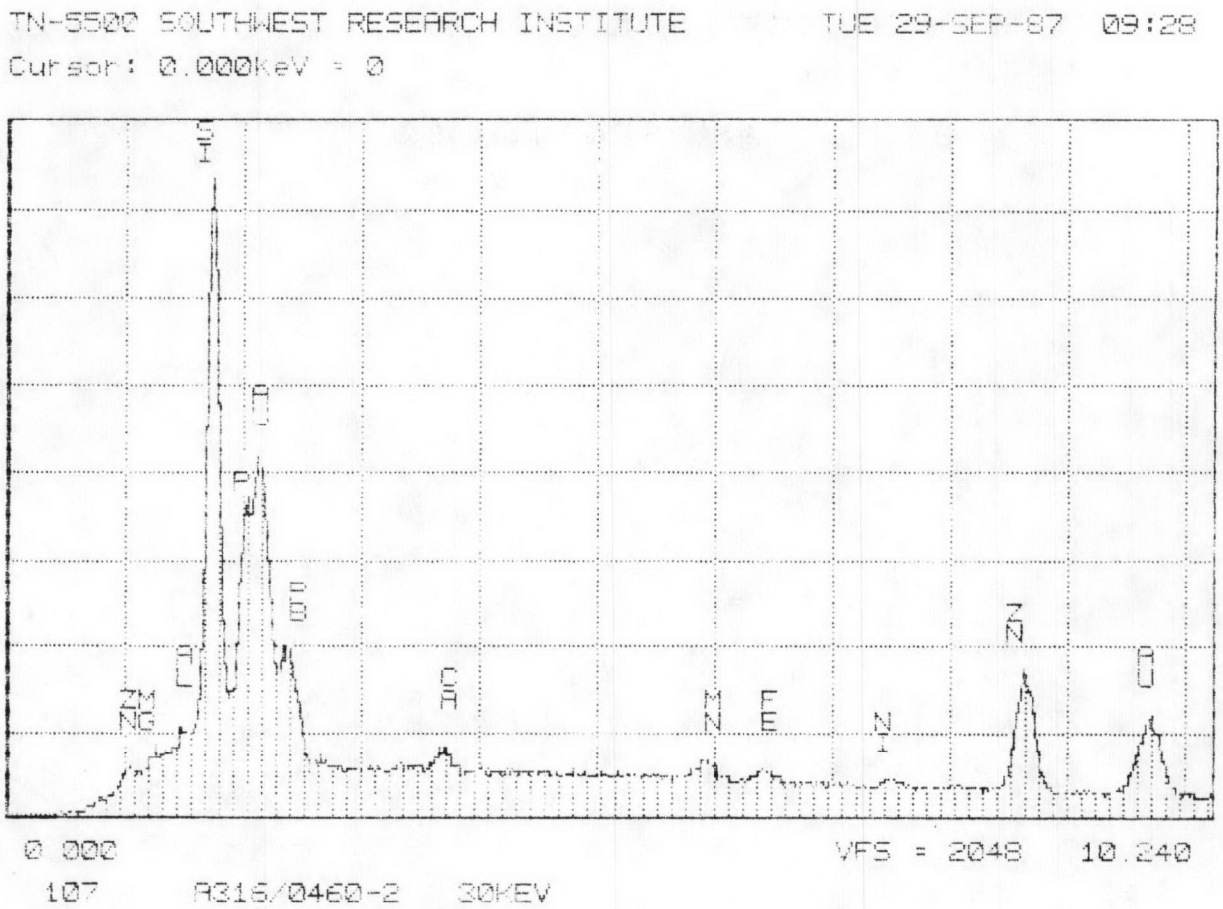

Figure D-59. SEM/EDX Spectrum of Converter A316/0460-2

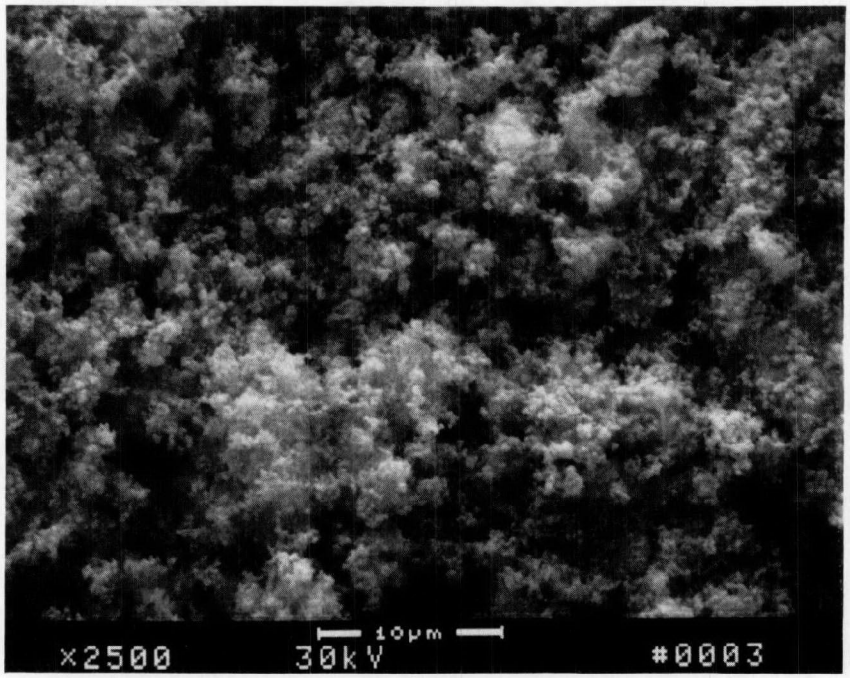

Figure D-60. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A316/0460-2

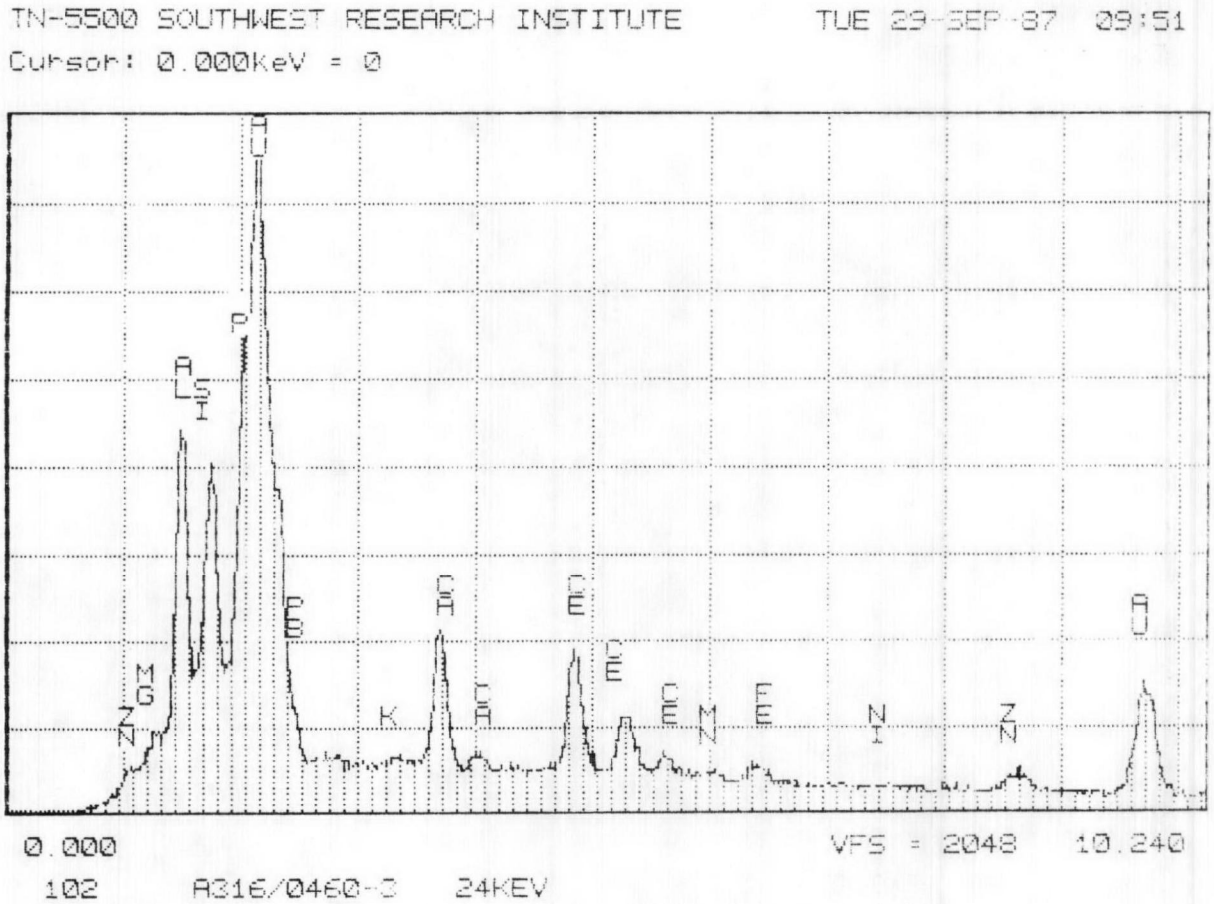

Figure D-61. SEM/EDX Spectrum of Converter A316/0460-3

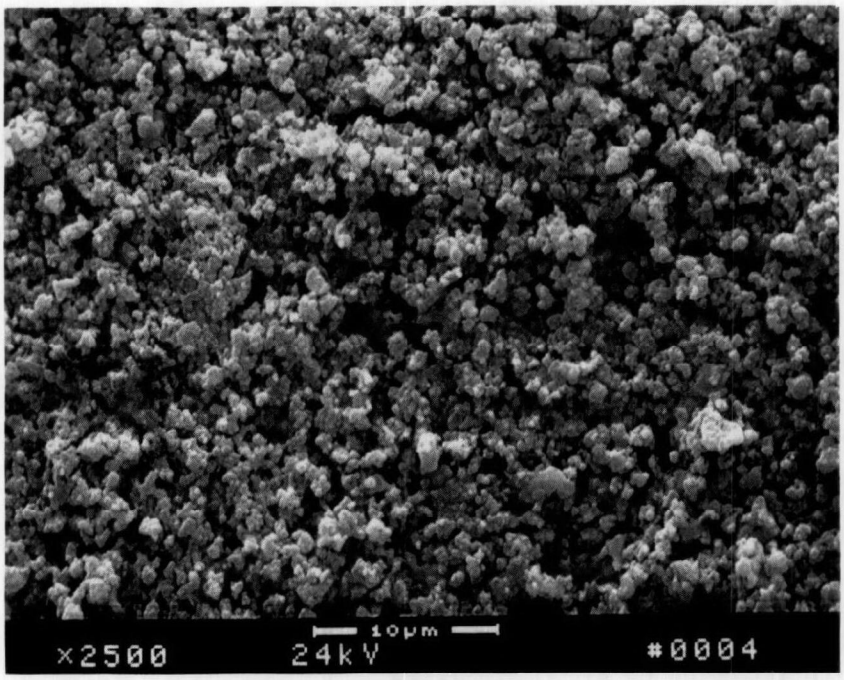

Figure D-62. Scanning Electron Micrograph at X2500 and 24KeV for Converter A316/0460-3

