ENHANCED INCLUSION REMOVAL FROM STEEL IN THE TUNDISH

DEVELOPMENT OF AN INCLUSION FILTERING SYSTEM WILL HELP THE U.S. STEEL INDUSTRY PREPARE FOR THE FUTURE

The U.S. Department of Energy is collaborating with the U.S. steel industry to develop an effective filtering system for significant reduction in the inclusion content, both in terms of size and amount, of the steel exiting from the tundish. The successful development of the system and its application to the continuous casting operation in the steel industry would result in improved steel product and better productivity from the continuous casting operation.

APPLICATIONS

The technology has the potential for application to the 100 million tons/year continuous casting operations through a retrofit modification of the currently used tundish designs. Even a small improvement in the quality and cost of steel could result in major overall benefits.

BENEFITS

- