

**ELECTRIC ARC FURNACE VITRIFICATION:
COOPERATIVE RESEARCH AND DEMONSTRATION TRIALS
CONDUCTED BY THE U.S. BUREAU OF MINES**

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ABSTRACT

Utilizing years of experience from conducting pyrometallurgical research for the minerals industry, U.S. Bureau of Mines scientists conducted waste vitrification tests in a small, 800-kVA, industrial-scale electric arc furnace facility at its research center in Albany, Oregon [now part of the U.S. Department of Energy, (DOE)] in cooperation with industry and other governmental agencies. The thermal treatment facility is capable of melting a wide range of wastes at feed rates up to 2,000-lb/h (900-kg/h) in full compliance with environmental regulations. Waste materials that have been melted during 16- to 100-h demonstrations include municipal waste combustion residues, simulated mixed TRU-contaminated wastes from DOE sites, and a variety of organic and inorganic wastes containing up to 90-pct combustibles. Summaries of the various melting trials conducted at the facility are presented and current research investigations are described.

INTRODUCTION

For many years pyrometallurgical research was conducted at the U. S. Bureau of Mines (USBM) using many different furnaces and a wide range of feed materials furnished by the ferrous, nonferrous, and nonmetallic mineral industries. This experience provided invaluable insight for conducting research in new environmental technologies. In addition to extensive furnace capabilities, the Bureau had the necessary mineral processing and feed preparation facilities as well as comprehensive analytical laboratories for conducting elemental analyses and mineral characterizations. Over the years, the electric arc furnace (EAF) evolved into a mainstay of the minerals industry; and the Bureau demonstrated, at commercial scale, that EAFs can dependably melt wide varieties of feed materials under vastly different operating conditions.

In October 1995, the Secretary of Interior negotiated with the

House Appropriations Committee to abolish the Bureau of Mines in order to save other Interior programs from funding cuts. The abolishment was completed in January 1996, with Albany Research Center (ALRC) programs being turned over to the DOE. The ultimate fate of the vitrification research program is uncertain as of this writing; this report is a summary of the work as it was conducted by the Bureau.

The Bureau assembled a small, industrial-scale (800-kVA), EAF waste treatment facility at ALRC in response to a need identified by the American Society of Mechanical Engineers (ASME) Research Committee on Industrial and Municipal Wastes; i.e., to develop reliable engineering data for vitrifying residues generated by municipal waste combustion facilities. In 1990, a cooperative agreement was signed by the USBM and the ASME to conduct vitrification demonstrations using EAF technology, and over 30 corporate and Government sponsors agreed to fund these studies. After the major sponsors committed funds, a meeting was held at the ALRC to plan details for conducting a 100-h, continuous residue vitrification demonstration and to determine what modifications would be required to existing EAF equipment at the facility. Participants included industry and government researchers, environmental regulators, U. S. and European furnace manufacturers and operators, solid waste industry professionals, engineering consultants, and academics. These participants represented a broad range of interests and concerns, and contributed greatly to both the EAF facility design and the overall vitrification test plan. Residues from five municipal waste combustion systems were selected to be vitrified during one continuous demonstration; however, limited project funding placed major constraints upon the desire to maximize the experimental design to suit the wishes of all the program sponsors. (Oden and O'Connor, 1994)