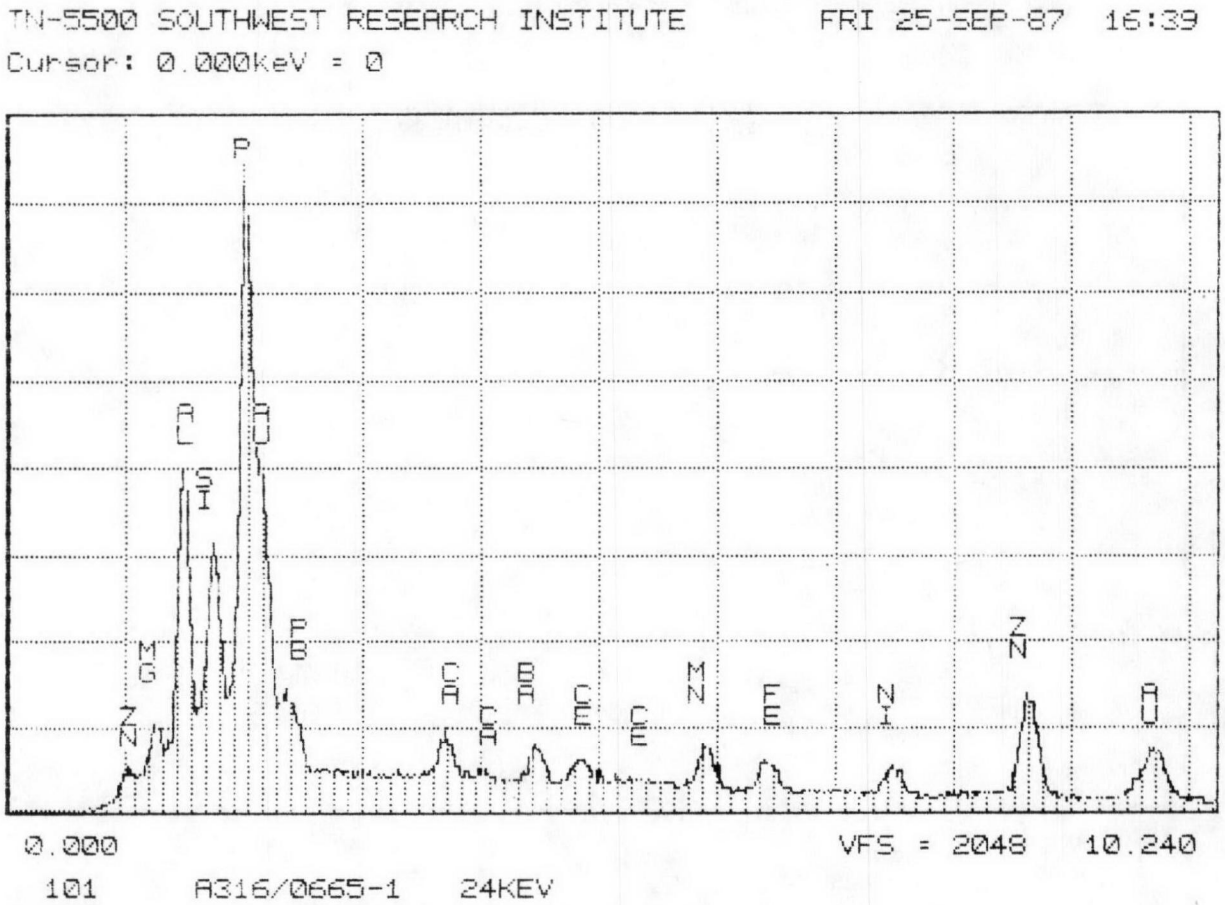

Figure D-63. SEM/EDX Spectrum of Converter A316/0665-1

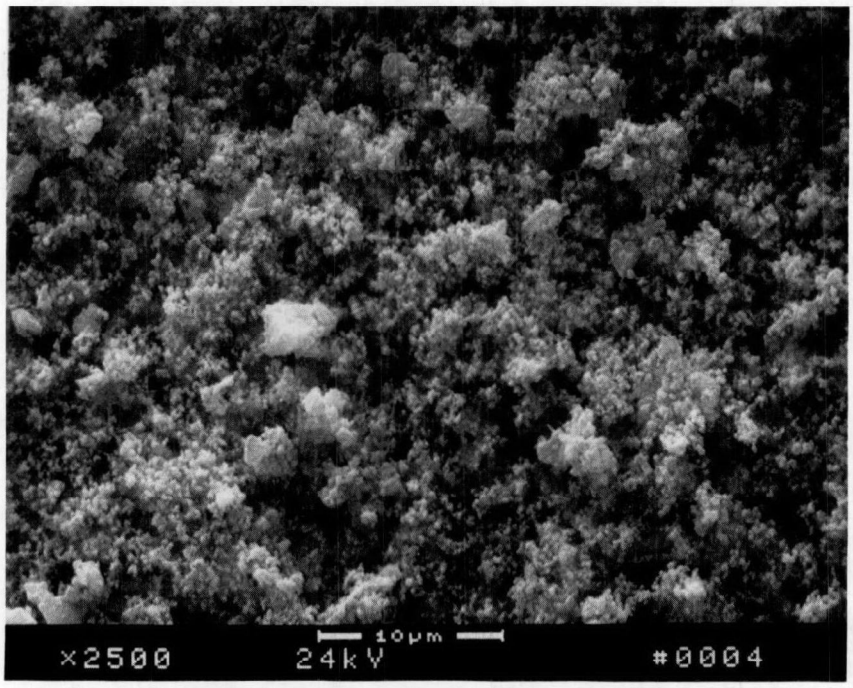

Figure D-64. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A316/0665-1

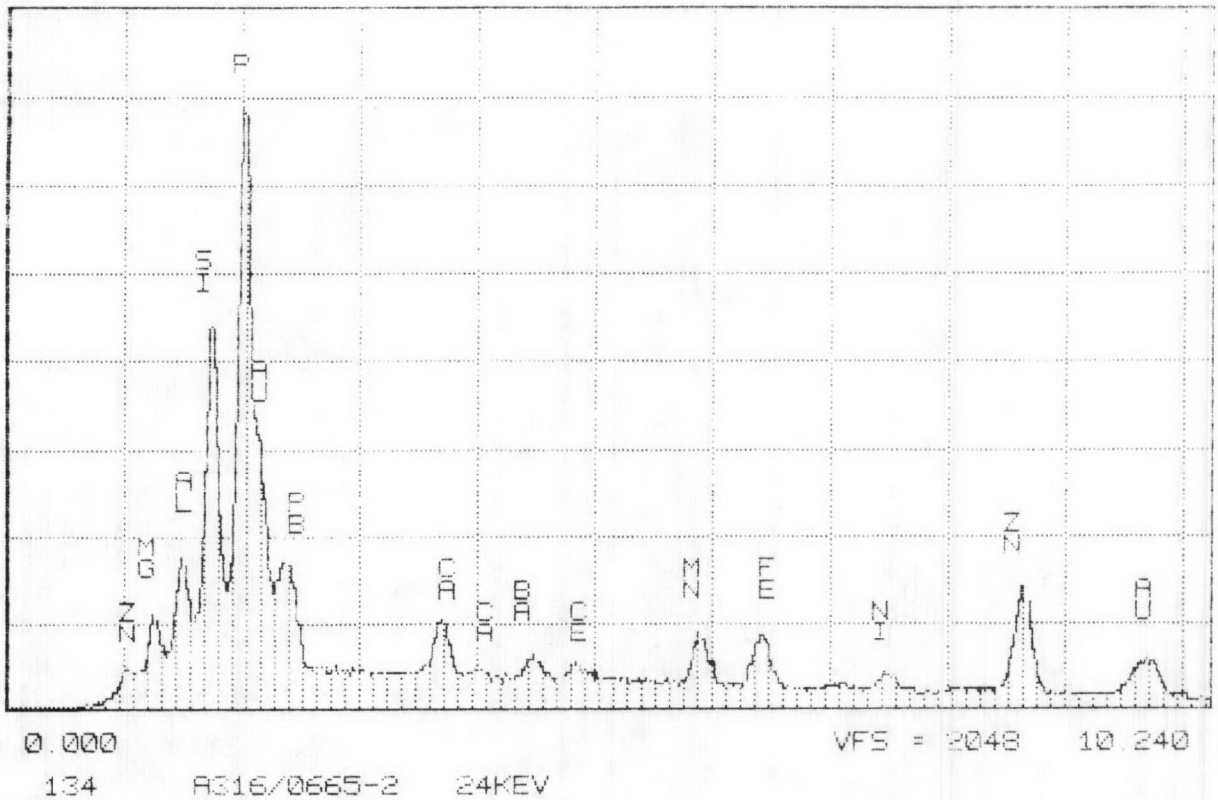

Figure D-65. SEM/EDX Spectrum of Converter A316/0665-2

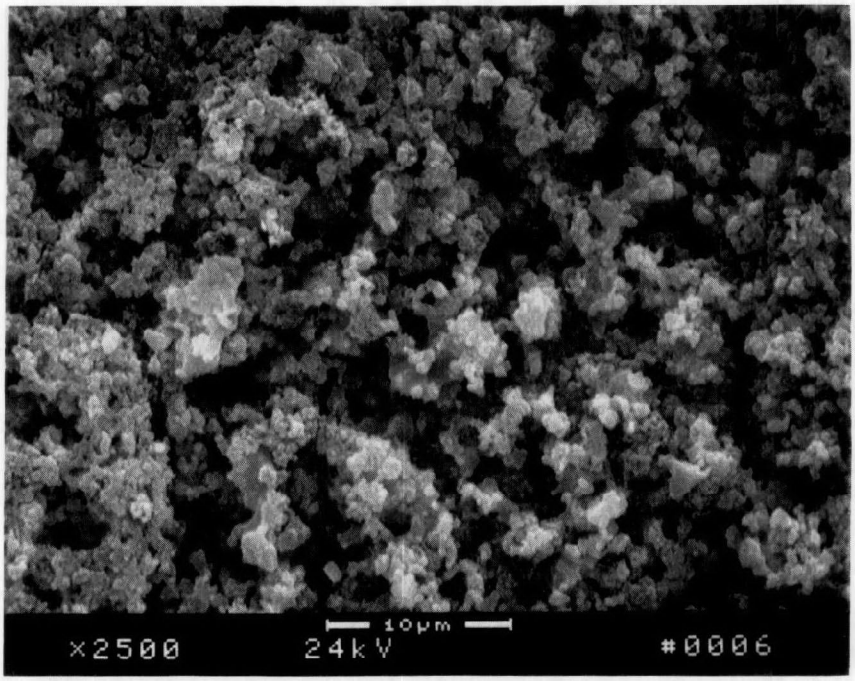

Figure D-66. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A316/0665-2

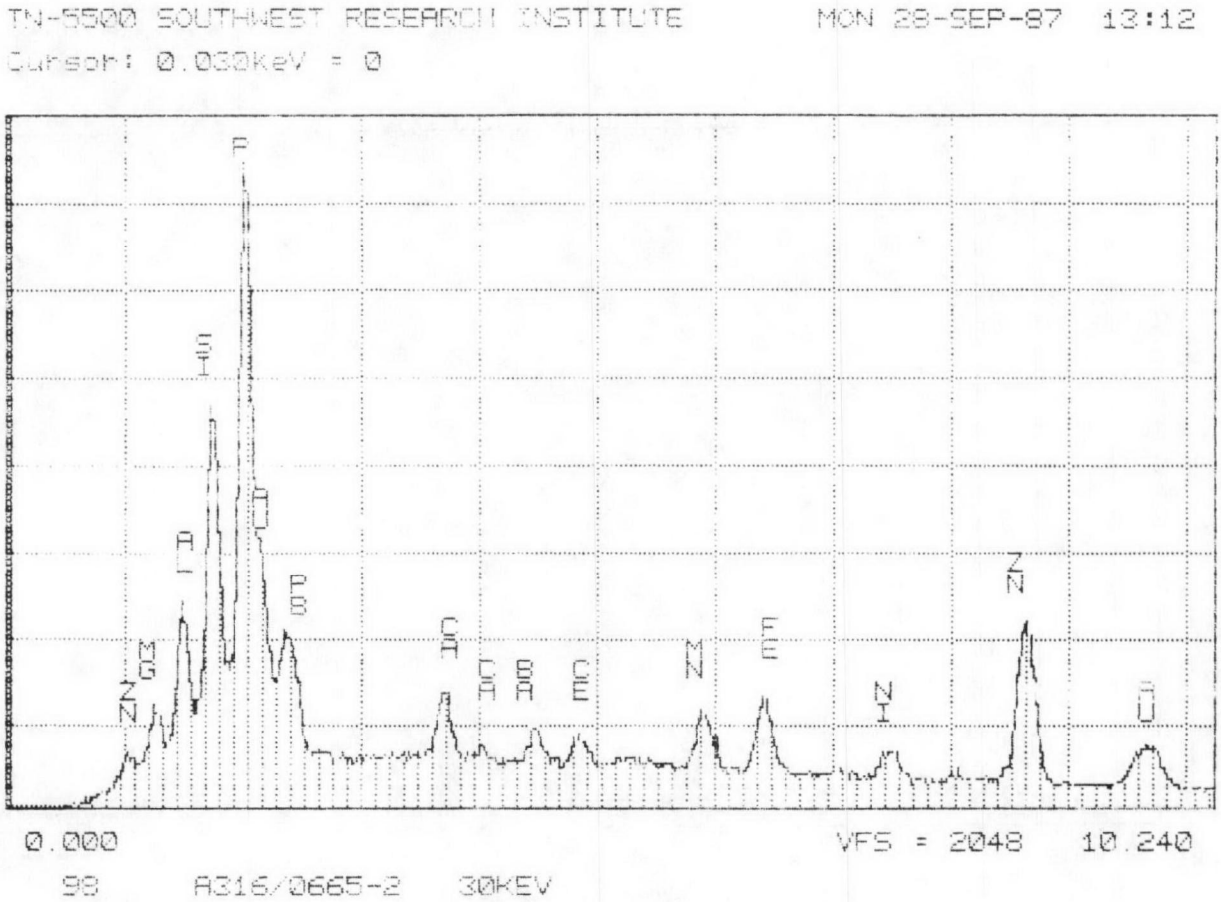

Figure D-67. SEM/EDX Spectrum of Converter A316/0665-2

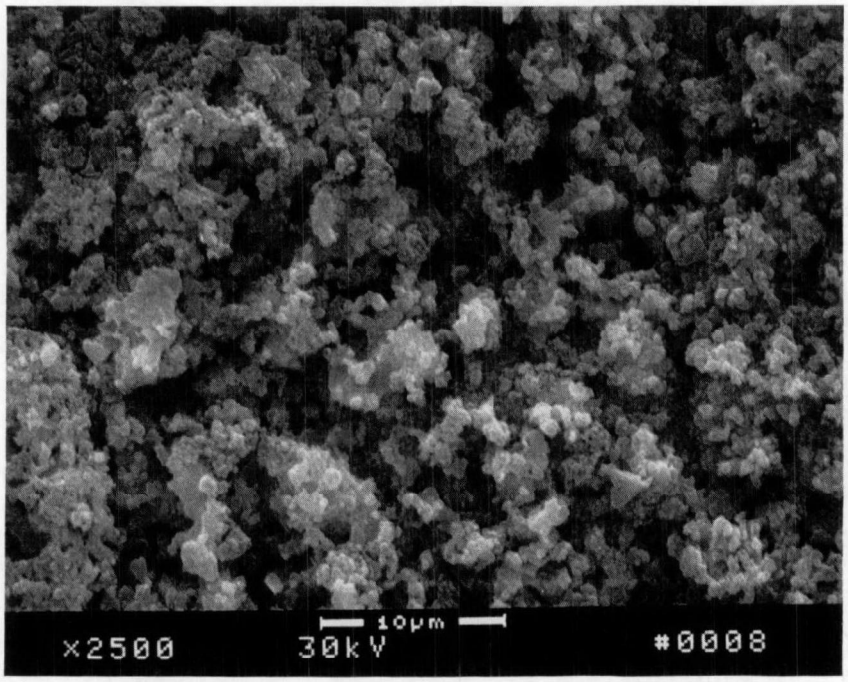

Figure D-68. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A316/0665-2

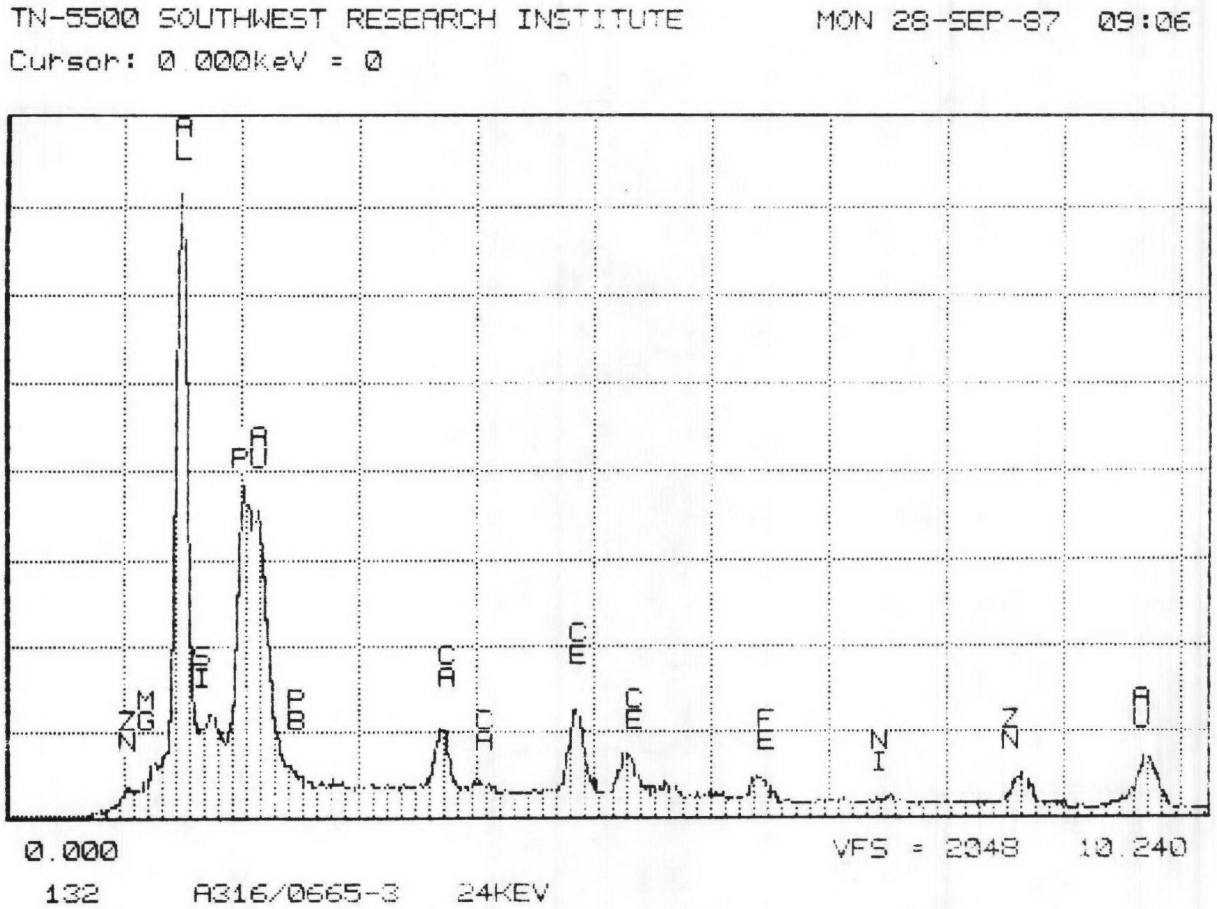

Figure D-69. SEM/EDX Spectrum of Converter A316/0665-3

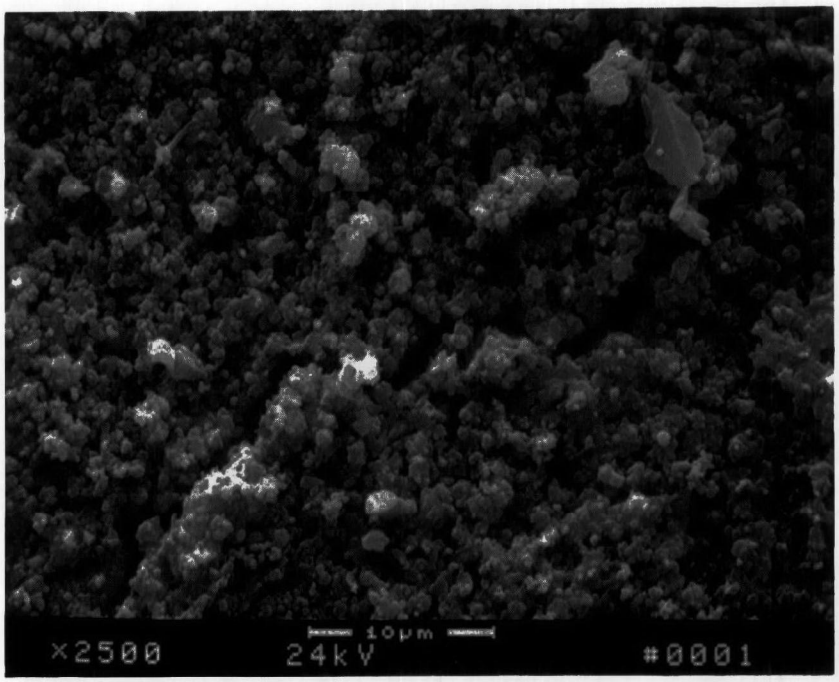

Figure D-70. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A316/0665-3

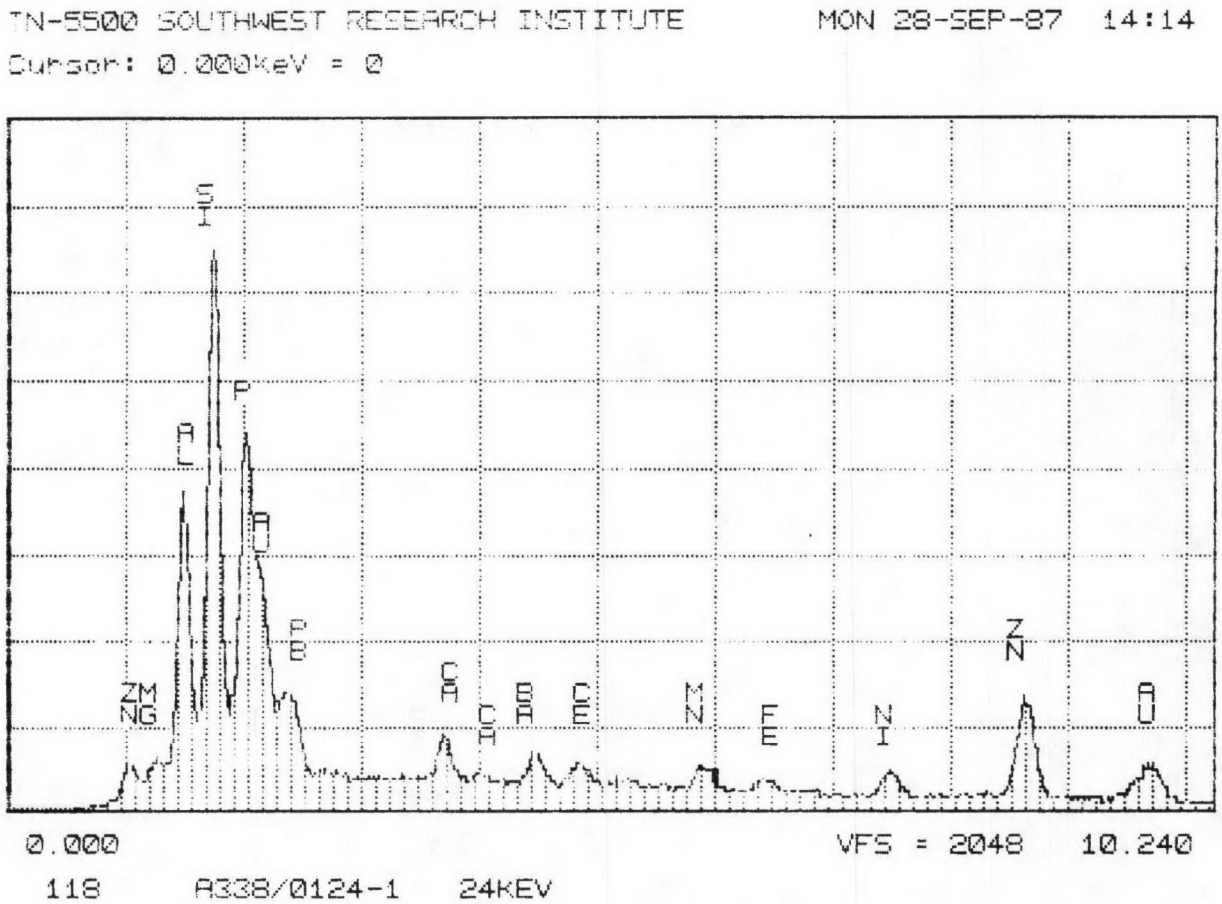

Figure D-71. SEM/EDX Spectrum of Converter A338/0124-1

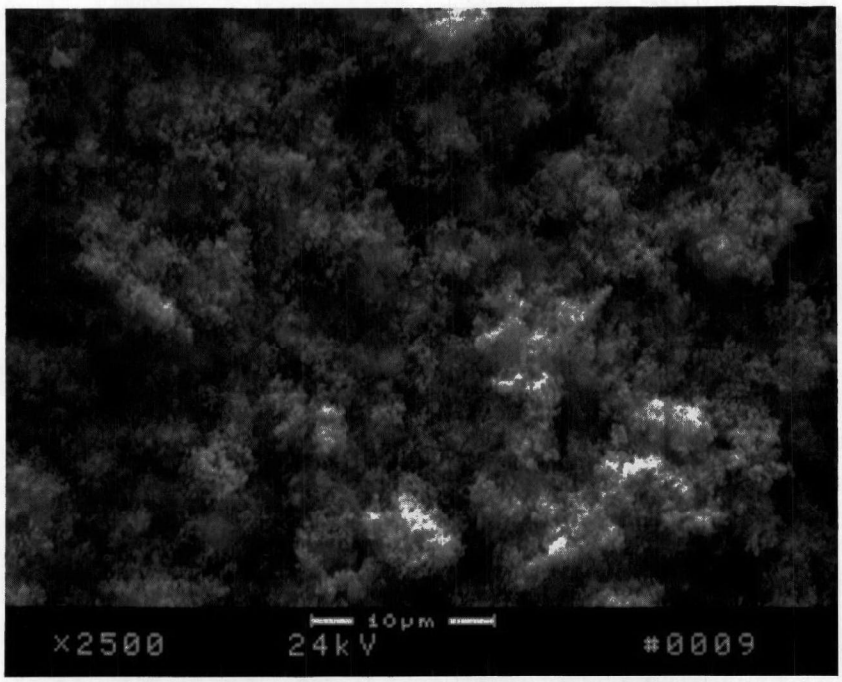

Figure D-72. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A338/0124-1

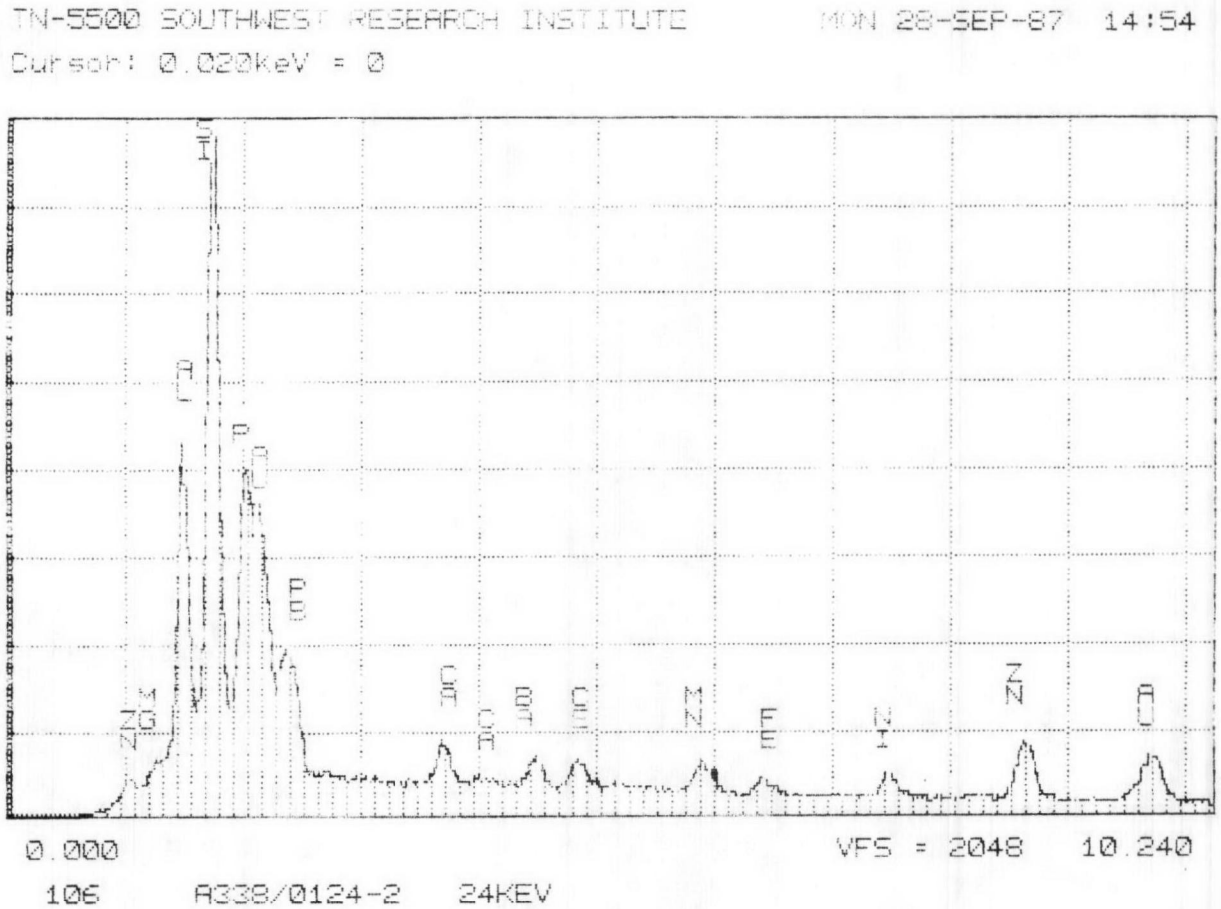

Figure D-73. SEM/EDX Spectrum of Converter A338/0124-2

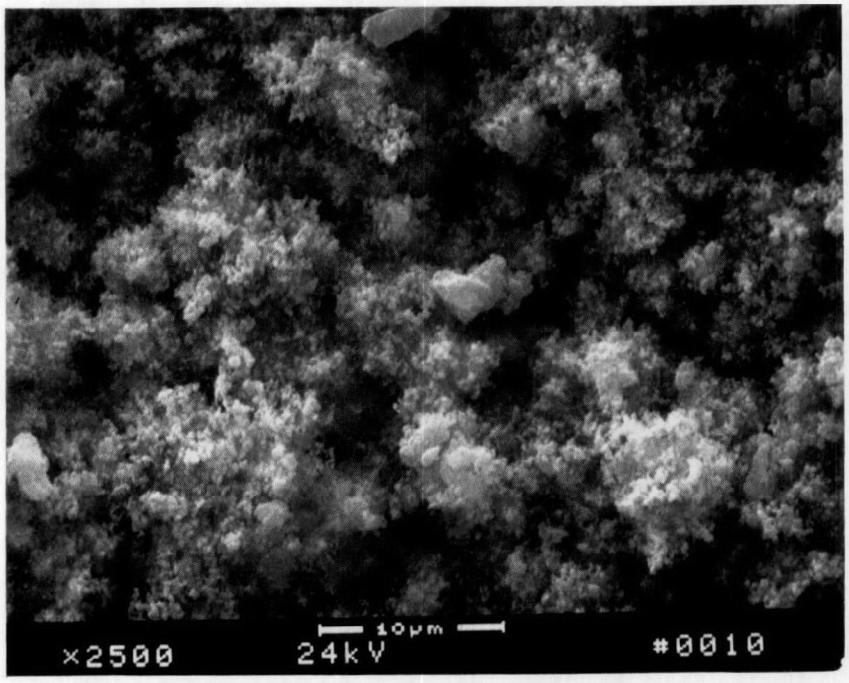

Figure D-74. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A338/0124-2

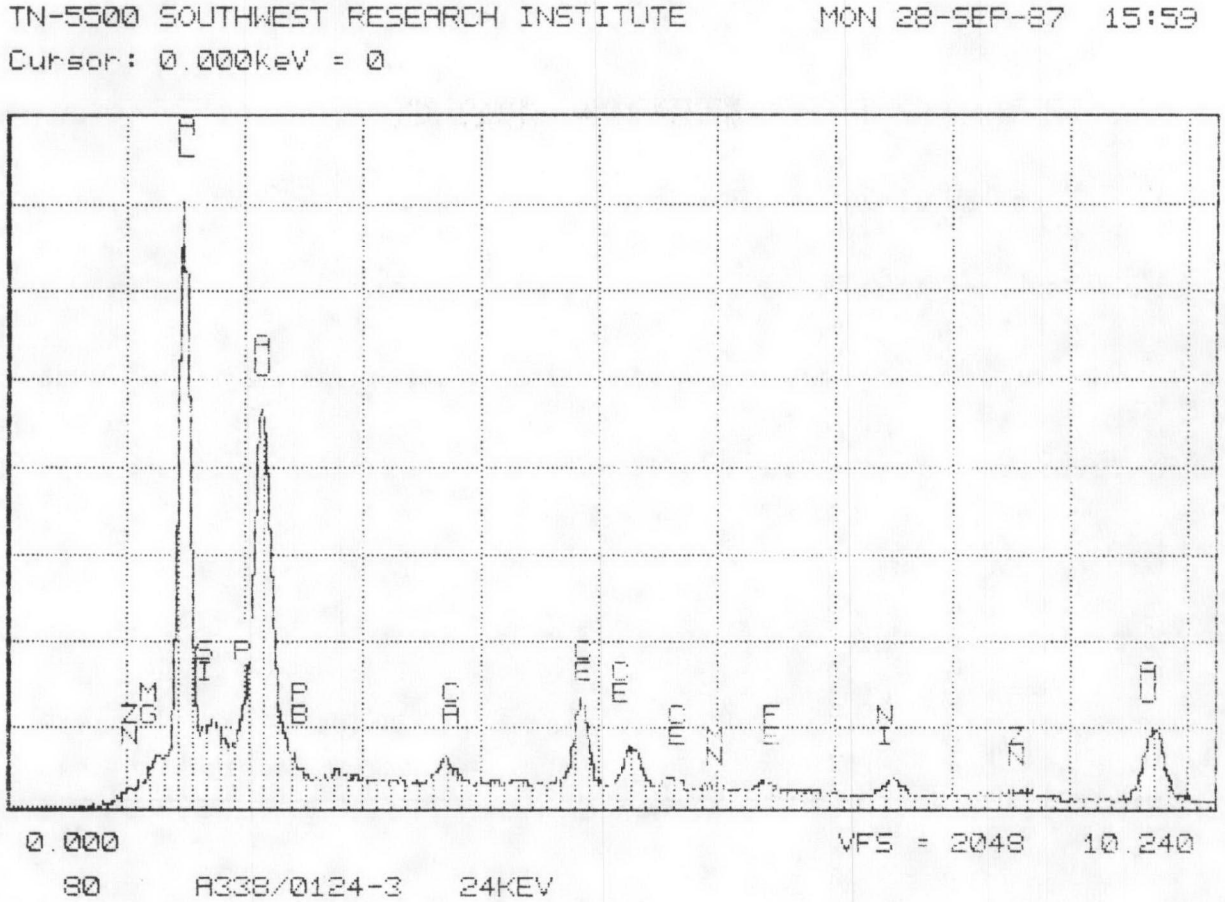

Figure D-75. SEM/EDX Spectrum of Converter A338/0124-3

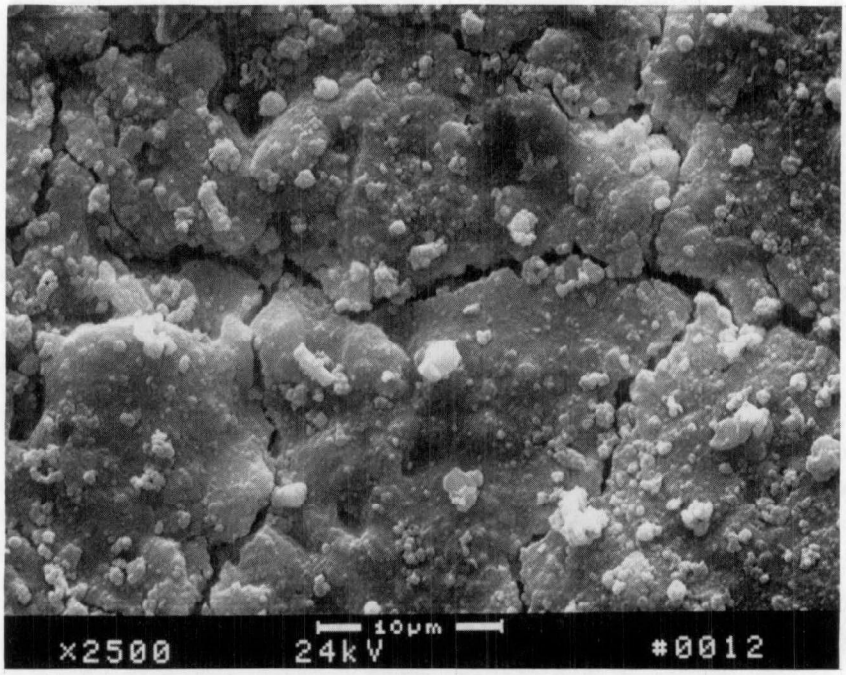

Figure D-76. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A338/0124-3

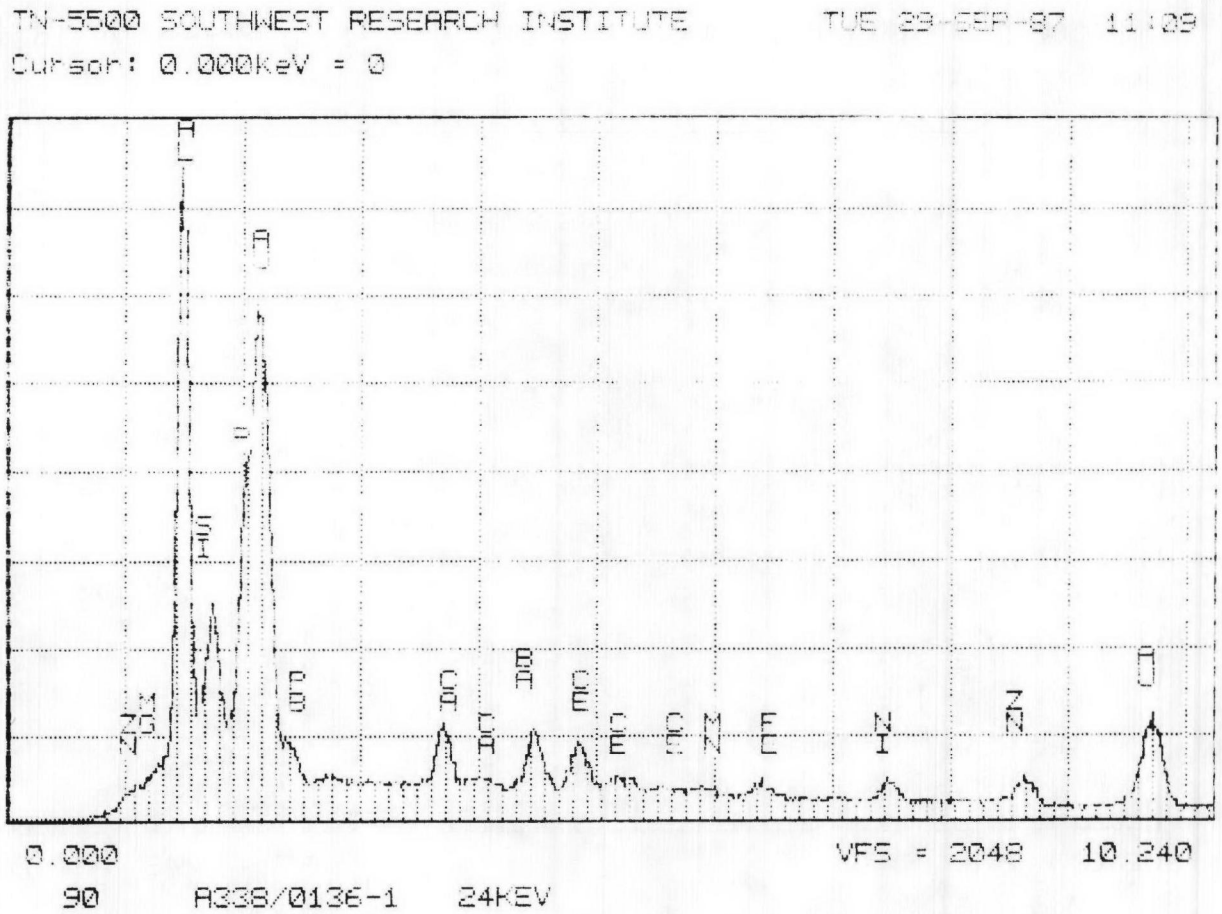

Figure D-77. SEM/EDX Spectrum of Converter A338/0136-1

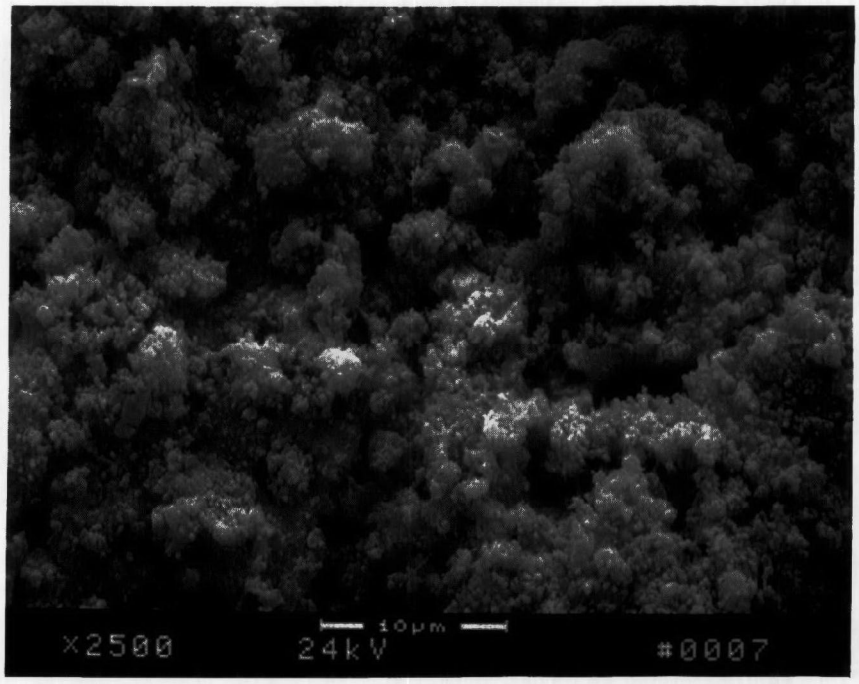

Figure D-78. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A338/0136-1

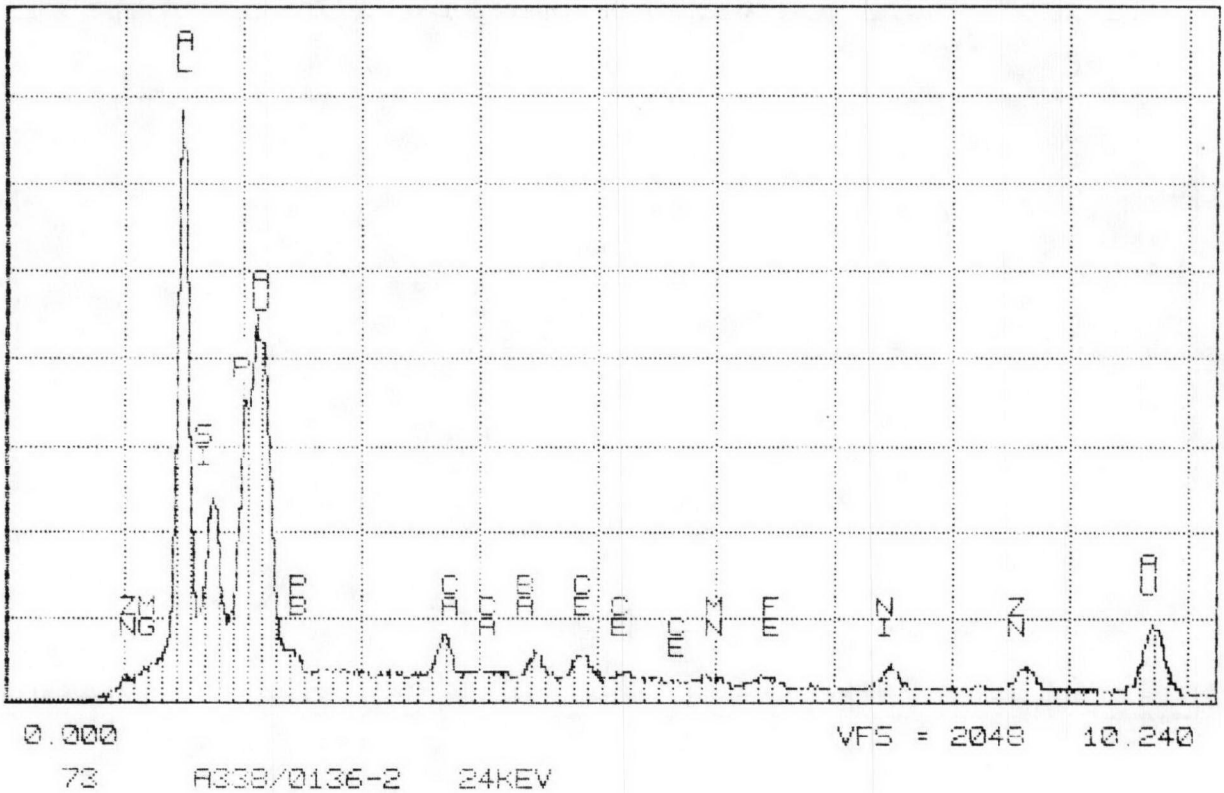

Figure D-79. SEM/EDX Spectrum of Converter A338/0136-2

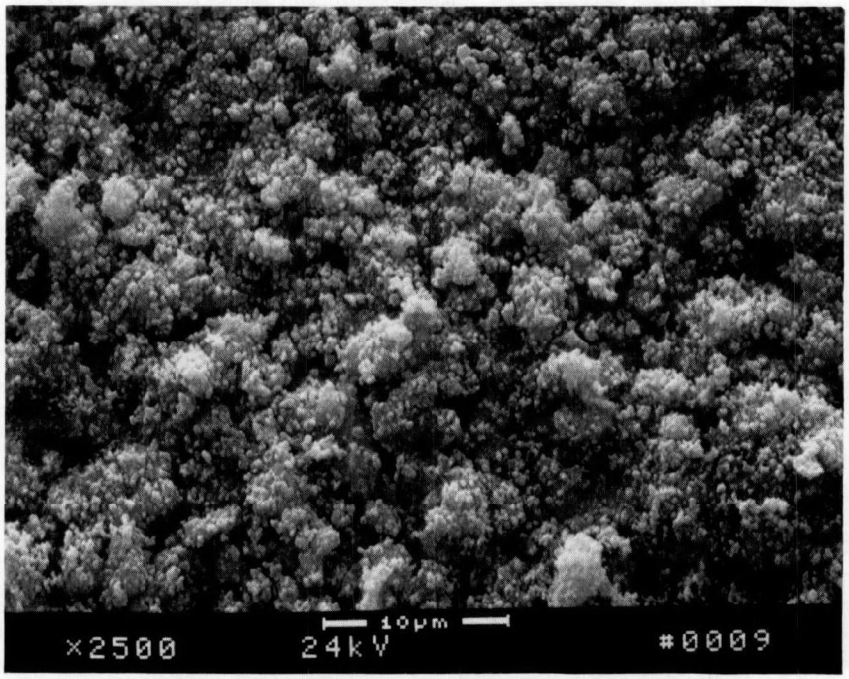

Figure D-80. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A338/0136-2

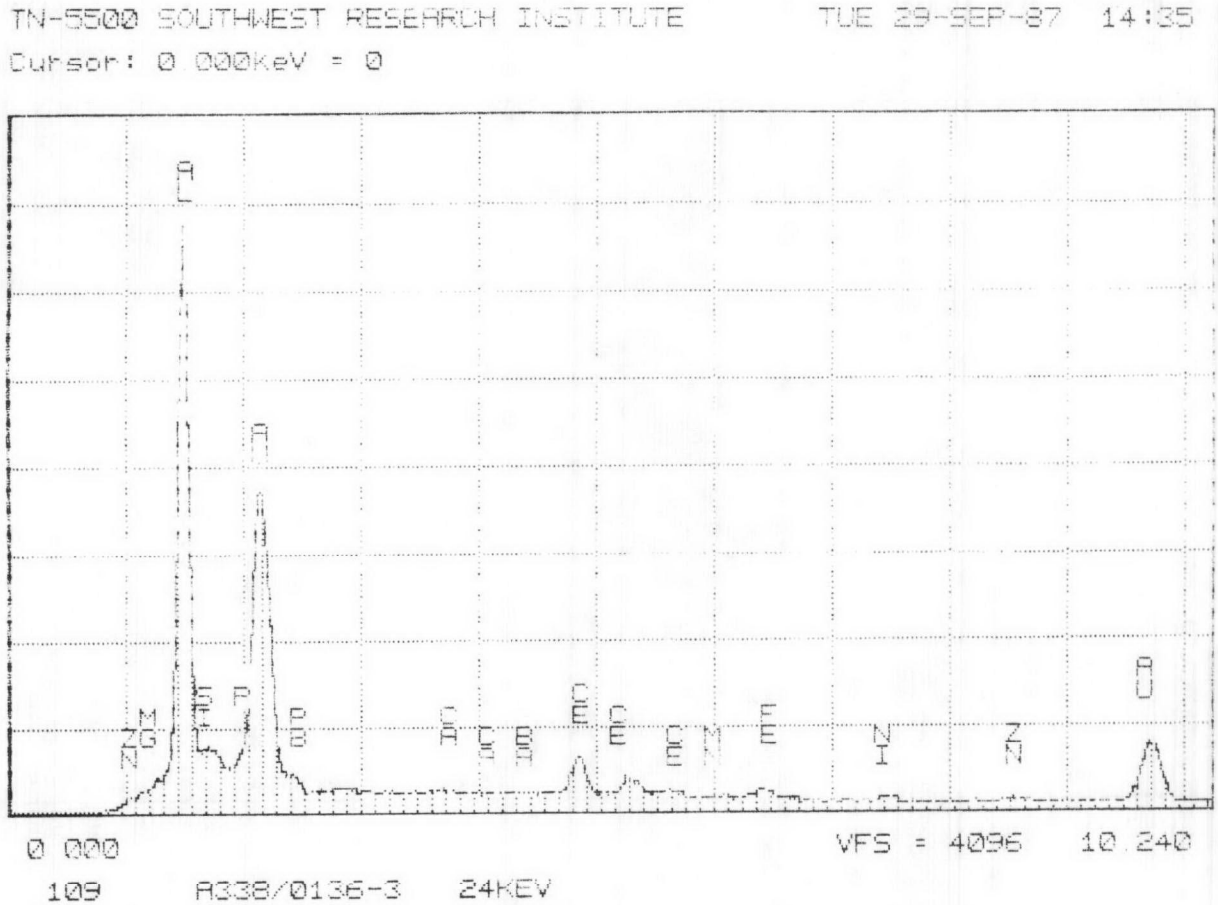

Figure D-81. SEM/EDX Spectrum of Converter A338/0136-3

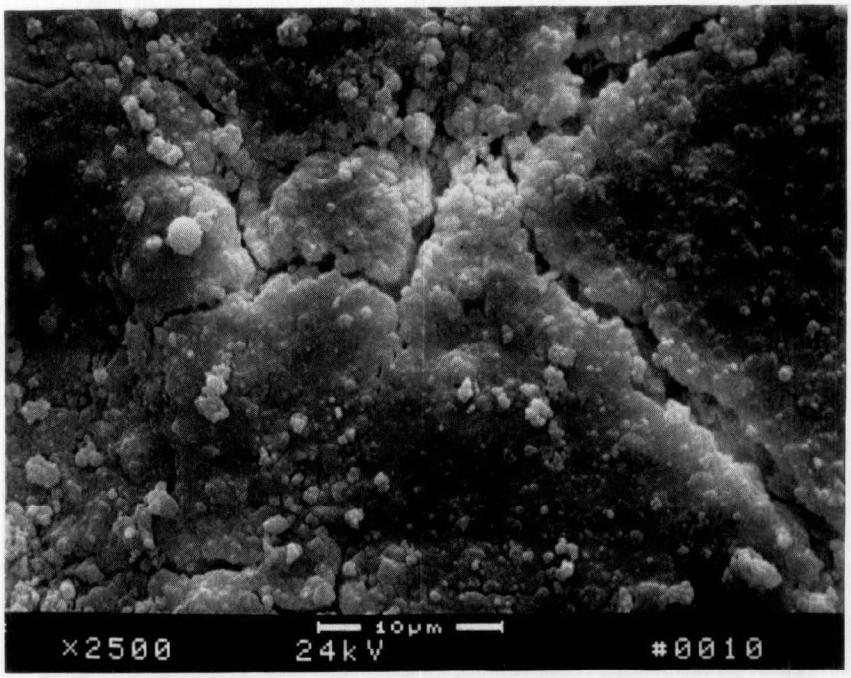

Figure D-82. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A338/0136-3

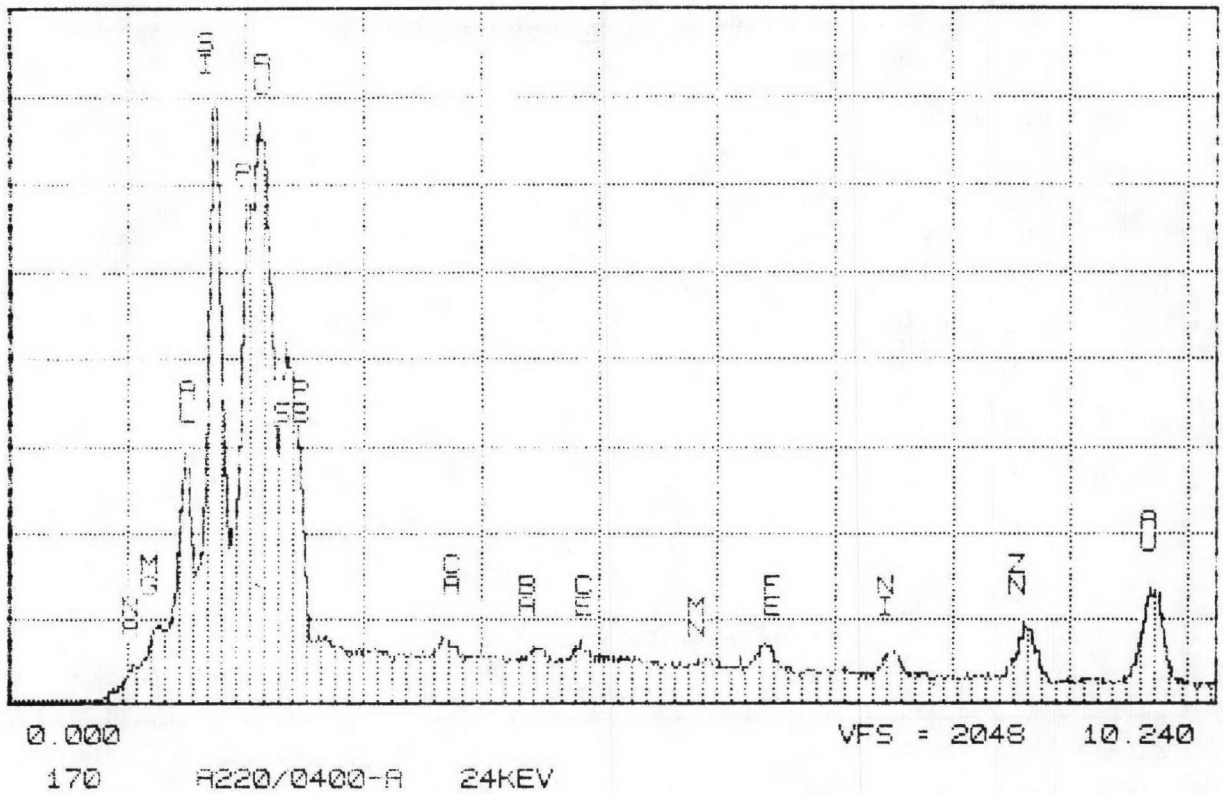

Figure D-83. SEM/EDX Spectrum of Converter A220/0400

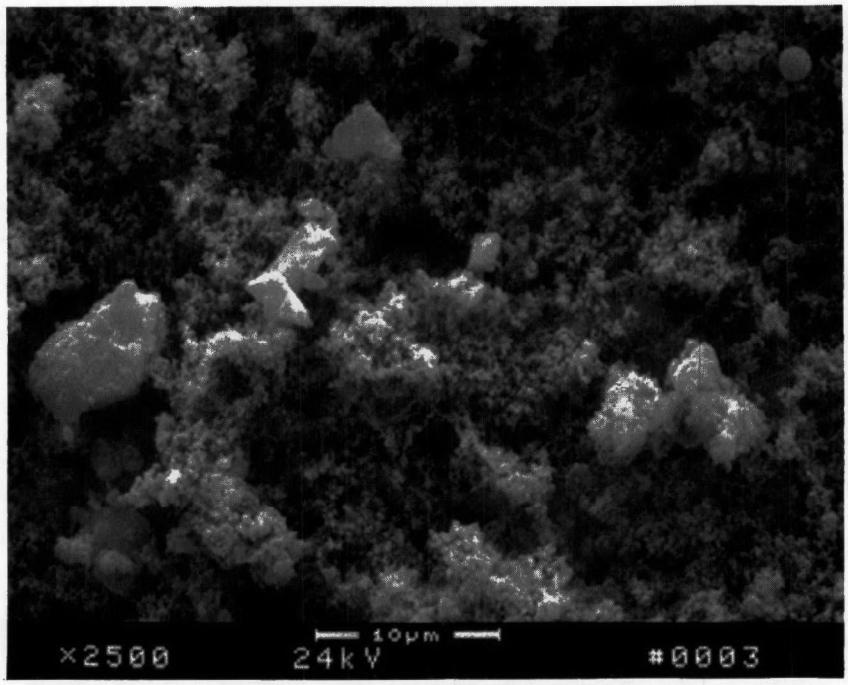

Figure D-84. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A220/0400

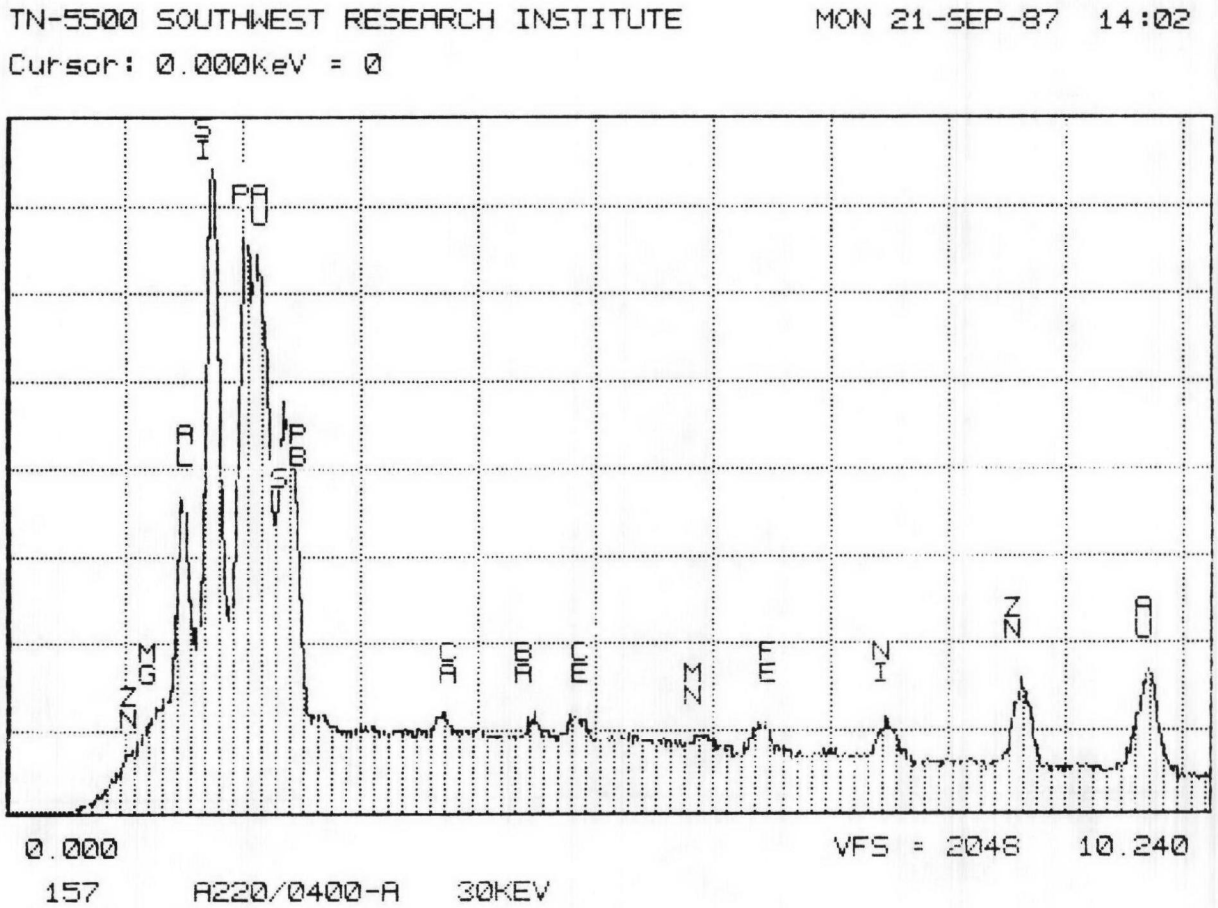

Figure D-85. SEM/EDX Spectrum of Converter A220/0400

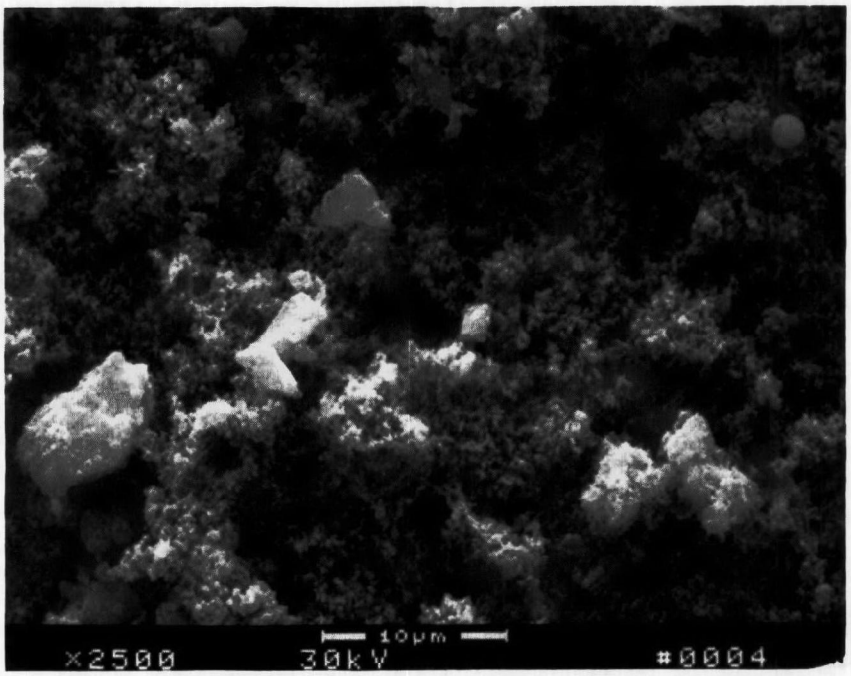

Figure D-86. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A220/0400

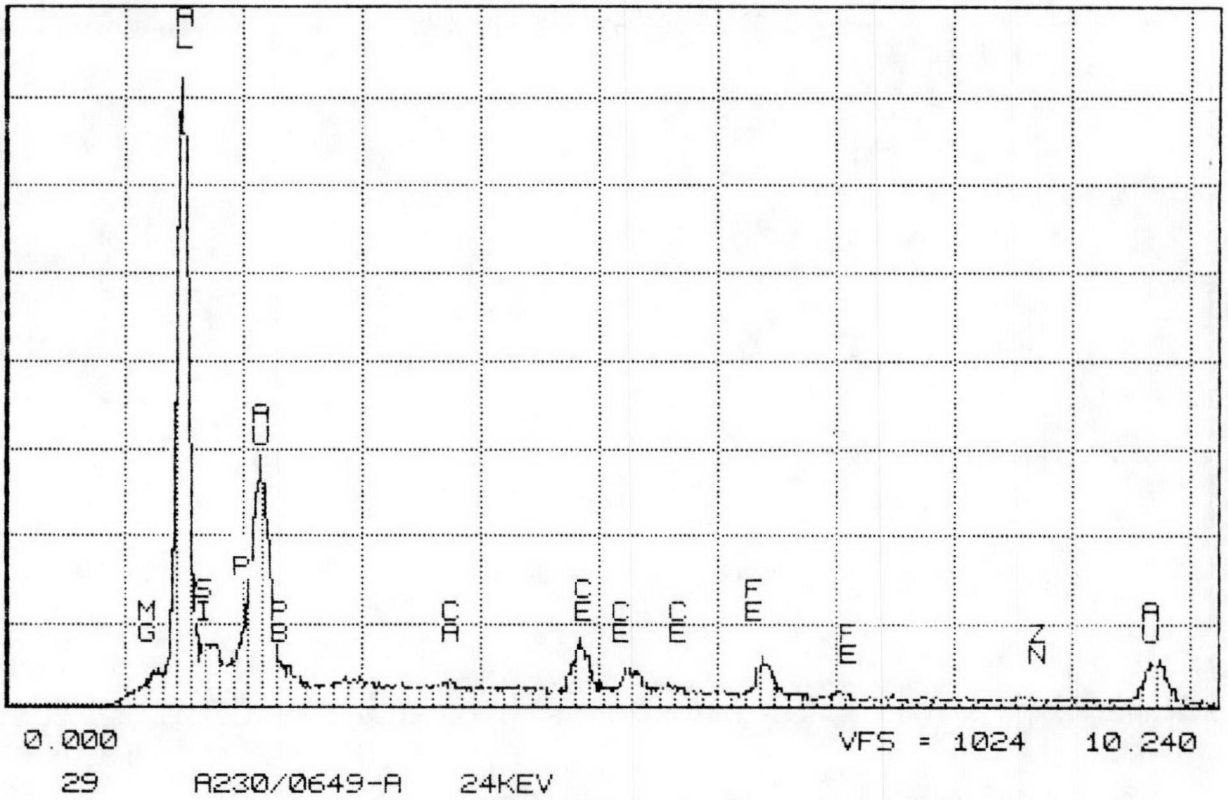

Figure D-87. SEM/EDX Spectrum of Converter A230/0649

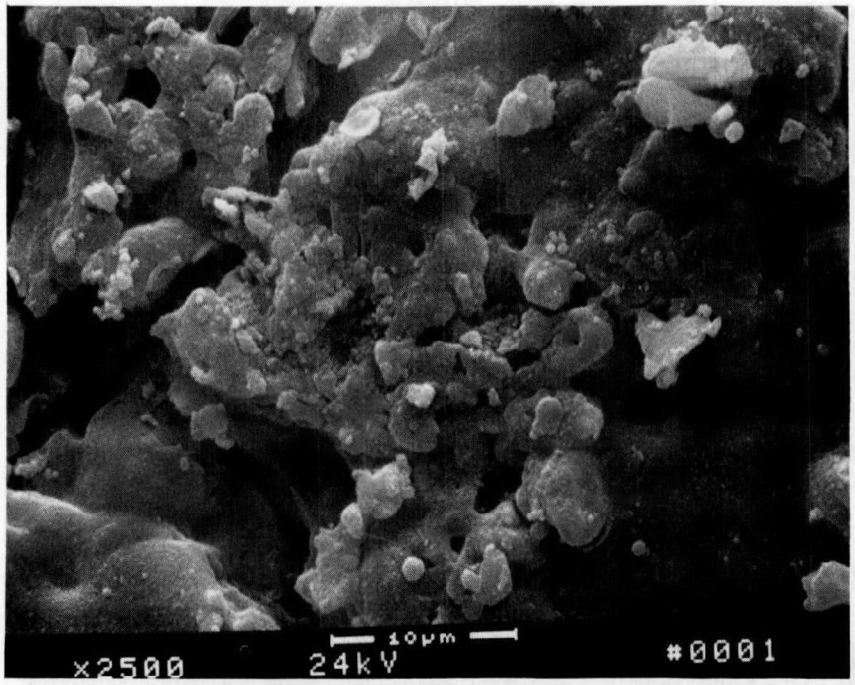

Figure D-88. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A230/0649

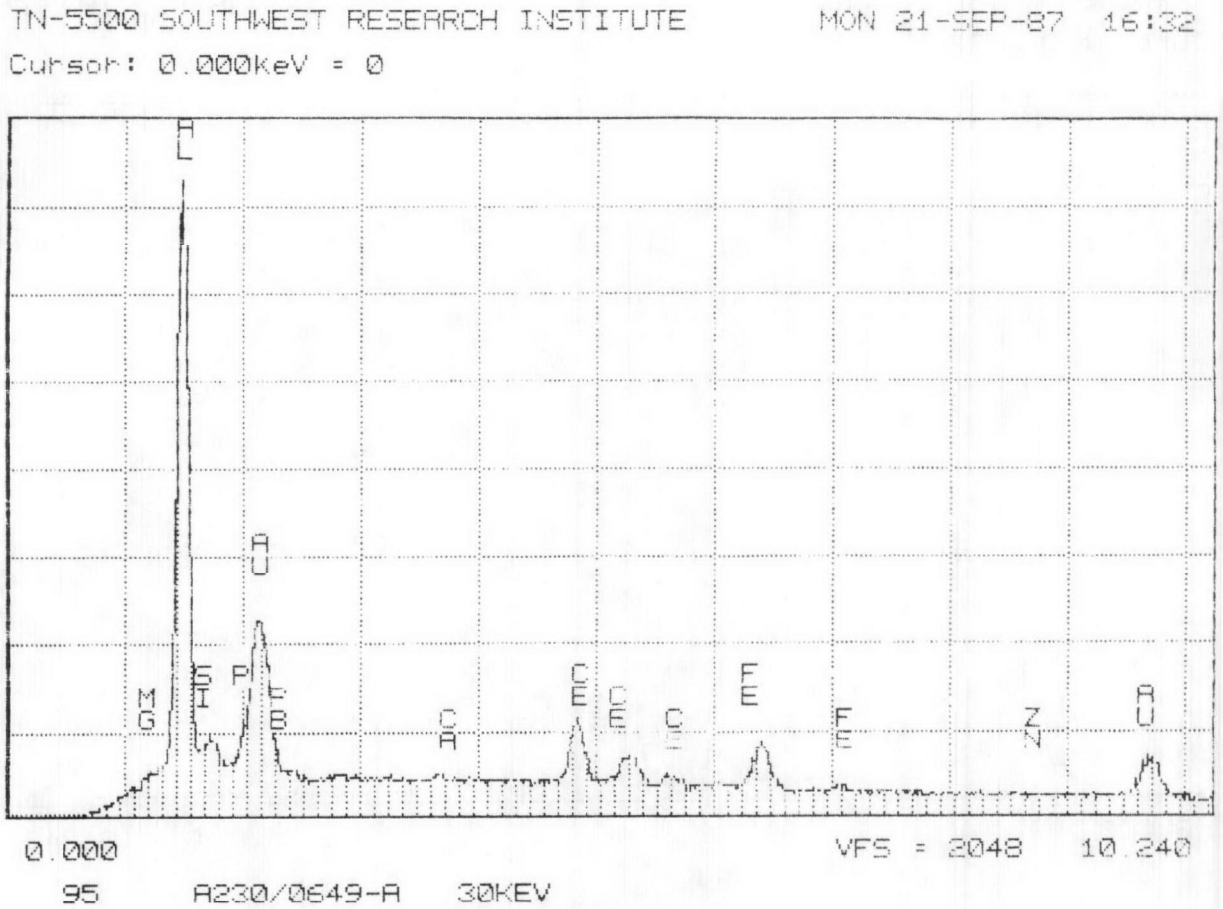

Figure D-89. SEM/EDX Spectrum of Converter A230/0649

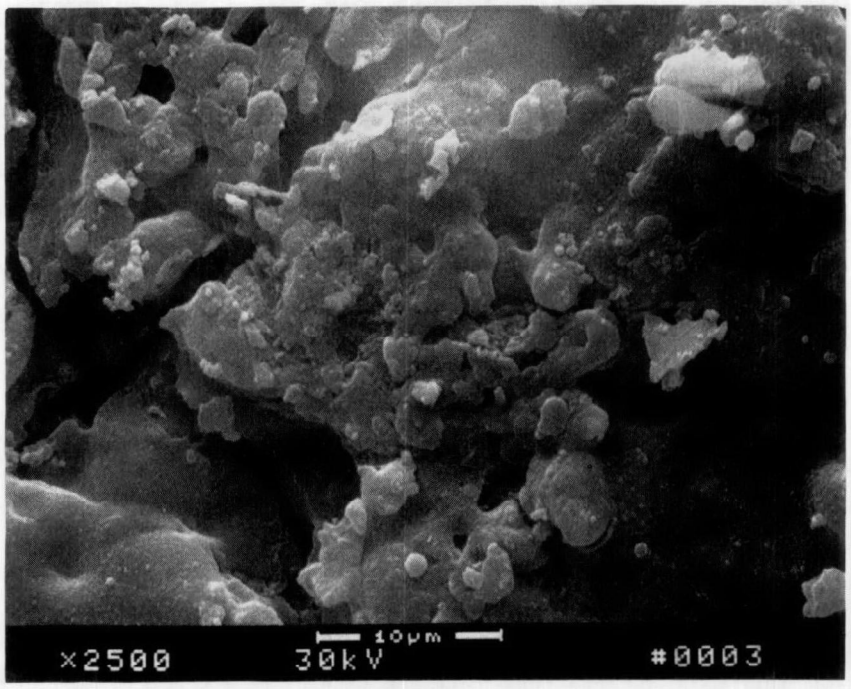

Figure D-90. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A230/0649

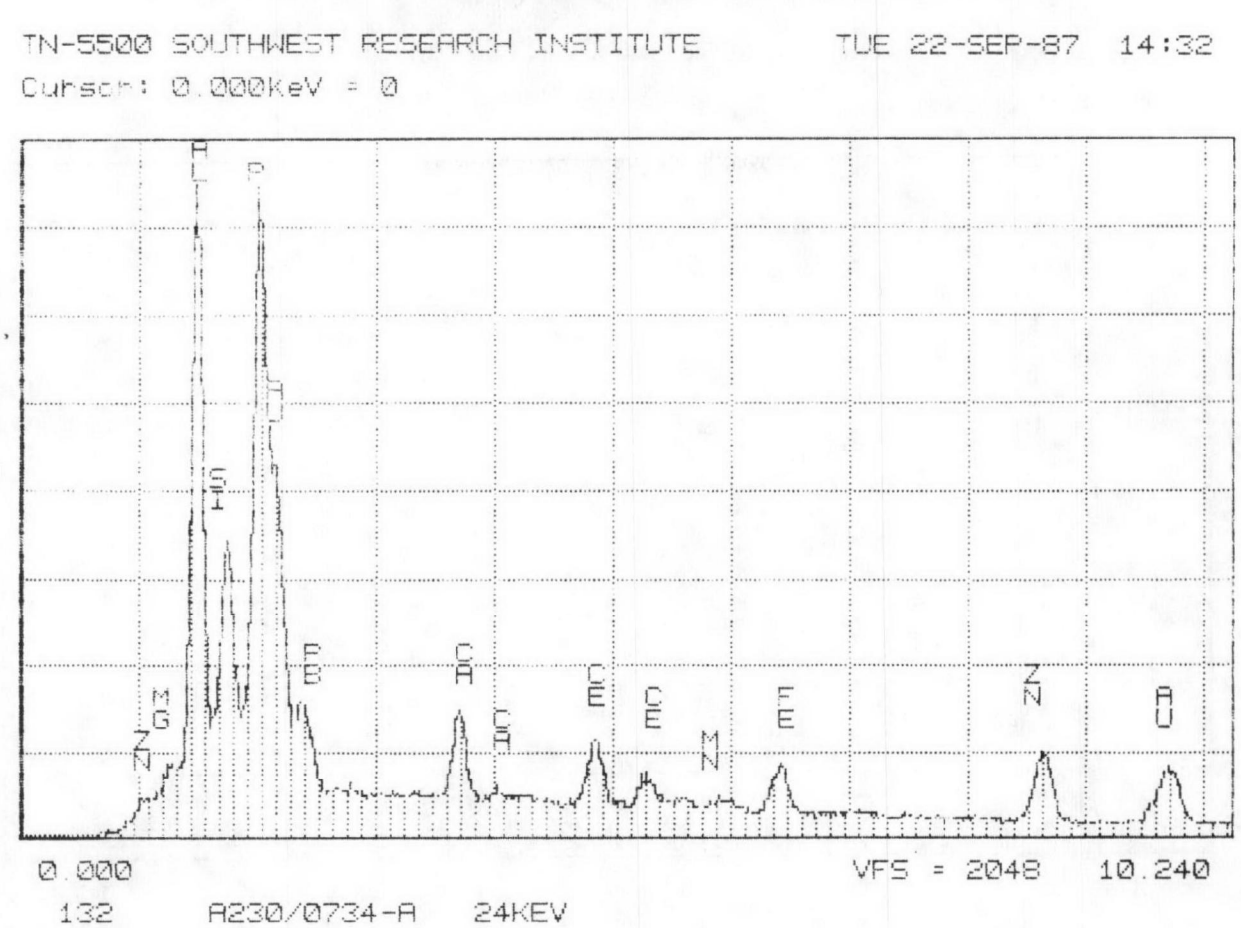

Figure D-91. SEM/EDX Spectrum of Converter A230/0734

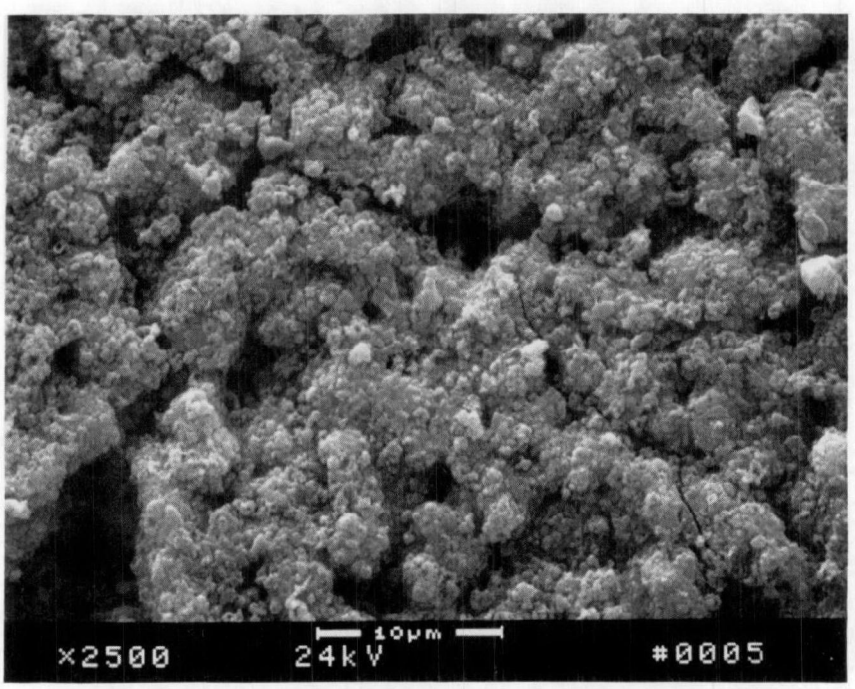

Figure D-92. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A230/0734

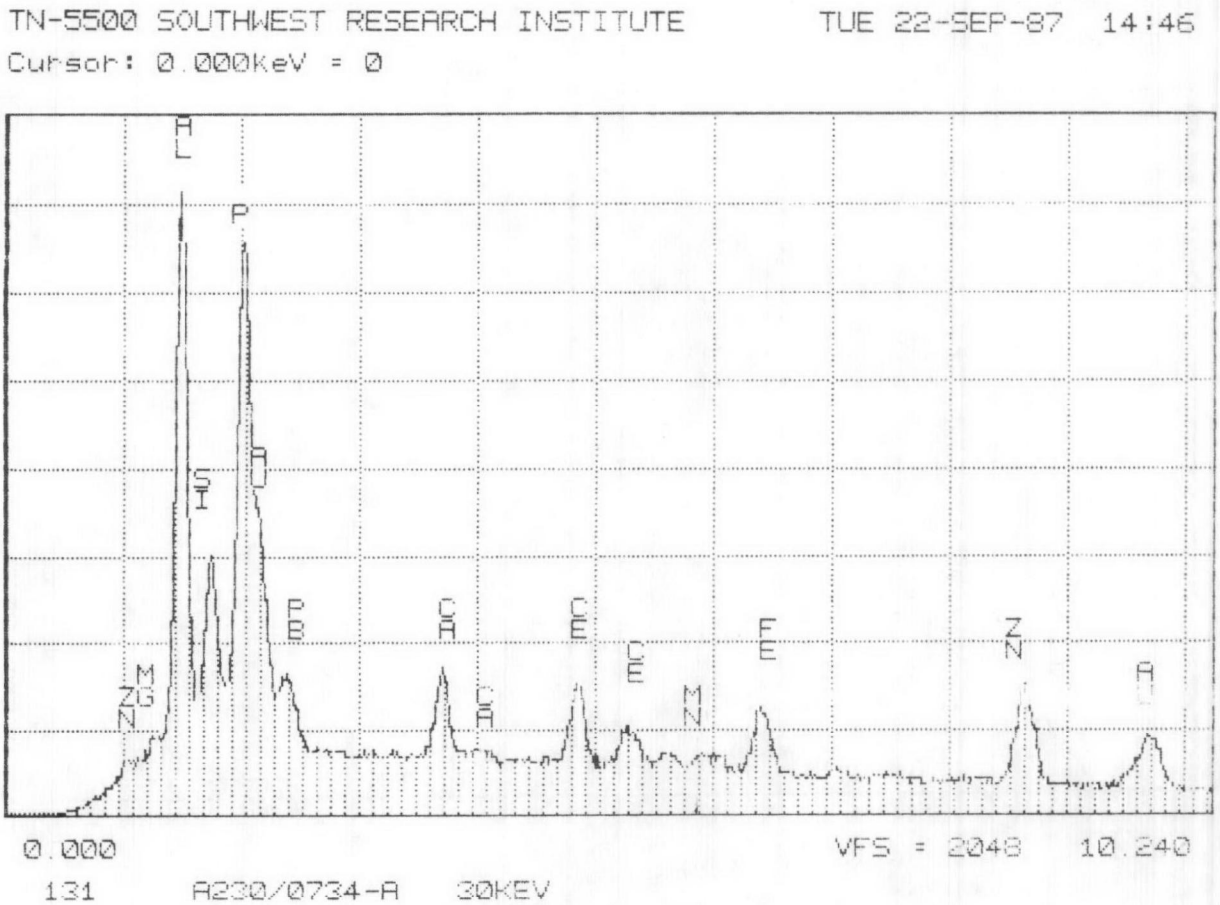

