9742 Removal of Residual Elements in the Steel Ladle

Benefits

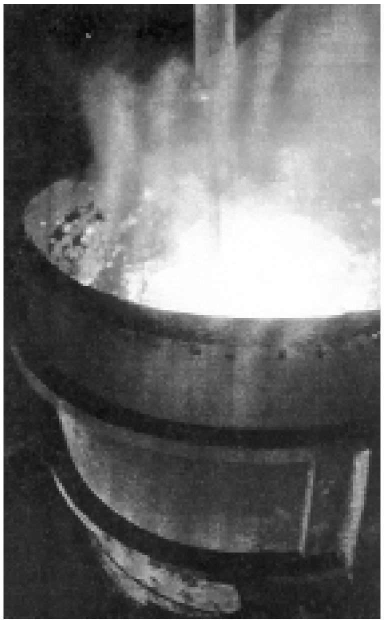
- ❖ Provide a method to remove/control undesirable residual elements, such as tin, contained in the steel ladle, thereby increasing the flexibility of charge materials into the steelmaking furnace.
- ❖ Increase the amount of steel scrap that can be recycled, thereby improving the environment and reducing steelmaking costs.
- ❖ Provide a method to improve the quality of steel contained in the steel ladle, thereby increasing its potential applications.

Applications

Through successful development, the Removal of Residual Elements in the Steel Ladle project will develop a model of the deep injection process in combination with absorption of reaction products by the top slag in the steel ladle. The model development promises to provide an operational method and control capability for improving the quality of molten steel contained in the steel ladle. The added control/removal capability could be adopted by existing and planned ladle metallurgy stations.

Development of the deep injection process control model will improve steelmaking flexibility and steel quality

The U.S. Department of Energy is partnering with the steel industry to develop processes to improve steel production efficiency. The steel industry uses scrap and other recycled materials, in addition to iron-ore based metallic materials, to produce molten steel for downstream processing. A good portion of the undesirable residual elements in liquid steel can originate from the recycled materials. Careful selection of charge materials to the steelmaking furnace is necessary to minimize and control these residual elements at acceptable levels. Steelmaking furnaces currently produce about 100 million tons of liquid steel that is all handled via steel ladles for further processing. The total annual value of steel handled by steel ladles is approximately $50 billion. Developing methods to improve the consistency and efficient operation of the steelmaking furnaces is of unquestioned value to the steel industry. Control of the quality of molten steel delivered by steel ladles is an extremely important requirement for profitable steel mill operations. Consistent delivery of the molten steel free from undesirable residual elements is a key requirement.



Removal of residual elements from molten steel will lead to greater efficiency and productivity.

The Development of the Deep Injection Model (continued)
The project will employ calcium injection to ensure an extremely low local oxygen potential and rapid reaction kinetics, in combination with a top slag to absorb the reaction products and hold those products without any significant reversion back to the steel bath. The focus of this work will be on feasibility of tin removal and ultimately to develop a process that will allow a greater portion of scrap with tin content to be used for steel production.

This project aims to: 1) develop a method to remove/control undesirable residual elements, such as tin, contained in a steel ladle, thereby, providing flexibility of charge materials into the steelmaking furnace; 2) increase recycling of steelmaking metallic materials, thereby improving the environment and reducing steelmaking costs; and 3) provide a method to improve the quality of steel contained in the steel ladle, thereby increasing its potential applications.

Project Description
Goal: There are two primary objectives of this project: 1) to develop a process model from experimental kinetic data from injection experiments and information gathered on the rate of reversion from the top slag; and 2) to propose steel mill field tests, based on the results of studies carried out, to demonstrate the process capability.

Progress and Milestones
- Equipment assembly for reversion tests with tin has been completed and shakedown tests of the equipment are underway.
- Setting up and testing of equipment to conduct injection studies in small-scale melts under vacuum are underway.
- Field testing at a steel mill was performed and will be followed by broad-based dissemination of results through the Iron and Steel Society conference and a detailed final report submitted on November 26, 2001.

Total Project Cost/Duration
$365,000/45 months.

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