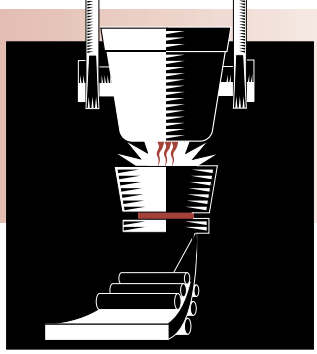
STEEL

Project Fact Sheet



Improving Refractory Service Life and Recycling Refractory Materials in Electric Arc Furnace Steel Production

Benefits

- Reduction in refractory consumption per ton of steel produced
- Economic reuse of material
- Two percent energy efficiency improvements per ton of steel
- Decrease in furnace downtime
- Less spent refractory in landfills

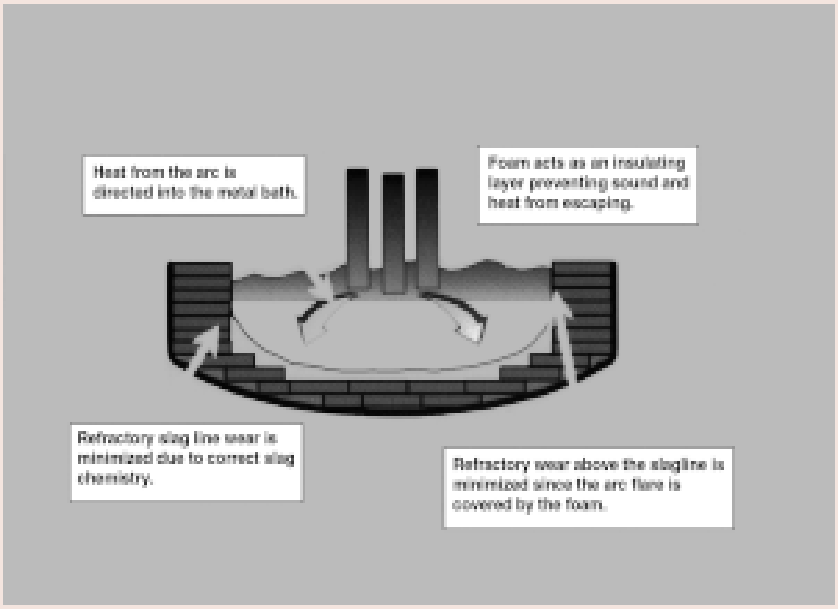
Applications

Information from refractory modeling and control of the slag foaming process in an electric arc furnace will allow an electric arc steel producer to: 1) better control the slag foaming process through science rather than guesswork; 2) base refractory material selection on wear projections; 3) predict the outcome of electric arc furnace process changes on refractory wear; and 4) identify reuse options for spent material.

Electric arc furnaces have the highest refractory wear of steel production furnaces

Traditionally, users of refractories have chosen the best refractory liner material for slag and wear resistance. Steel makers have emphasized the minimization of refractory repair costs, flux additions, and downtime for repairs. This research is directed at improving refractory service life in the electric arc furnace through: 1) integration of electric arc furnace data and experiments into models; and 2) maintaining better control of slag chemistry and the slag foaming process to maximize refractory service life in addition to achieving desired metallurgical goals, noise suppression, and energy savings. Refractory consumption averages two pounds per ton (0.8 kilograms per metric ton) of steel for brick and nine pounds per ton (4.5 kilograms per metric ton) for gunned repair materials. Upon removal from service, spent refractory materials are typically disposed of in landfills. Although disposal of spent refractories represents a minor cost consideration in current steel production, growing concerns exist regarding future environmental regulations, liability, landfill space, and cost. This project evaluates electric arc furnace data refractory waste streams to identify reuse/recycling opportunities.

Control of Slag Foaming



Improved refractory service life through better control of slag foaming.

Project Description

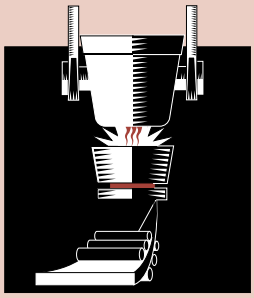
Goal: Increase life of refractory materials by developing a "what if" model based on both experimental data and furnace experience. This project will also identify reuse applications for spent refractories.

The performance of refractories is critical to the profitable manufacture of steel. Improving the service life of refractory materials will reduce furnace downtime, allowing an electric arc furnace more "on-line" time for steel production. The focus of improved refractory service life will be through control of the slag foaming process and through modeling and predicting refractory wear. By improving refractory service life through control of slag foaming and wear modeling, other benefits such as lower energy consumption per ton of steel produced and reduced refractory waste per ton of steel produced will be achieved. The research will also identify applications for spent refractories. This will minimize the materials needing costly landfill disposal.

A team of refractory producers, steel producers, processors of steelmaking wastes, and researchers from university and government laboratories with an interest in improving refractory performance will evaluate refractory materials exposed to steelmaking slag/metal/atmosphere environments for chemical, physical, and microstructural changes. This information, along with modeling and control of the slag foaming process, will be used to improve the service life of refractory materials and to model refractory wear. The electric arc furnace will be treated as a complex interaction of material and cost considerations involving slag, metal, and refractory material. As a part of this program, ways to utilize spent refractory materials will be investigated, with emphasis on furnace applications such as refractory repair materials and on slag conditioners.

Progress and Milestones

- Project start date, October 1997.
- Spent refractory materials from a number of steel producers are being evaluated. Information for other participating steel producers that are members of the Steel Manufacturers Association is also being gathered.
- Potential applications for spent refractory materials are being evaluated.
- Computer models are being designed to predict refractory wear based on industrial experience and actual/predicted data.
- Computer models are being designed to predict and control slag foaming in the electirc arc furnace during steel melting.
- Model input data for slag foaming is being generated.
- Model is being tested in a commercial electric arc furnace.
- Project completion date, September 2001.



Project Partners

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Argonne National Laboratory
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Baker Refractories
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Chaparral Steel
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May 2001