Figure D-93. SEM/EDX Spectrum of Converter A230/0734

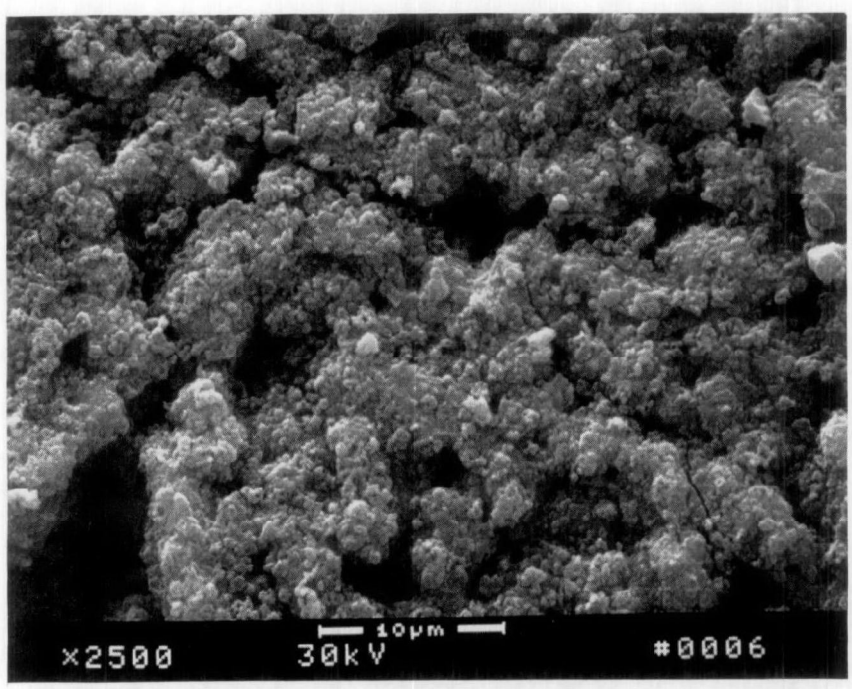

Figure D-94. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A230/0734

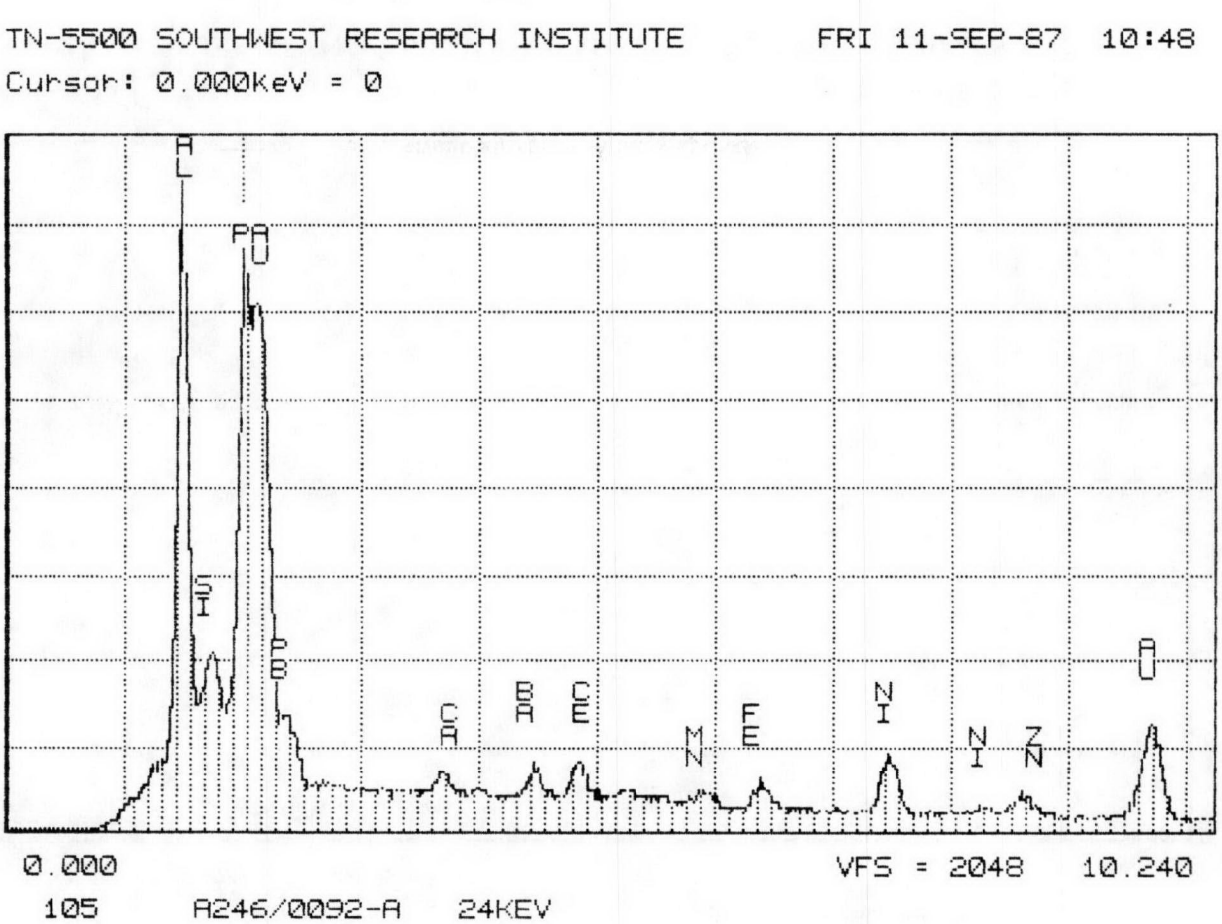

Figure D-95. SEM/EDX Spectrum of Converter A246/0092

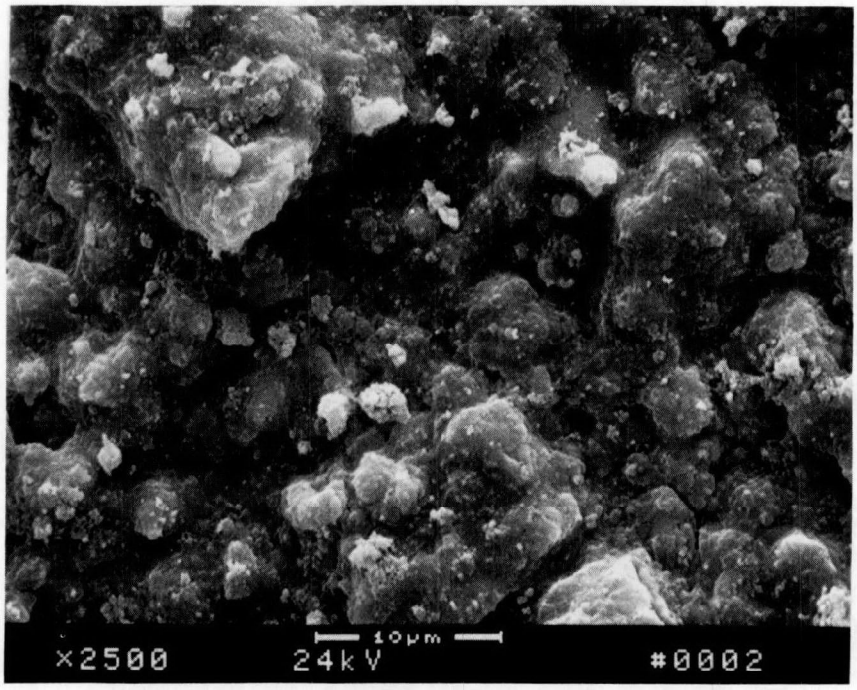

Figure D-96. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A246/0092

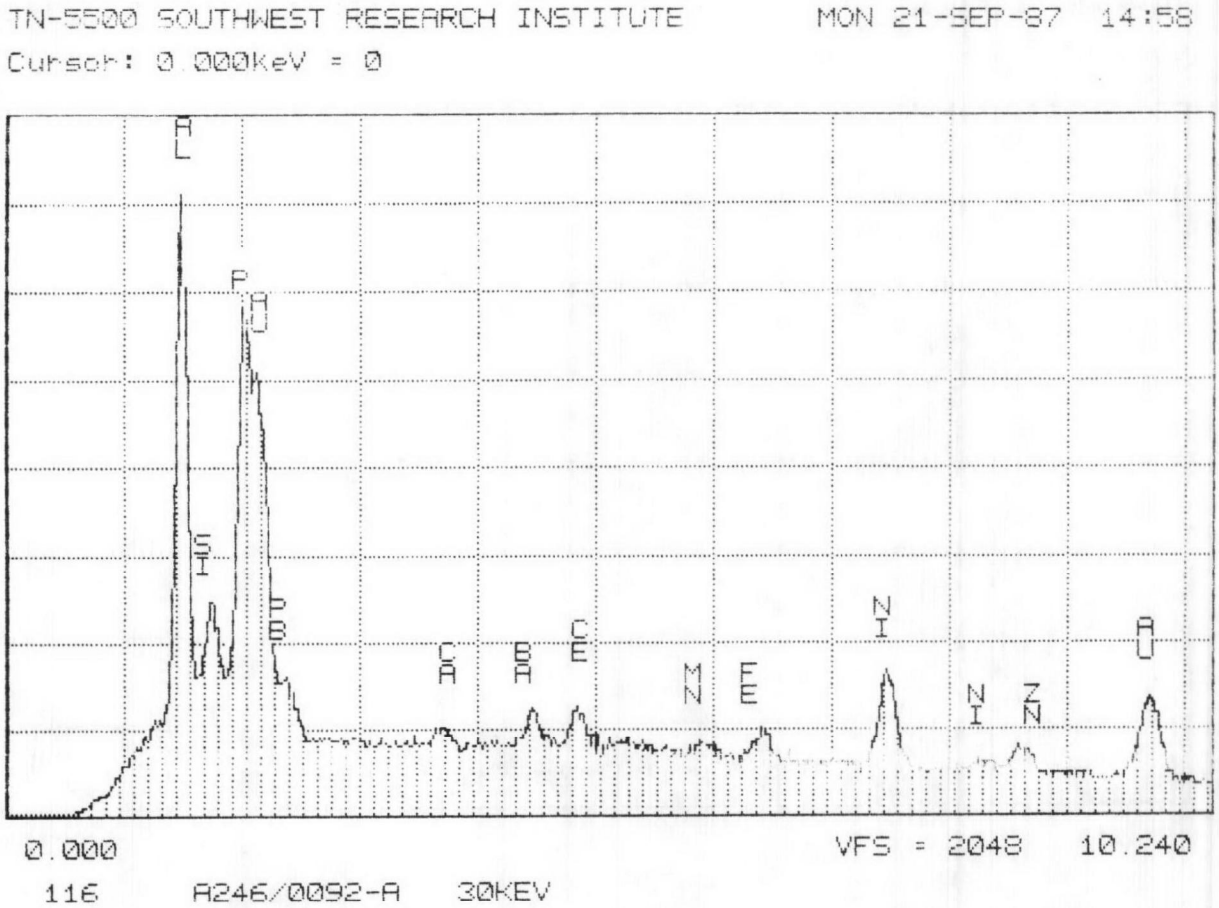

Figure D-97. SEM/EDX Spectrum of Converter A246/0092

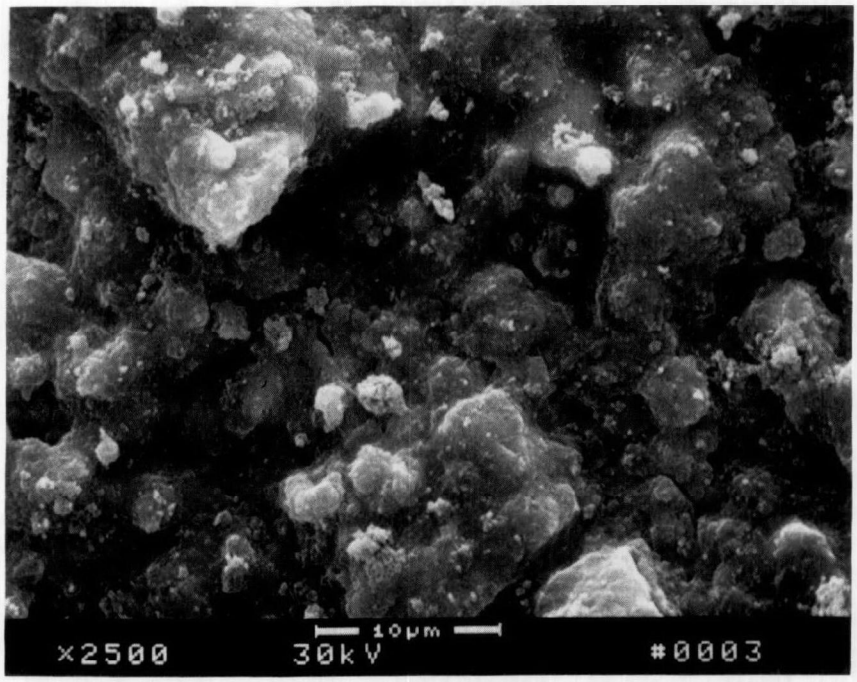

Figure D-98. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A246/0092

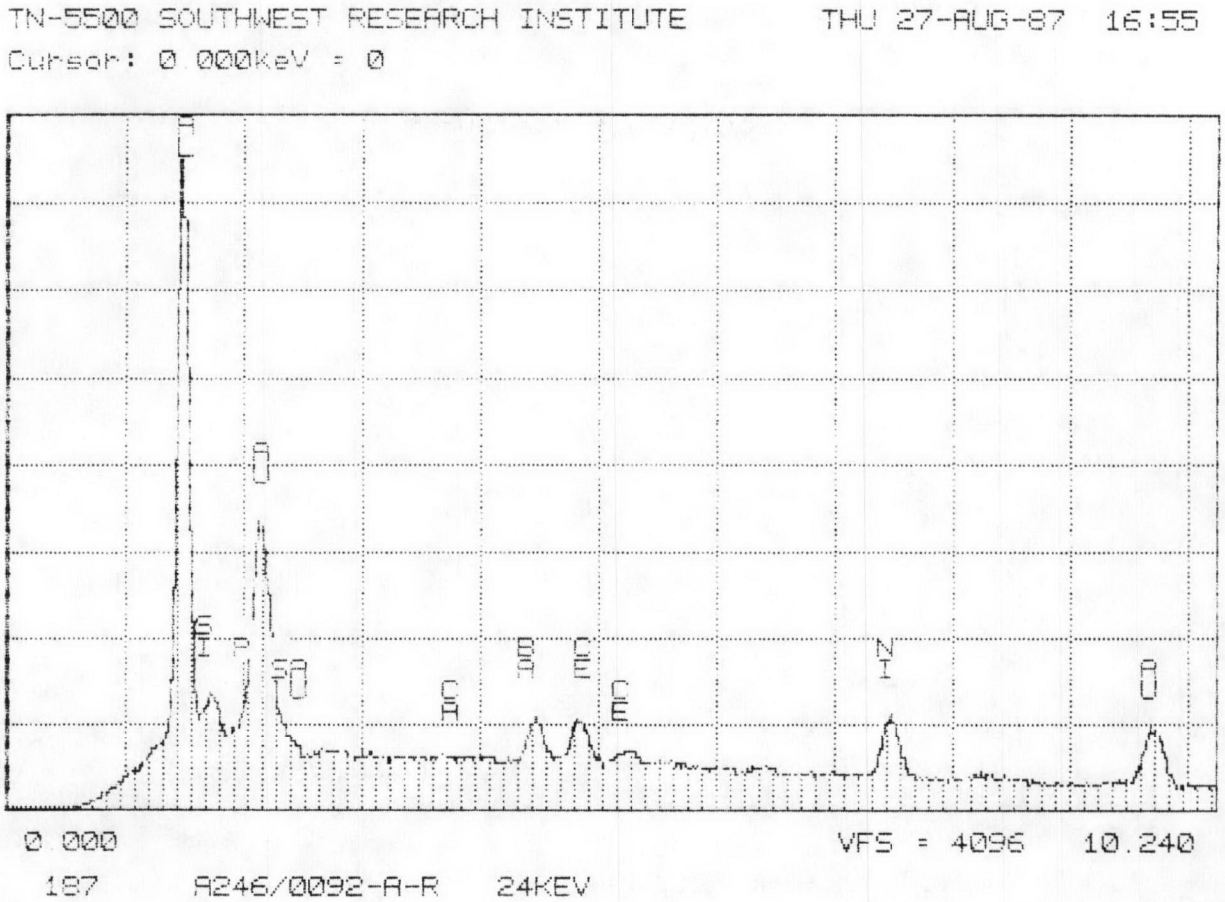

Figure D-99. SEM/EDX Spectrum of Converter A246/0092-Rear Face

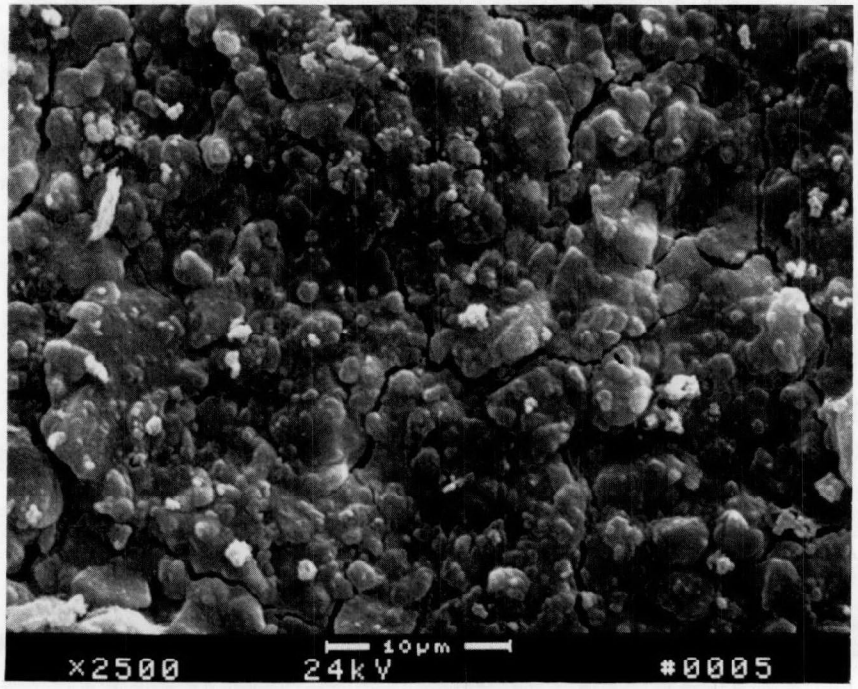

Figure D-100. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A246/0092-Rear Face

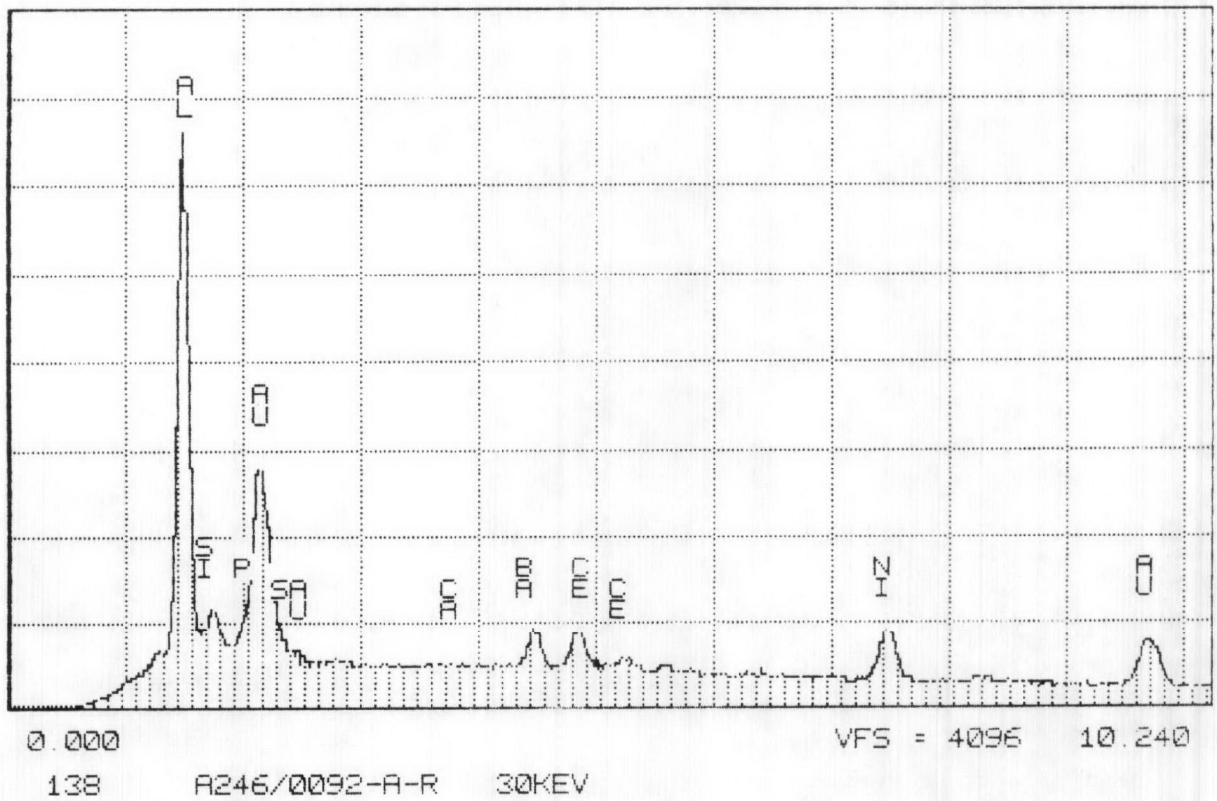

Figure D-101. SEM/EDX Spectrum of Converter A246/0092-Rear Face

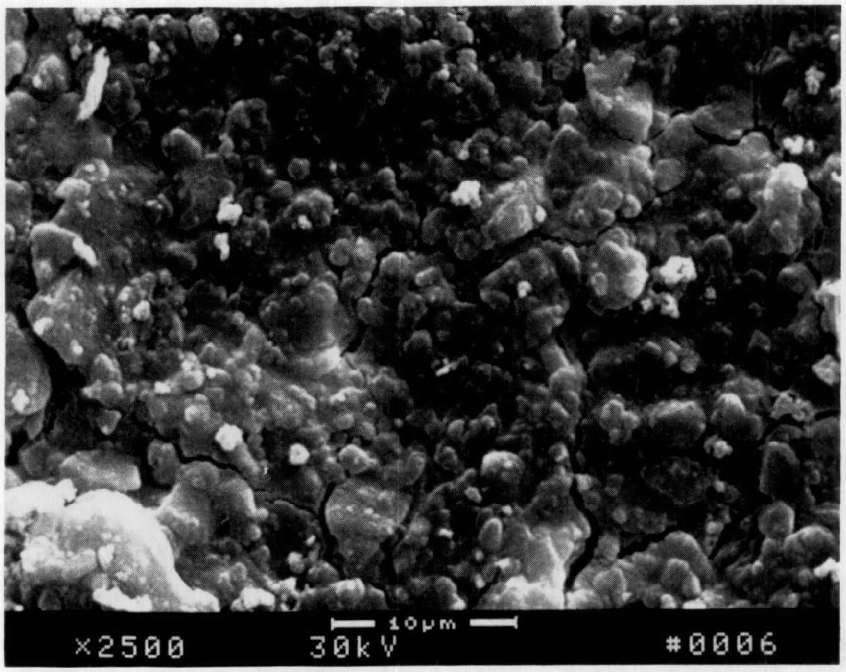

Figure D-102. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A246/0092-Rear Face

