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Project Summary

Measurement and Prediction of the Resistivity of Ash/Sorbent Mixtures Produced by Sulfur Oxide Control Processes

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The report gives results of research into the measurement and prediction of the resistivity of ash/sorbent mixtures resulting from processes intended to remove sulfur oxides from the flue gas produced when burning medium- to high-sulfur coal. It was found that the usual method for measuring the resistivity of coal fly ash samples must be modified to obtain accurate and repeatable values for the resistivity of these mixtures. The high resistivities of the mixtures appear to be due to the quite high resistivities of the sorbent compounds they contain. This research indicated that, if analytical difficulties can be overcome, it should be possible to predict the resistivity of an ash/sorbent mixture based on a knowledge of the amounts of calcium compounds contained in the dust.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Furnace and cold-side sorbent injection processes under development for controlling sulfur oxide (SO_x) emissions at coal-fired power plants result in a dust which consists both of coal fly ash and partially spent sorbent material. This means that the dusts produced with these technologies will be physically different from ordinary fly ash. The presence of the sorbent material also causes the resistivity of the mixture to be much higher than that of the fly ash alone. Since most sites being considered for retrofit installation of these control processes have small electrostatic precipitators, such high resistivity dusts will probably be quite difficult to collect.

Resistivity Measurements

The usual procedure for measuring the resistivity of coal fly ash yields inconsistent resistivity values and an overall lack of repeatability when applied to ash/sorbent mixtures. This was found to be due to decomposition of calcium hydroxide at temperatures above 300°C. But by limiting the maximum temperature to 250°C and making the measurements using descending temperatures, consistent and repeatable resistivity values were obtained.

Modeling Resistivity

The computer model for predicting the resistivity of fly ash developed by EPA and Southern Research Institute did not work for these mixtures. This was attributed to the physical difference of ash/sorbent mixtures from fly ash. In particular, the existing computer model predicts resistivity primarily on the basis of the amount of alkali metal ions (primarily those of sodium and lithium) in the fly ash. But charge transference tests did not identify any migrating species in the ash/sorbent mixtures, indicating that the alkali metal ions do not play a primary role in charge conduction in these mixtures.

Examining the resistivities of reagent grade calcium compounds thought to be present in the mixtures showed that these resistivities were quite high. This indicated that the resistivity of an ash/sorbent dust might be determined by the resistivity of one or more calcium compounds contained in the dust. Multiple regression analyses found that the resistivity of a mixture was strongly correlated with the resistivity of one or more sorbent compounds. Attempts to correlate the resistivity of these complex mixtures with the amount of sorbent compounds determined by chemical analysis of the sample were generally unsuccessful. However, similar attempts with less complex samples consisting only of sorbent exposed to SO_x were much more successful. This indicates that the procedure used to determine the amounts of calcium compounds within the ash/sorbent mixtures may not have been adequate. Therefore, the research described here indicates that the approach used to predict the resistivity of ash/sorbent samples should work if an accurate method of determining the chemical composition of the mixtures can developed.

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The complete report, entitled "Measurement and Prediction of the Resistivity of Ash/Sorbent Mixtures Produced by Sulfur Oxide Control Processes," (Order No. PB92-126812/AS; Cost: $19.00, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
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