R & D facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Process Development

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Electric Arc Furnace Research Facility

The electric arc furnace (EAF) research facility located at the NETL site Albany, Oregon, has a 50 year history of pyrometallurgical research into primary smelting, steelmaking, waste treatment, and recycling. The EAF research facility includes a unique set of furnaces sized from bench to pilot-scale.

The furnaces include:

- 50 kW, single-phase AC, tilting-shell
- 300 kW, single-phase AC, tilting-shell EAF
- 0.8 MW, three-phase AC, static-shell EAF
- 1.0 MW, three-phase AC, tilting-shell steelmaking EAF

Case Histories Melting (Vitrification)

- Simulated low-level radioactive wastes
- Cr- and Pb-contaminated soils
- Dredging spoils
- Coal boiler bottom ash
- Mineral wool

Metal tap from 1.0 MW three-phase AC EAF

Smelting

- Primary Fe, Cr, Ni & Ti ores
- Zn smelter wastes
- Aluminum potliner
- PGM-bearing catalyst wastes
- Silicon smelting

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Iron/Steelmaking

- Cast iron scrap
- Steel scrap
- Steel casting consolidation

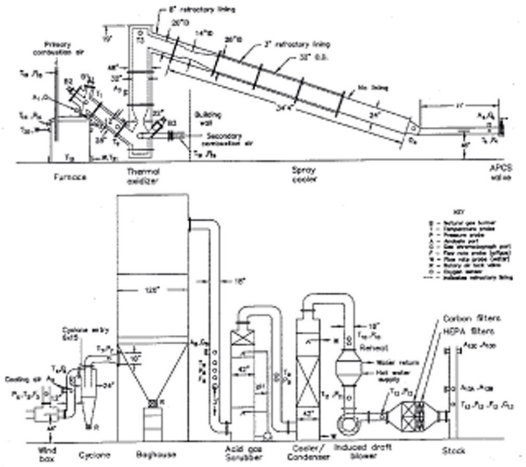
Top view of silicon smelting furnace

A fifth EAF was built in the last year for silicon smelting. This furnace is a 150 kW, single-phase AC, static-shell EAF, and utilizes a single top electrode with a carbon (graphite) hearth acting as the anode or second electrode. The silicon smelting furnace is scaled for a production rate of approximately 5 kg Si per hour. Addition of a rectifier on the secondary side of the transformer could convert the furnace to a DC configuration, without changing the electrode and hearth design.

The 0.8 MW EAF is a dual-purpose smelter/melter, and has been used for several pilot-scale demonstrations in both modes of operation. The furnace is sealed and can be kept at a slight negative pressure for environment control. The system includes continuous feeding by metered screw conveyors, and a dedicated air pollution control system, including a close-coupled thermal oxidizer, with particulate and acid gas control.

Emissions monitoring can be conducted by gas chromatograph and individual gas analyzers on both of the pilot-scale EAF. Gases analyzed include C_2H_6, CH_4, CO, CO_2, H_2, O_2, NO_x, and SO_2.

Much of the work conducted at the NETL EAF research facility has been funded through Cooperative Research and Development Agreements (CRADA) and Contributed Funds-In Agreements. These agreements have included both industry and federal agency partners. The scale and variety of furnaces available make the facility a unique research and development tool for the U.S. Department of Energy.



Schematic of 0.8 MW EAF system

Metal tap and 0.8 MW EAF system