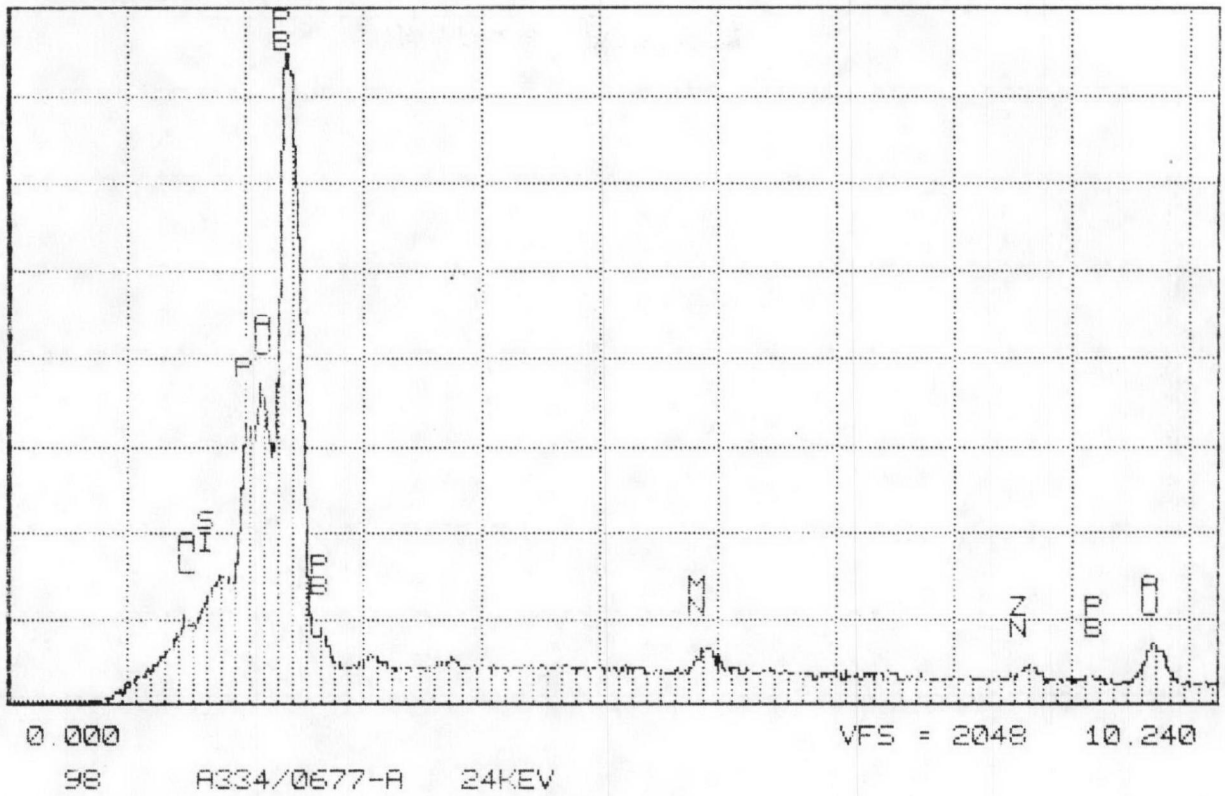

Figure D-103. SEM/EDX Spectrum of Converter A334/0677

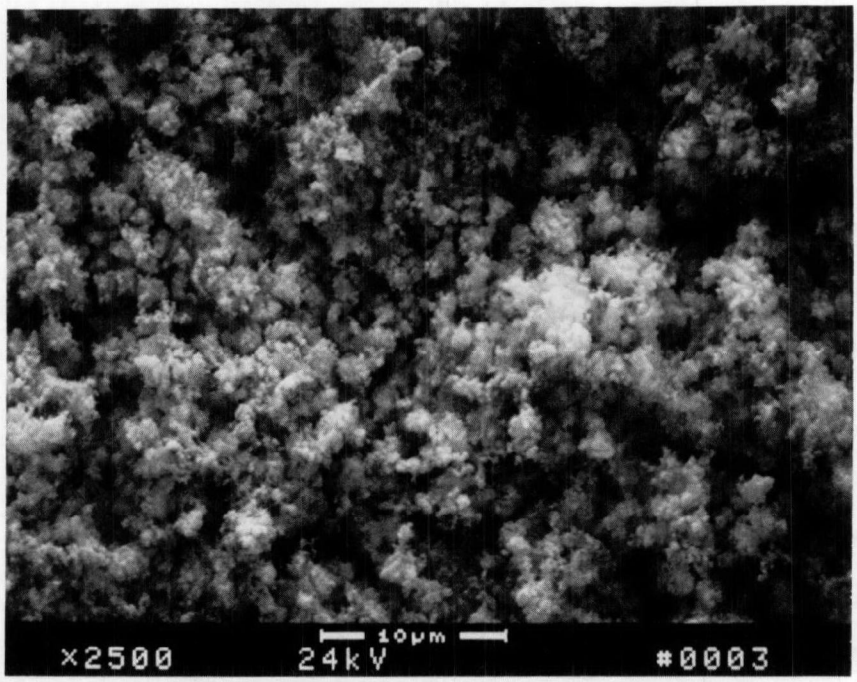

Figure D-104. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A334/0677

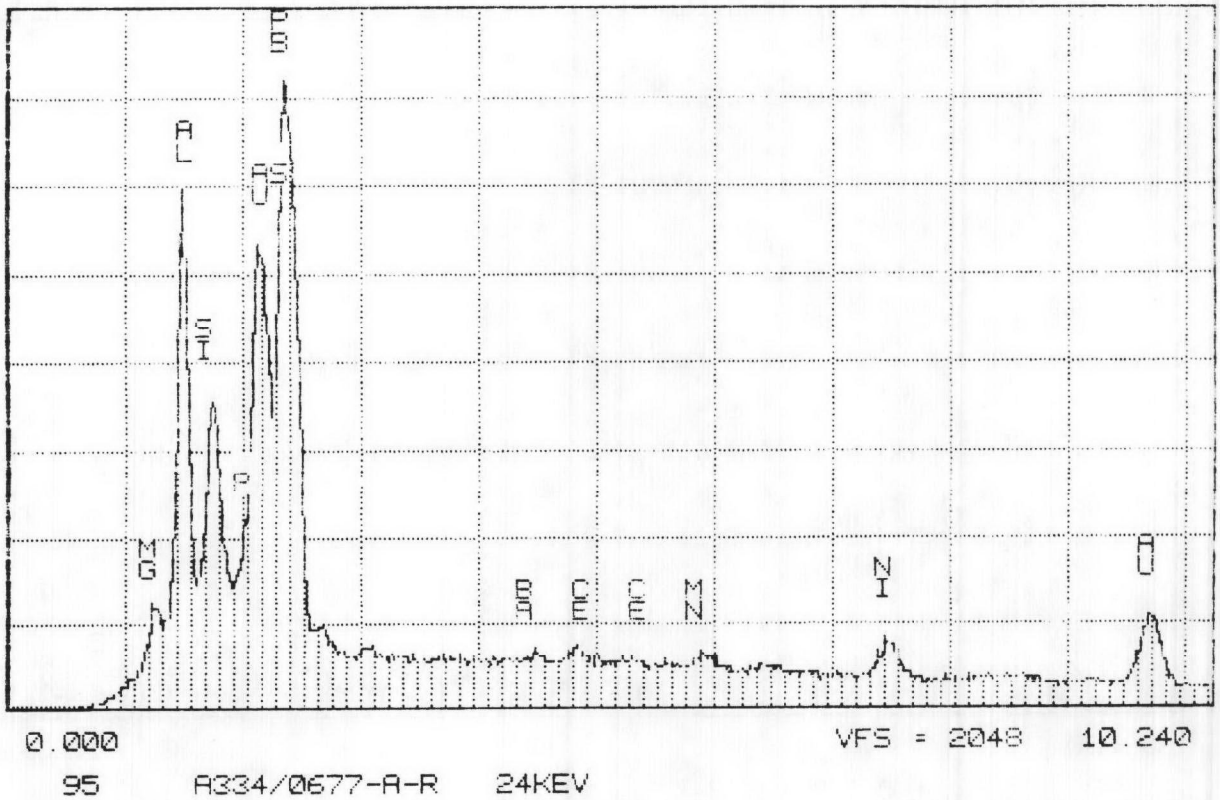

Figure D-105. SEM/EDX Spectrum of Converter A334/0677-Rear Face

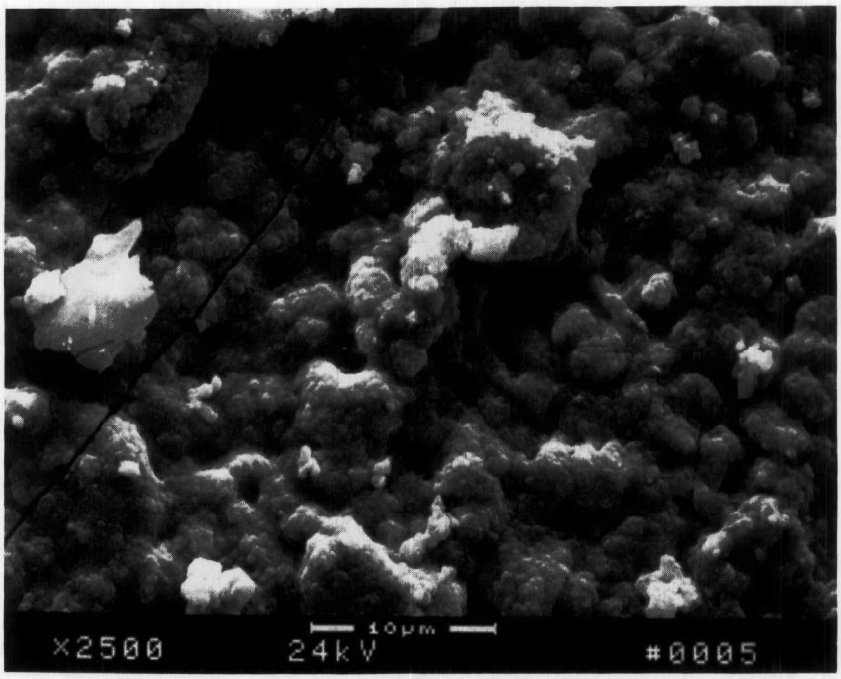

Figure D-106. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A334/0677-Rear Face

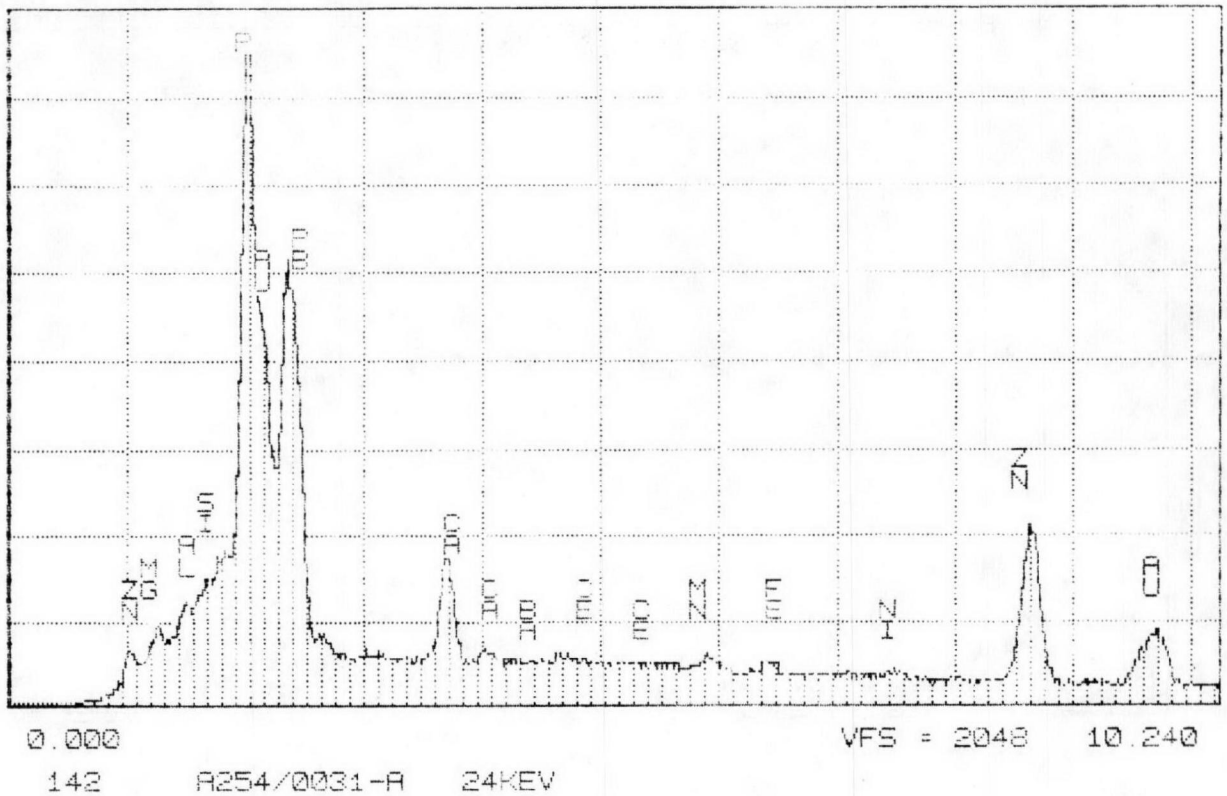

Figure D-107. SEM/EDX Spectrum of Converter A254/0031

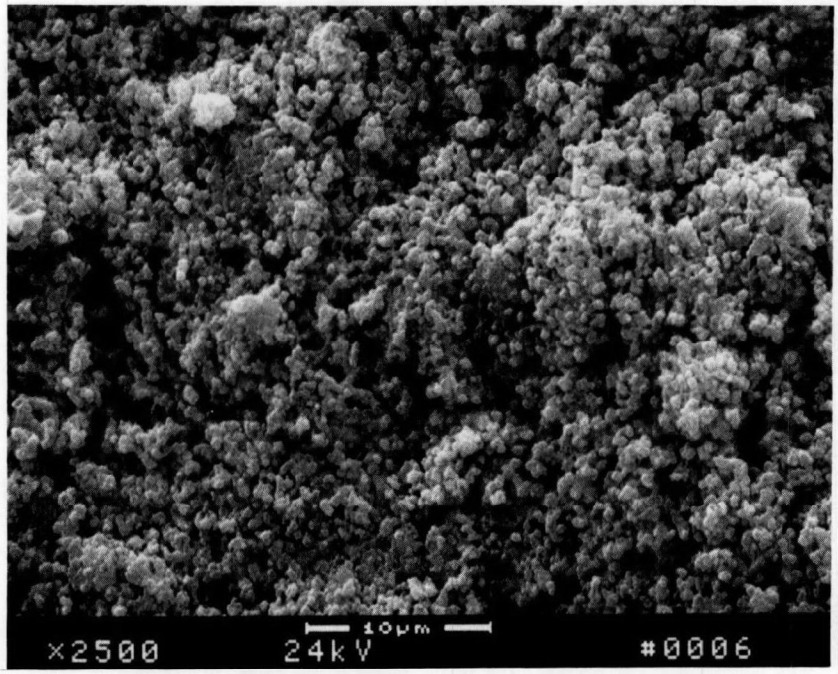

Figure D-108. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A254/0031

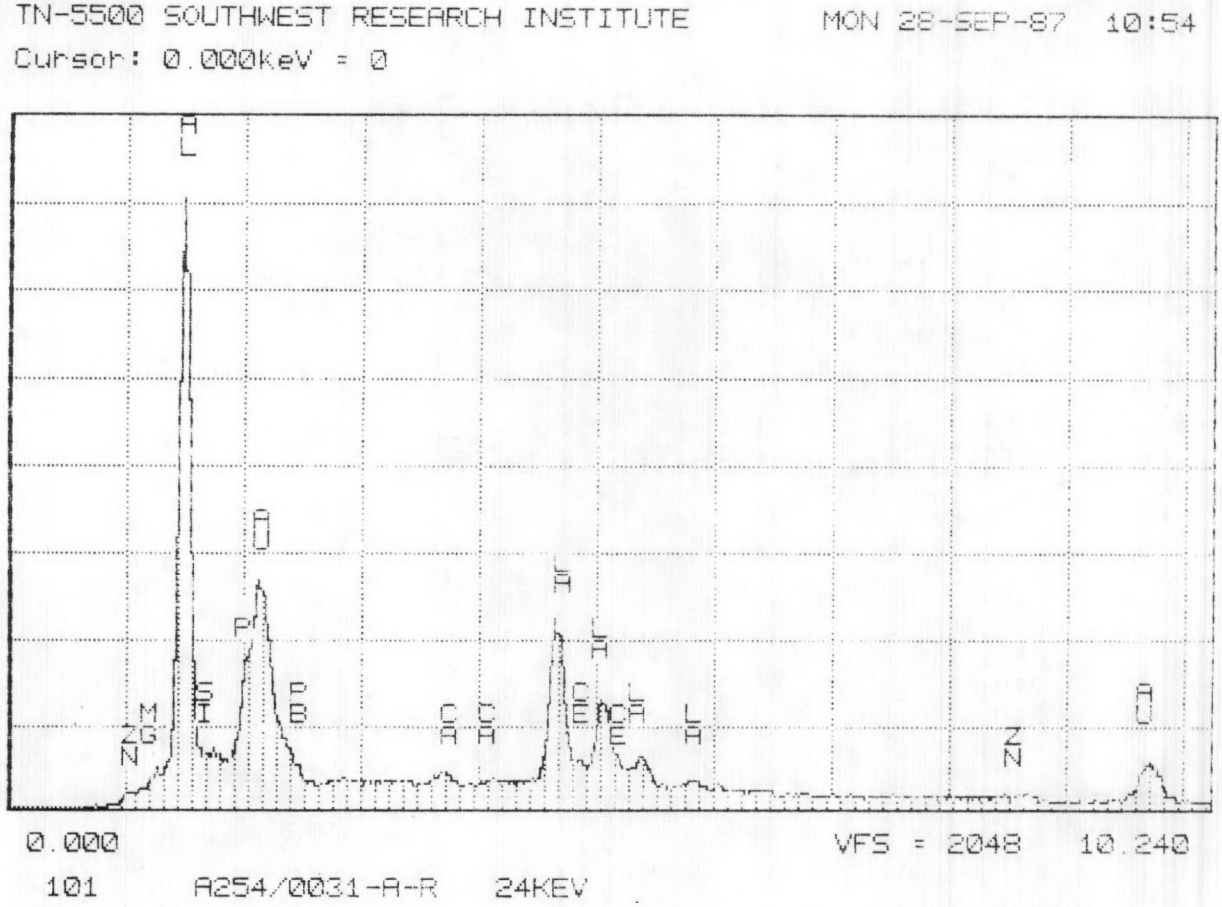

Figure D-109. SEM/EDX Spectrum of Converter A254/0031-Rear Face

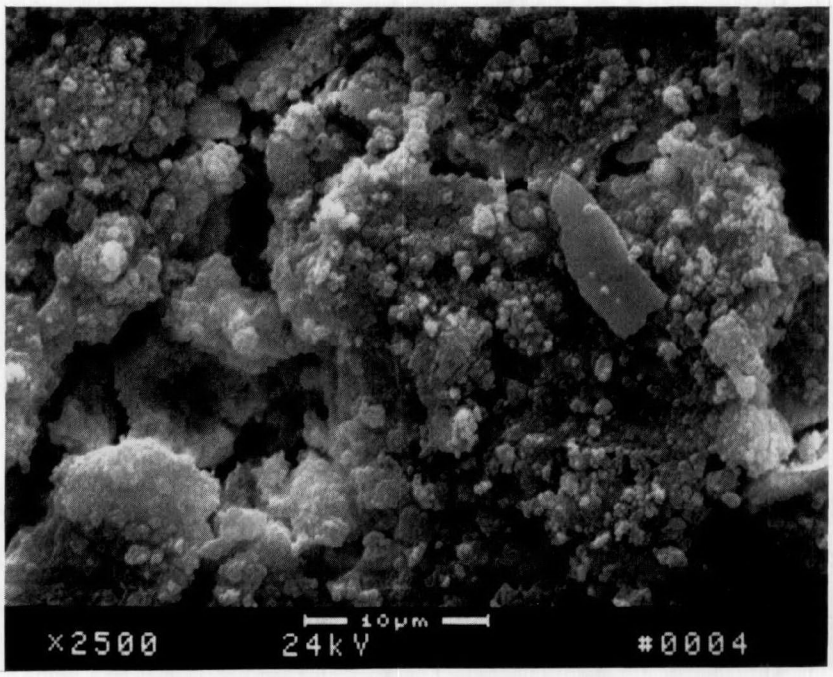

Figure D-110. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A254/0031-Rear Face

