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Waste Vitrification Through Electric Melting

Ferro Corporation

Technology Description: The objective of vitrification technology is to convert contaminated soils, sludges, and sediments into an oxide glass, rendering them suitable for landfilling as a nonhazardous material. The technology uses joule heating to melt the waste matrix, destroying organic compounds in the process, and encapsulating the inorganic constituents in a leach resistant form.

Figure 1 shows a schematic of the process. An oxide glass mixture is mixed with the soil in ratios determined in part by the contaminants to be vitrified. The glass mixture acts as a fixation medium and facilitates the flow of current between the electrodes until the soil reaches a temperature and viscosity sufficient to conduct the current and produce melting. As the thermal gradient approaches organic materials, these materials vaporize. The cold layer of feed at the top of the melter acts as a counterflow scrubber condensing volatiles and keeping them in the melting process. Combustion products escaping the melt are processed in an off-gas collection system.

Waste Applicability: Vitrification stabilizes inorganic components found in hazardous waste. The high temperature involved in glass production (about 1500°C) decomposes anthracene, bis(2-ethylhexyl phthalate) and pentachlorophenol in waste. The decomposition products can easily be removed from the low volume of melter off-gas. The technology can be applied to soil, sludges, and sediments.

Test Results: Several glass compositions were developed for vitrification of soils contaminated with organic and inorganic components. Ten replicates of the glass were processed from EPA synthetic soil matrix (SSM) and glass making materials, and subject to Toxicity Characteristic Leaching Procedure (TCLP) testing. SSM and glass making additives were processed in a laboratory-scale unit at temperatures of 1500-2000°C. Materials were processed at the rate of 17 lb/hr. The laboratory melter was operated in a variety of electrode configurations with an energy usage of 3.3 to 3.5 kilowatt hours per kilogram of material processed. The feed was composed of 67% soil and 33% glass making additives. During these tests, measurements were taken to monitor the process and assess the quality of the vitrified product. The results of the TCLP Analyses for these replicates are presented in Table 1.

The results of this study show that the Ferro Corporation waste vitrification technology was able to:

1) utilize glass compositions tailored to the waste being treated to vitrify hazardous soils and sludges,

2) produce a vitrified product that can pass TCLP requirements for the release of seven toxic, inorganic components,

3) continuously produce the target glass composition from an input of typical soils contaminated with organic and inorganic species, plus glass making materials.

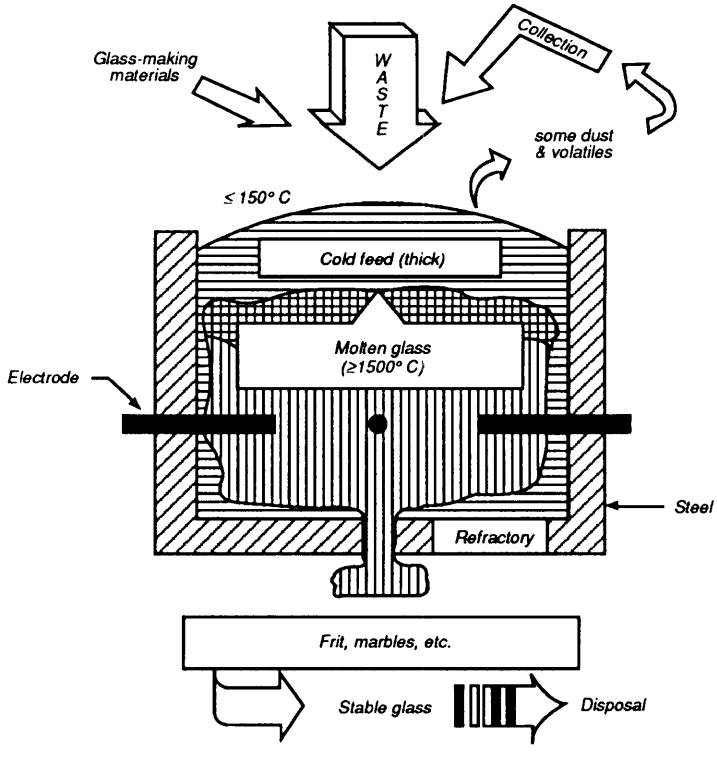

Figure 1. *Electric furnace vitrification.*

Table 1. TCLP Analyses Results

Metal	TLCP Analyte Concentration, ppm	
	Remediation Limit	Mean of Glass Replicates
As	5	<0.100
Cd	1	<0.010
Cr	5	0.019
Cu	5	0.355
Pb	5	0.130
Ni	5	<0.010
Zn	5	0.293

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