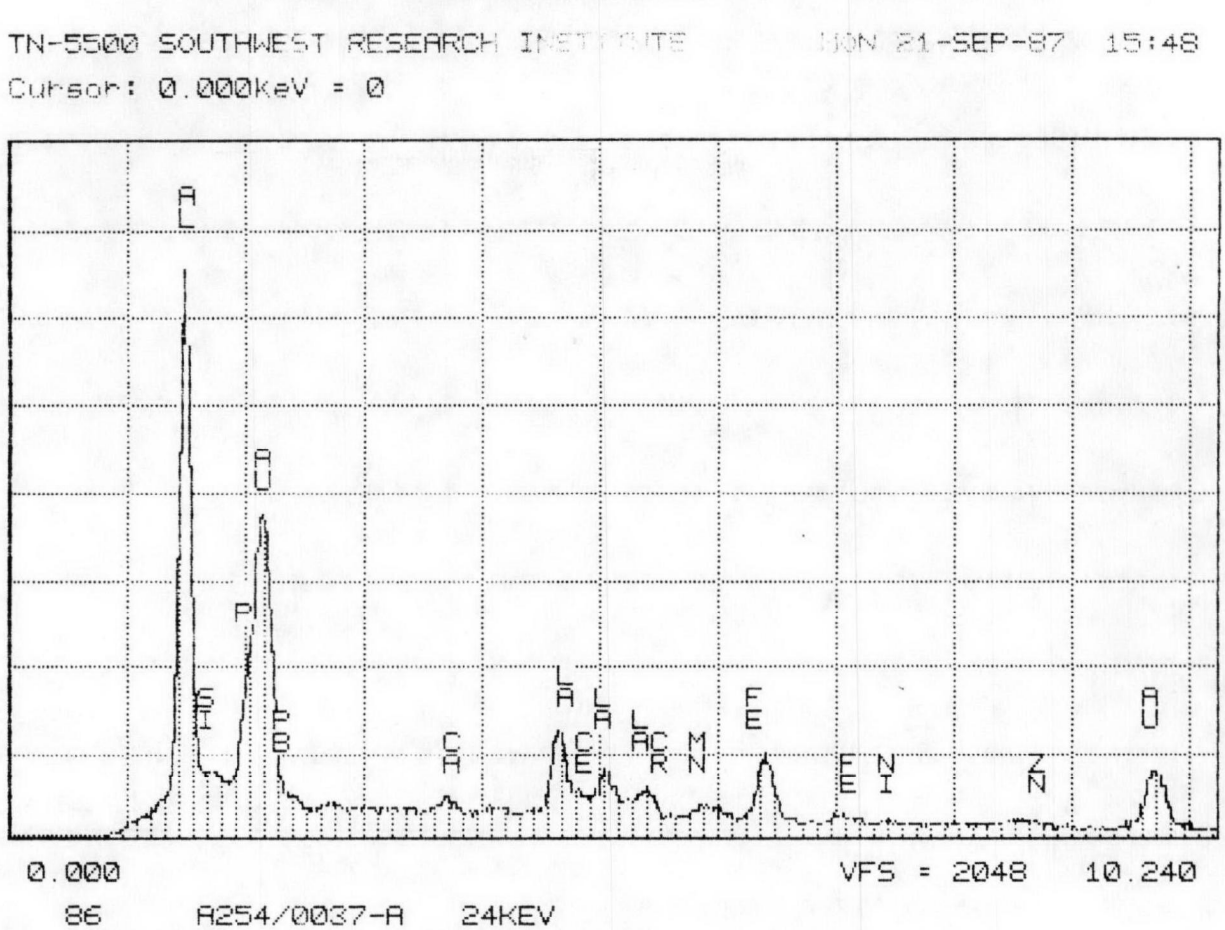

Figure D-111. SEM/EDX Spectrum of Converter A254/0037

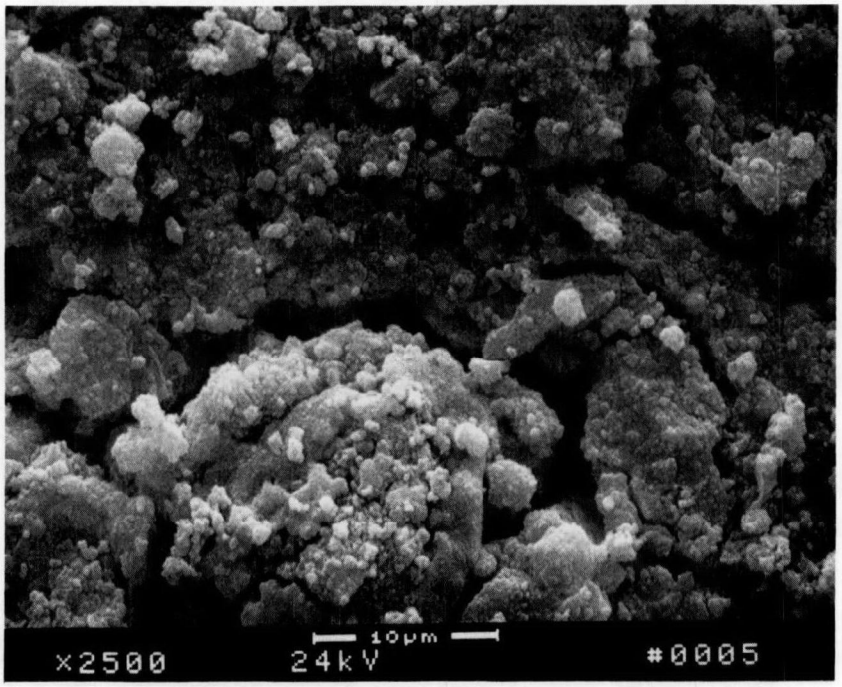

Figure D-112. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A254/0037

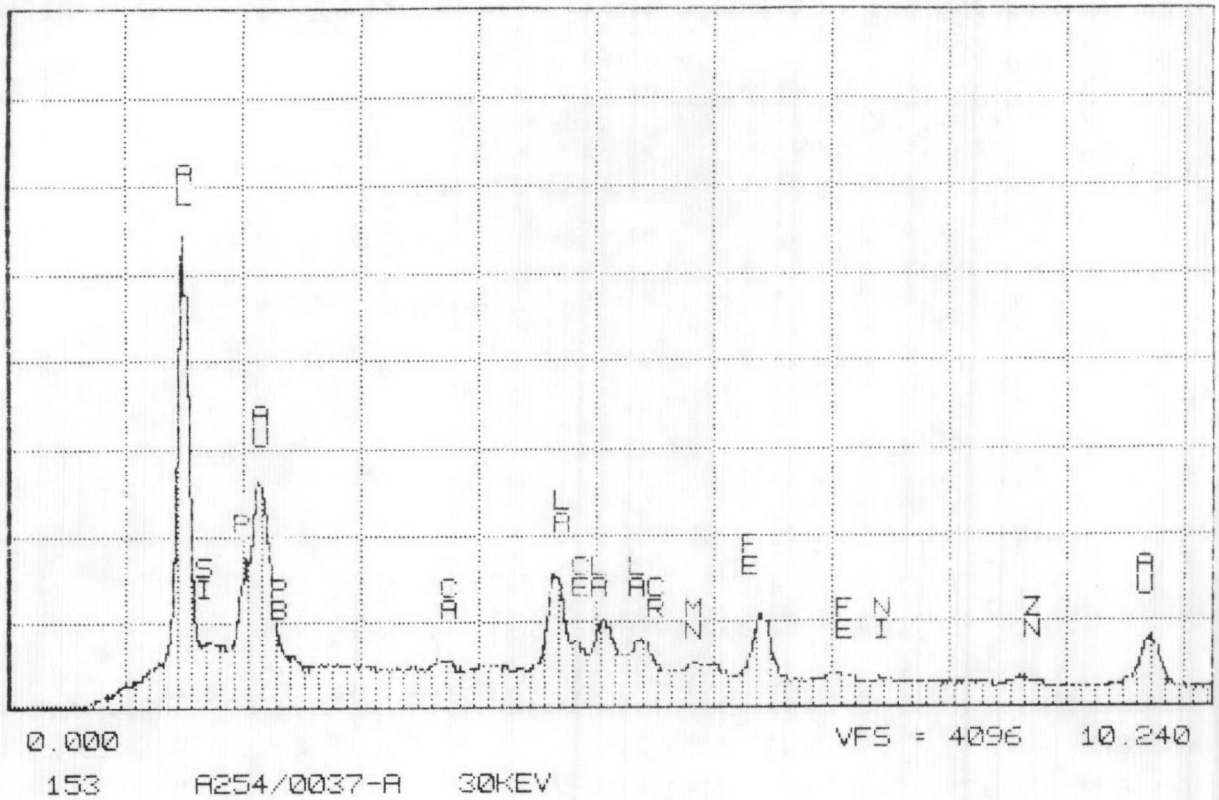

Figure D-113. SEM/EDX Spectrum of Converter A254/0037

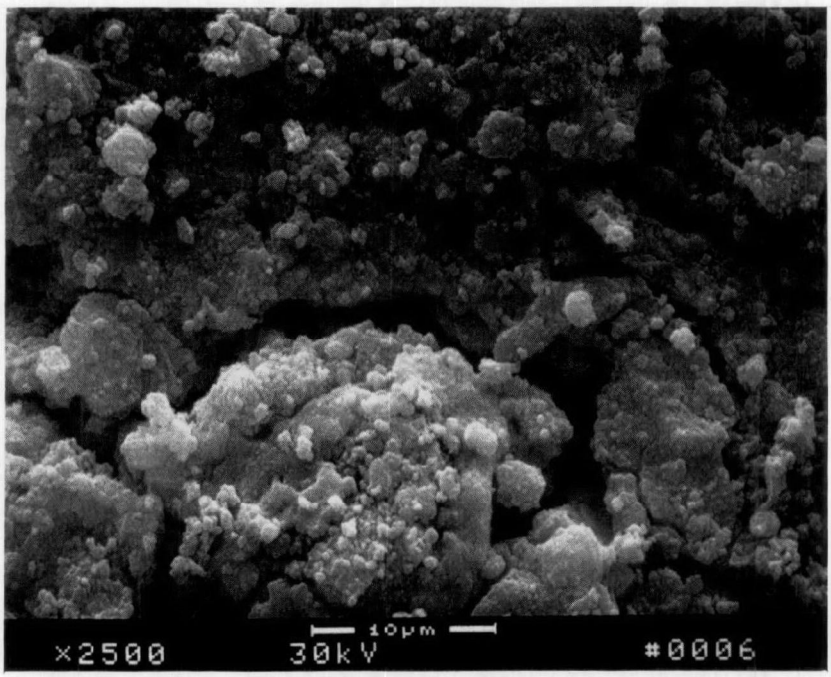

Figure D-114. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A254/0037

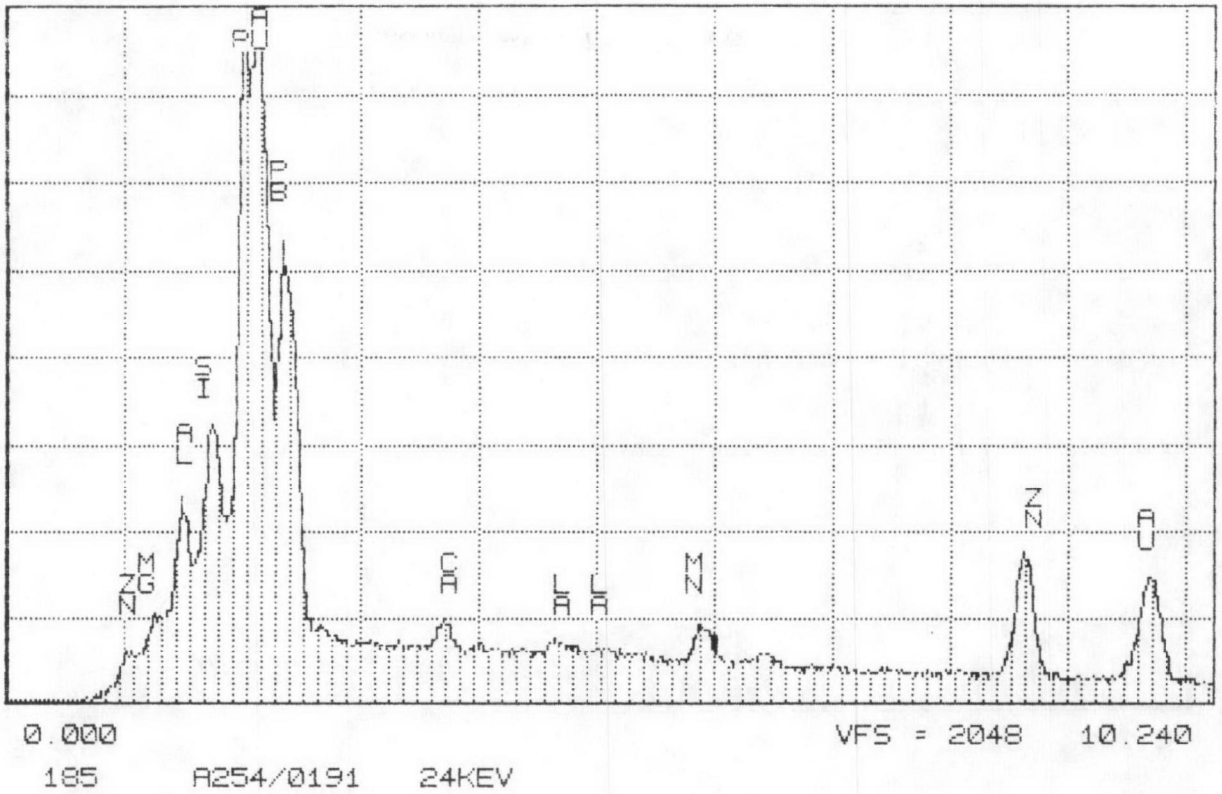

Figure D-115. SEM/EDX Spectrum of Converter A254/0191

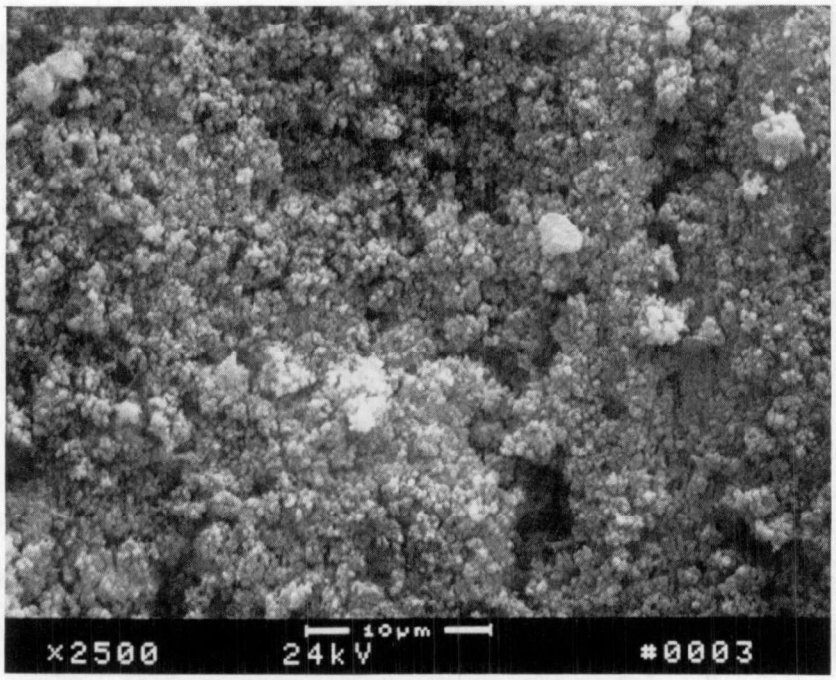

Figure D-116. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A254/0191

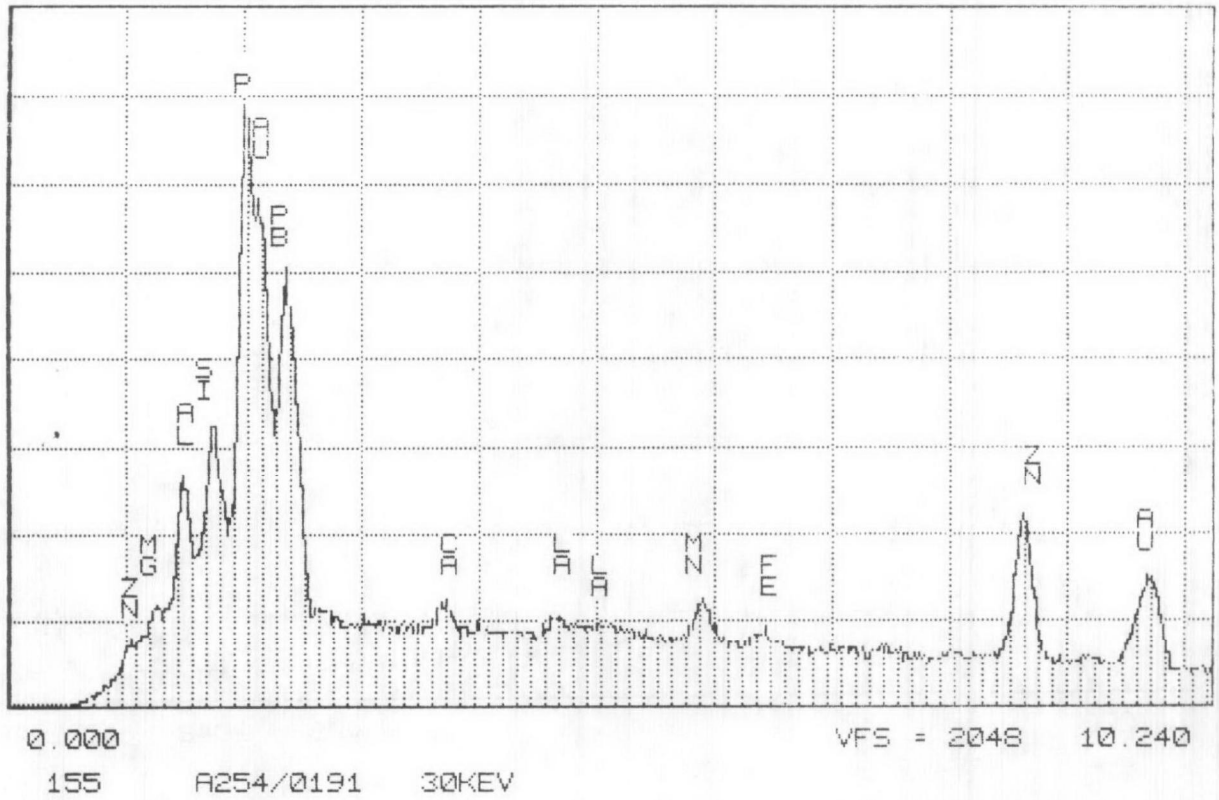

Figure D-117. SEM/EDX Spectrum of Converter A254/0191

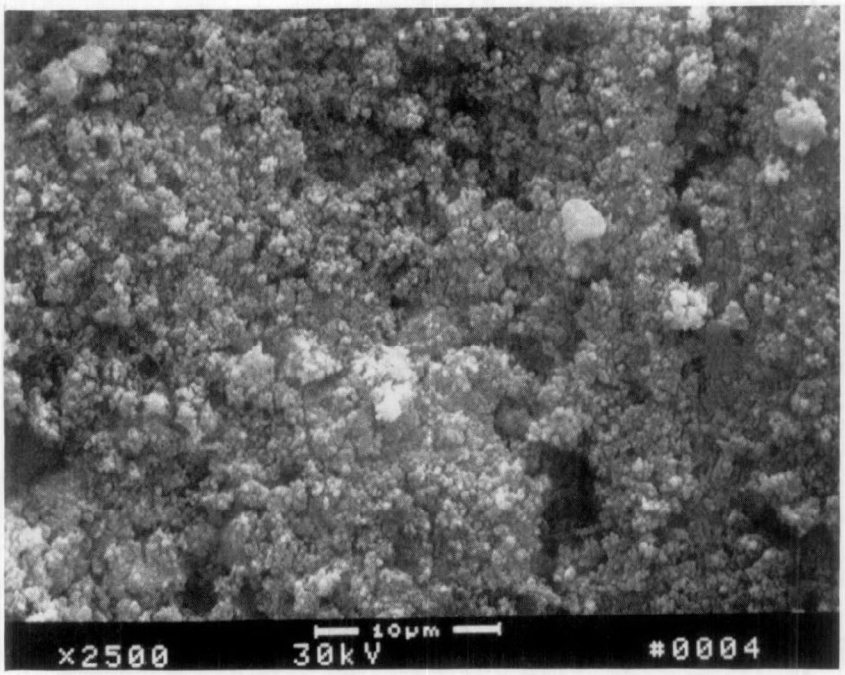

Figure D-118. Scanning Electron Micrograph at X2500 and 30 KeV for Converter A254/0191

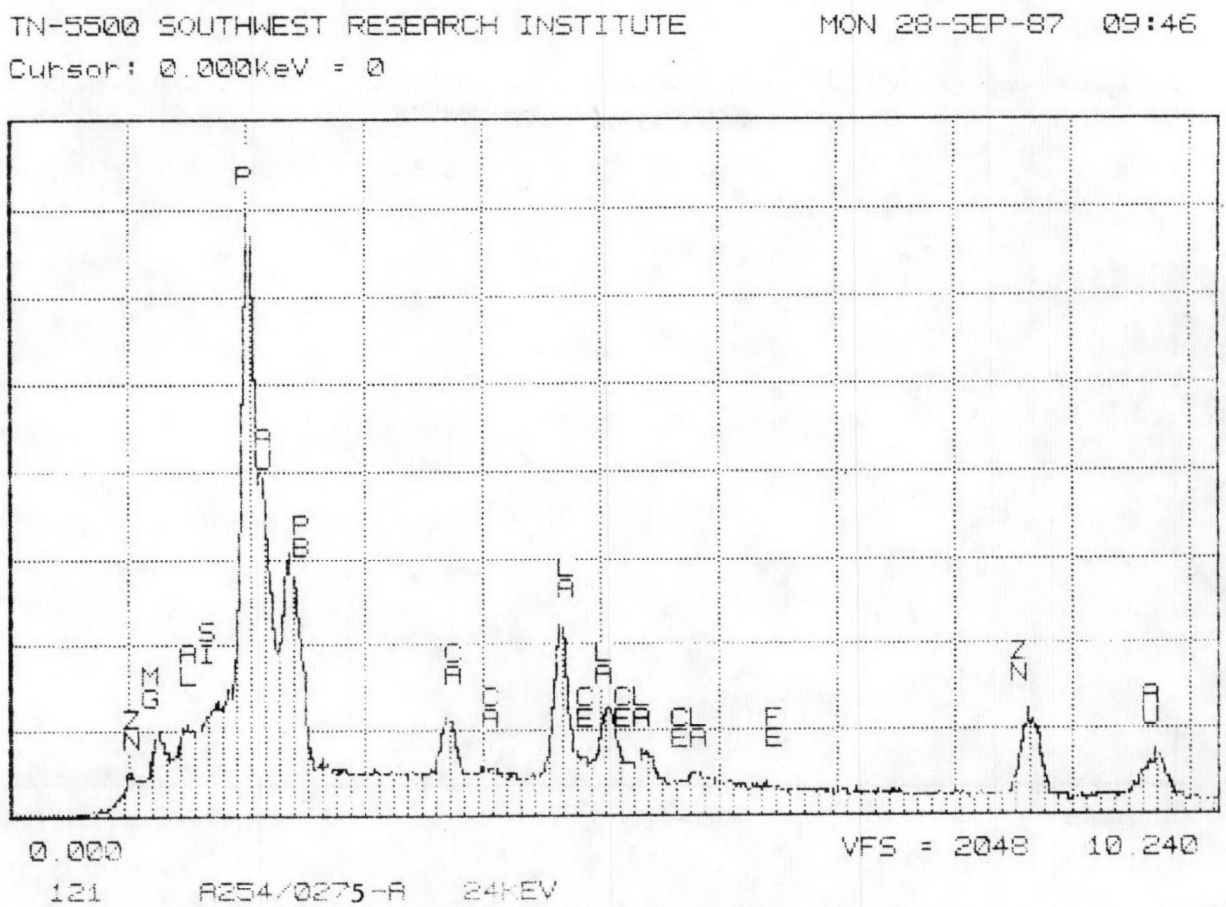

Figure D-119. SEM/EDX Spectrum of Converter A254/0275

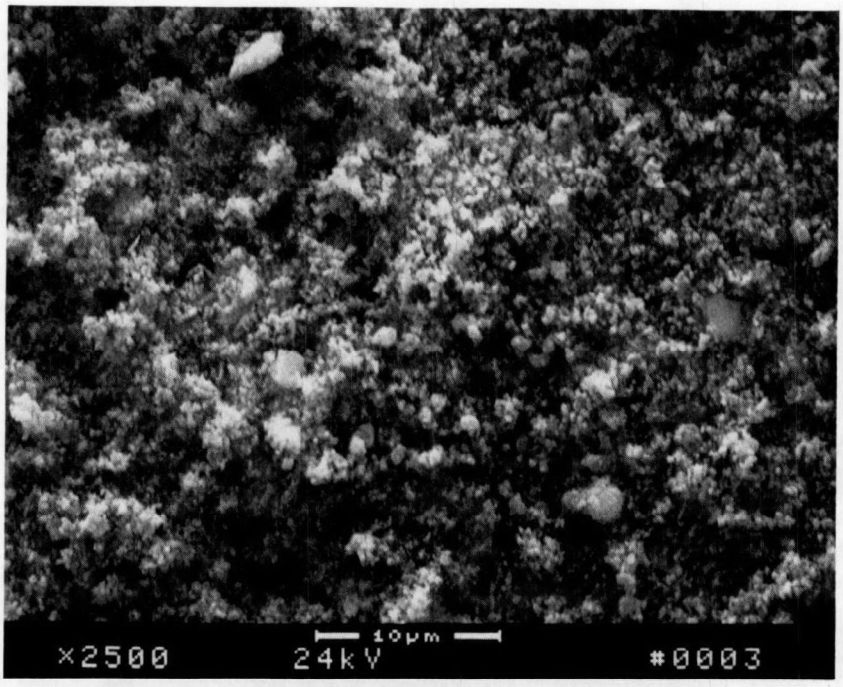

Figure D-120. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A254/0275

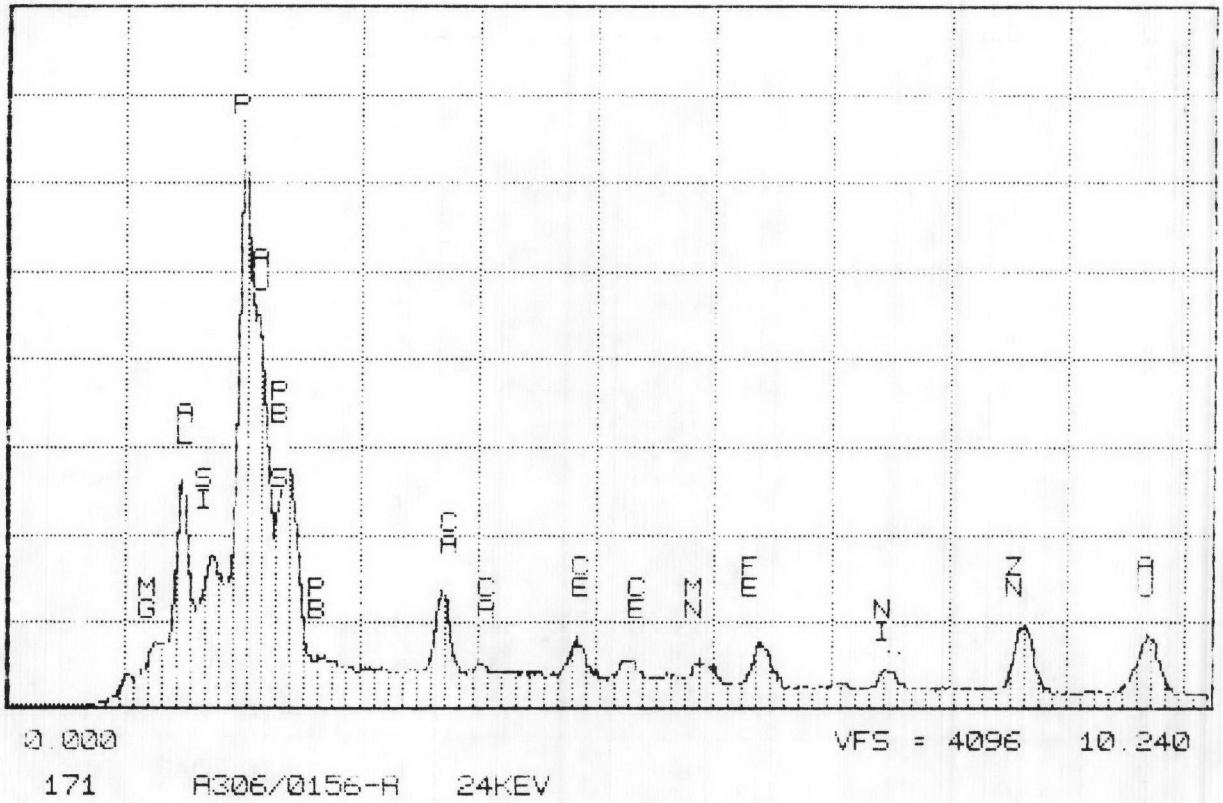

Figure D-121. SEM/EDX Spectrum of Converter A306/0156

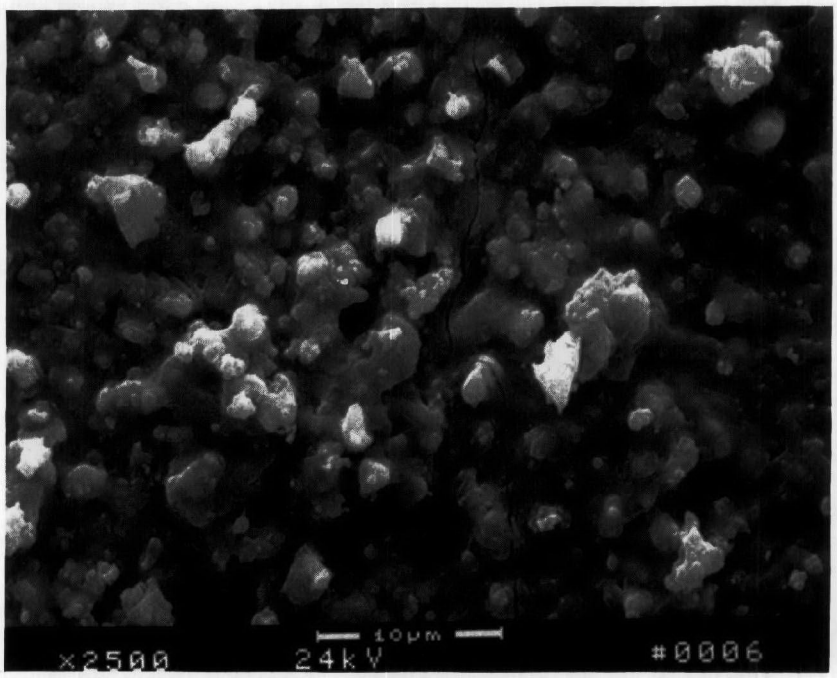

Figure D-122. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A306/0156

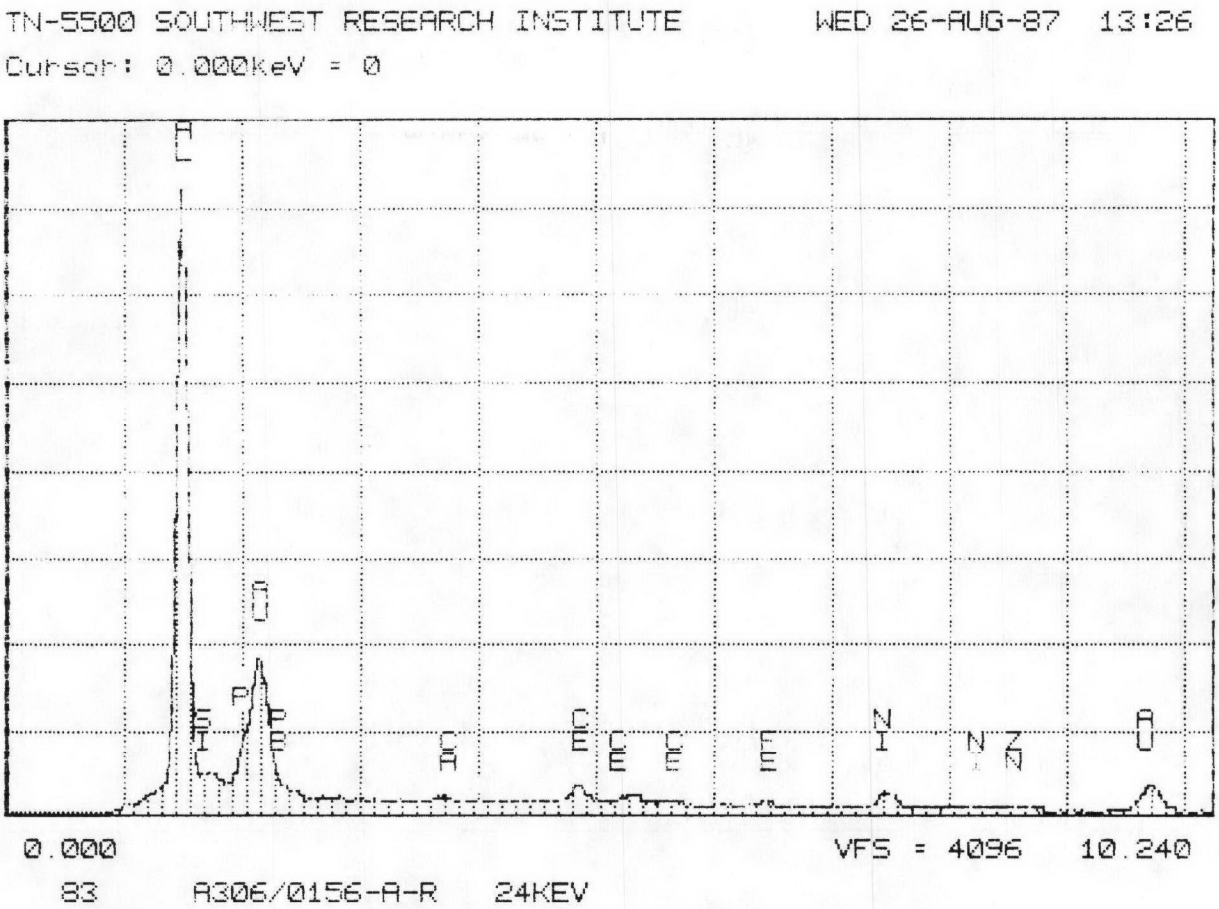

Figure D-123. SEM/EDX Spectrum of Converter A306/0156-Rear Face

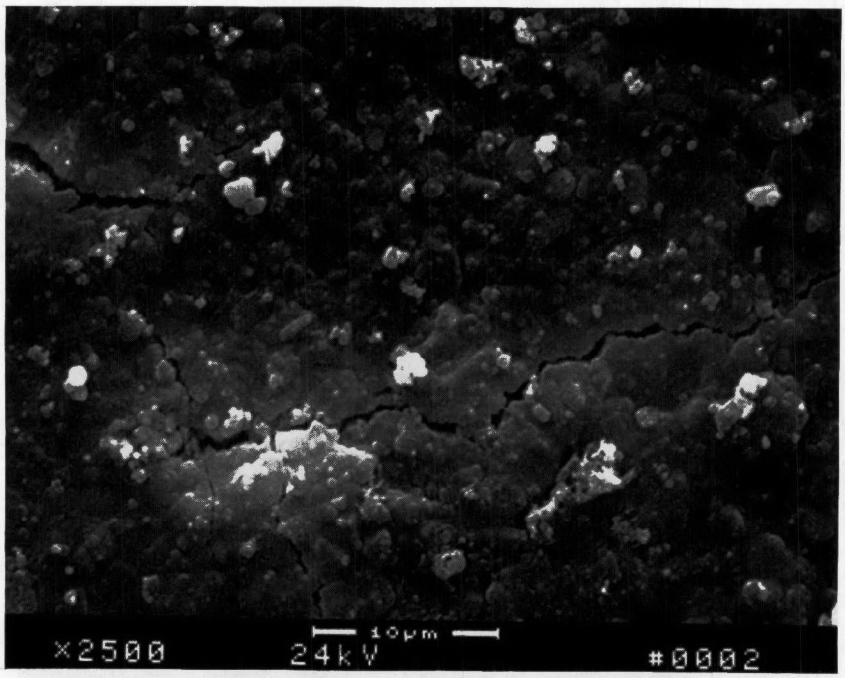

Figure D-124. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A306/0156-Rear Face

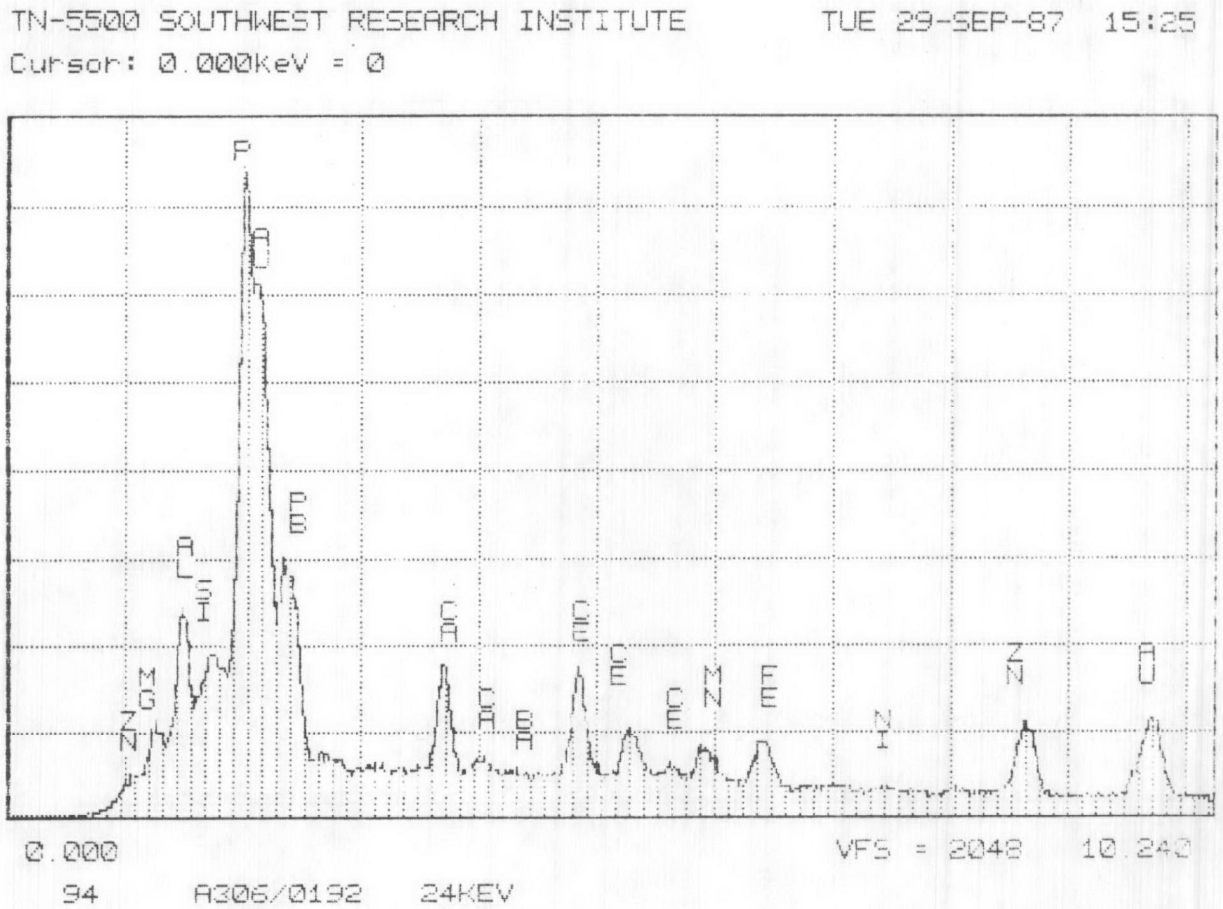

Figure D-125. SEM/EDX Spectrum of Converter A306/0192

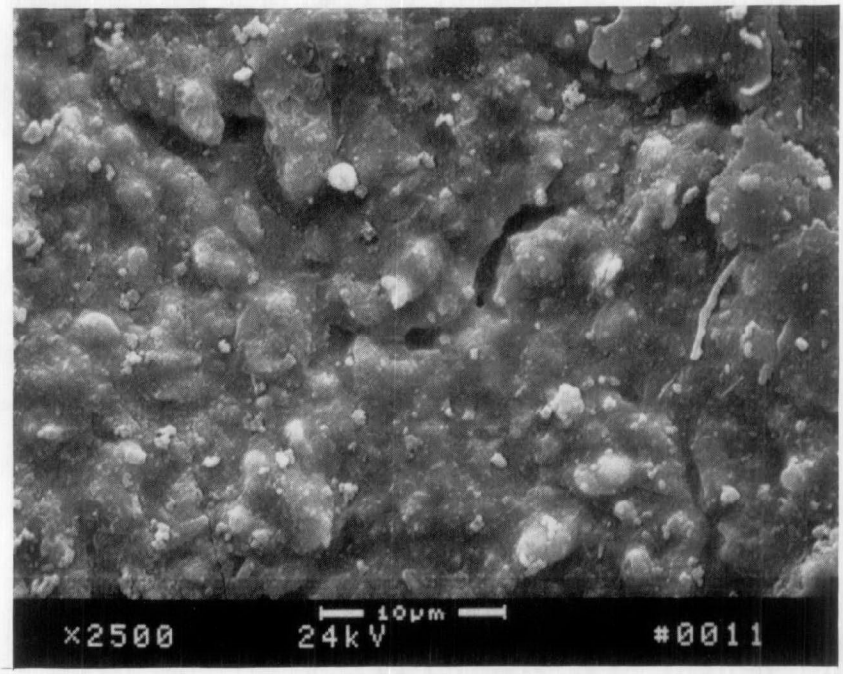

Figure D-126. Scanning Electron Micrograph at X2500 and 24 KeV for Converter A306/0192

APPENDIX E

BET EQUATION VERSUS RELATIVE PRESSURE FOR OXYGEN SENSORS

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/21/87

SAMPLE I.D.: A317/0196
SAMPLE WEIGHT: 4.0736 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.12	0.03	0.0490	1.75030
8.860	0.21	0.05	0.0869	1.84578
22.000	0.50	0.12	0.2157	2.24122

BET SURFACE AREA: 0.95 +/- 0.02 m^2/g
SLOPE: 2.9765 +/- 0.1007
INTERCEPT: 1.5969 +/- 0.0138
C: 2.86
Vm: 0.22 cm^3/g
CORRELATION COEFFICIENT 0.9994

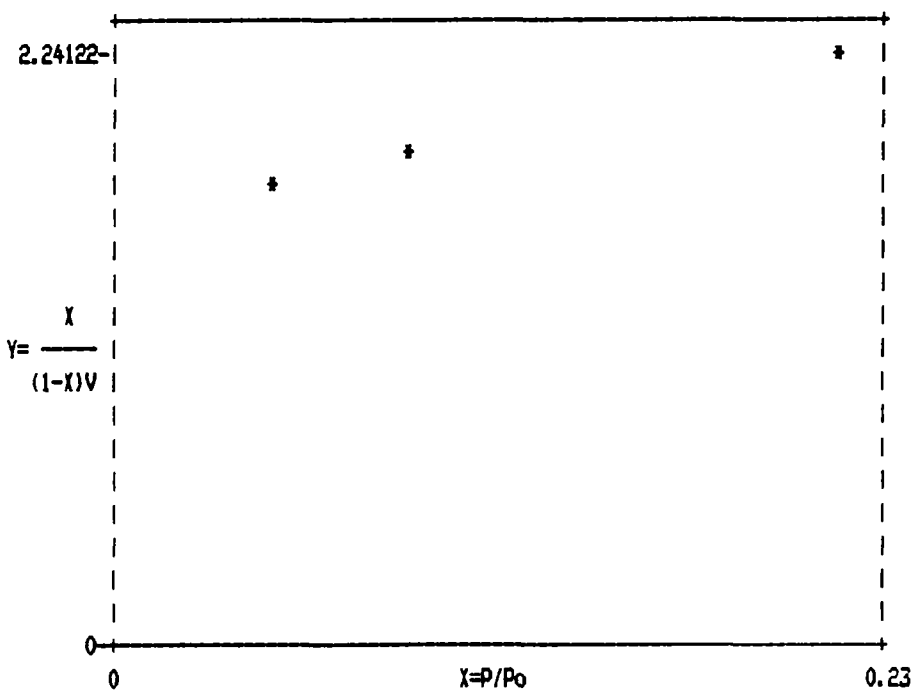

Figure E-1. Plot of BET equation versus relative pressure for Oxygen Sensor A317/0196

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/21/87

SAMPLE I.D.: A317/1157
SAMPLE WEIGHT: 3.2500 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
8.860	0.41	0.13	0.0869	0.75426
14.900	0.65	0.20	0.1461	0.85560
22.000	0.95	0.29	0.2157	0.94110

BET SURFACE AREA: 2.09 +/- 0.14 m^2/g
SLOPE: 1.4436 +/- 0.1382
INTERCEPT: 0.6344 +/- 0.0219
C: 3.28
Vm: 0.48 cm^3/g
CORRELATION COEFFICIENT 0.9954

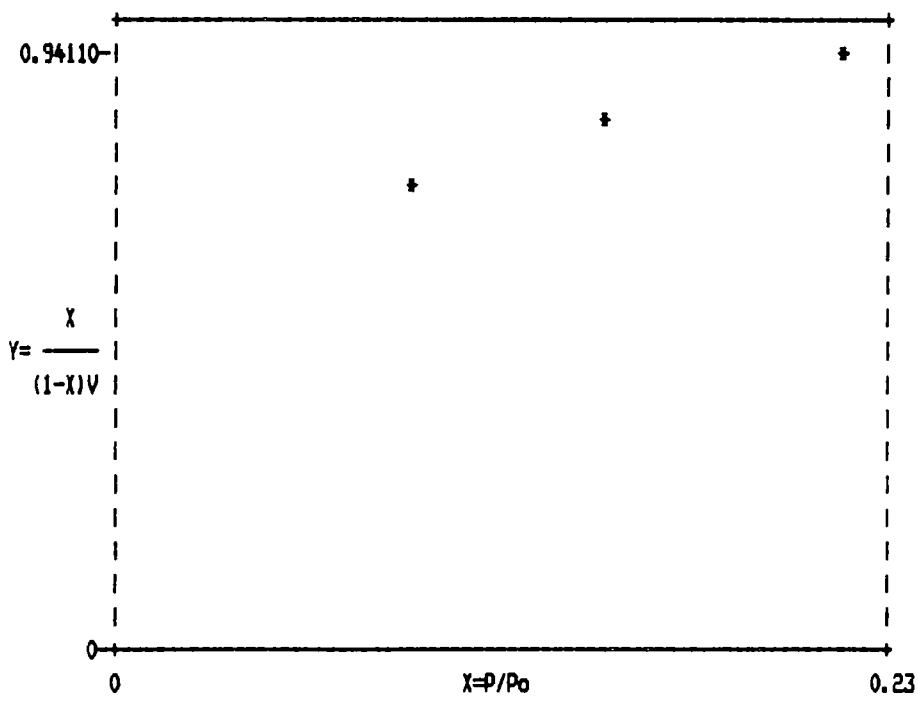

Figure E-2. Plot of BET equation versus relative pressure for Oxygen Sensor A317/1157

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/16/87

SAMPLE I.D.: A316/0205
SAMPLE WEIGHT: 2.7660 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.39	0.14	0.0490	0.36568
8.860	0.63	0.23	0.0869	0.41776
14.900	0.98	0.35	0.1461	0.48298
22.000	1.36	0.49	0.2157	0.55949

BET SURFACE AREA: 2.98 +/- 0.08 m^2/g
SLOPE: 1.1495 +/- 0.0368
INTERCEPT: 0.3134 +/- 0.0051
C: 4.67
Vm: 0.68 cm^3/g
CORRELATION COEFFICIENT 0.9990

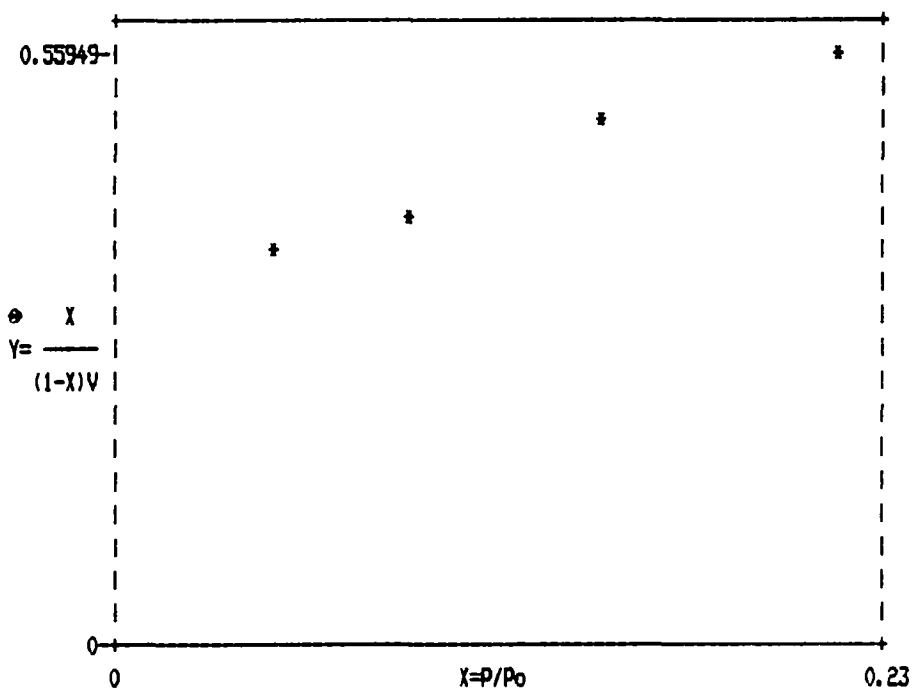

Figure E-3. Plot of BET equation versus relative pressure for Oxygen Sensor A316/0205

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/16/87

SAMPLE I.D.: A334/1502
SAMPLE WEIGHT: 4.0128 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
5.000	0.15	0.04	0.0490	1.37934
8.860	0.25	0.06	0.0869	1.52731
14.900	0.40	0.10	0.1461	1.71667
22.000	0.57	0.14	0.2157	1.93664

BET SURFACE AREA: 0.96 +/- 0.02 m^2/g
SLOPE: 3.3097 +/- 0.0990
INTERCEPT: 1.2281 +/- 0.0138
C: 3.69
Vm: 0.22 cm^3/g
CORRELATION COEFFICIENT 0.9991

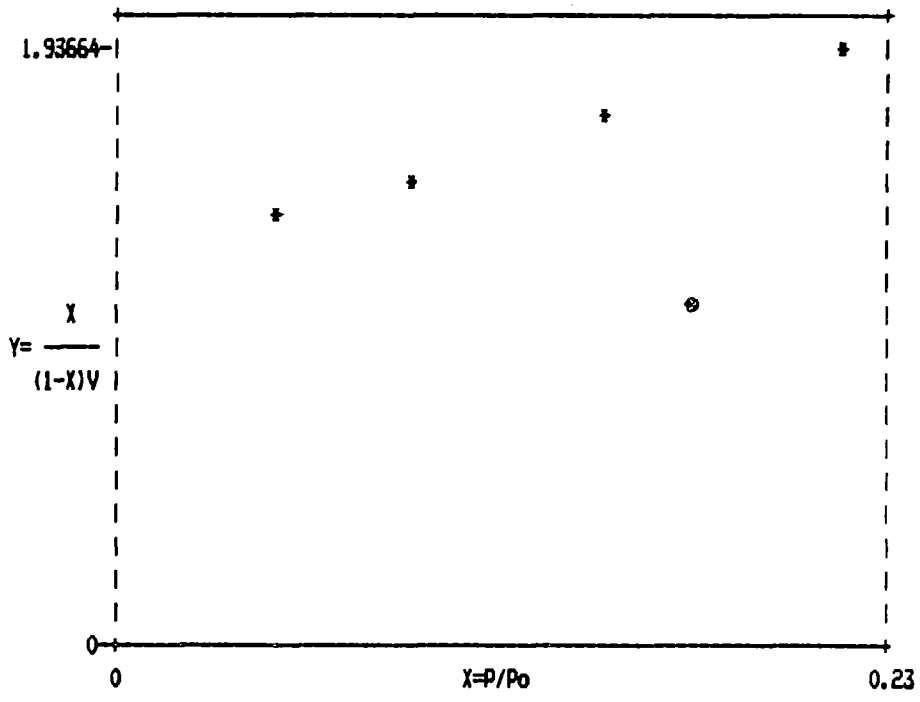

Figure E-4. Plot of BET equation versus relative pressure for Oxygen Sensor A334/1502

MICROMERITICS INSTRUMENT CORPORATION
FlowSorb 2300

BET SURFACE AREA ANALYSIS
REPORT DATE: 9/16/87

SAMPLE I.D.: A310/0298
SAMPLE WEIGHT: 2.7919 g
MOL. CROSS-SECTIONAL AREA: 0.162 nm^2
SAMPLE TEMPERATURE: 0.00 C

ADSORBATE: Nitrogen
BAROMETRIC PRESSURE: 760 mmHg
SATURATION PRESSURE: 775 mmHg

EXPERIMENTAL DATA (%)	(VOL)	VOL ADSORBED (cm^3/g AT STP)	X=P/Po	Y=X/[(1-X)V]
8.860	0.41	0.15	0.0869	0.64794
14.900	0.61	0.22	0.1461	0.78319
22.000	0.84	0.30	0.2157	0.91432

BET SURFACE AREA: 1.72 +/- 0.08 m^2/g
SLOPE: 2.0619 +/- 0.1146
INTERCEPT: 0.4734 +/- 0.0182
C: 5.36
Vm: 0.39 cm^3/g
CORRELATION COEFFICIENT 0.9985

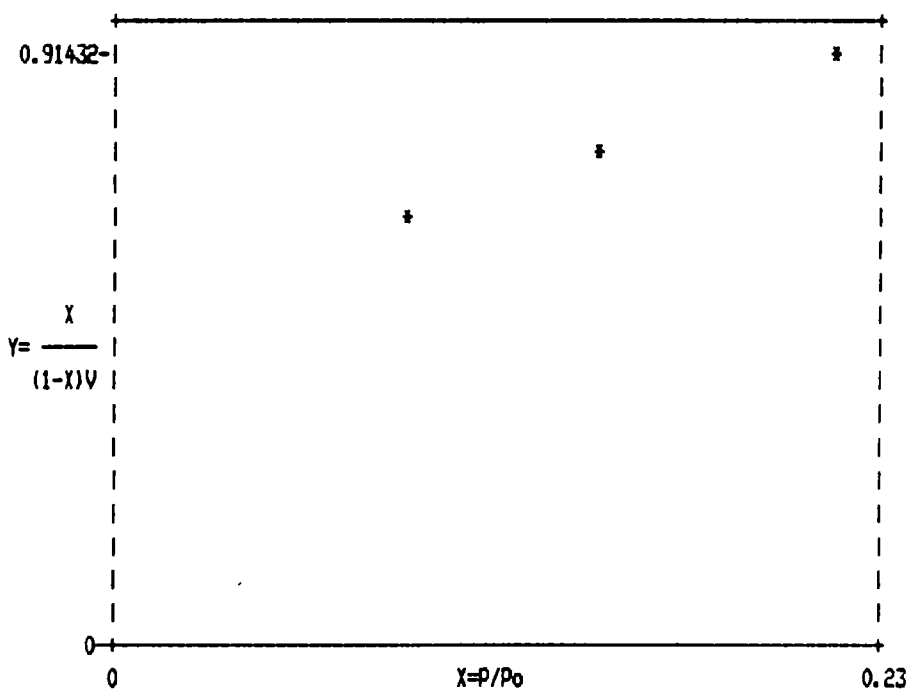

Figure E-5. Plot of BET equation versus relative pressure for Oxygen Sensor A310/0298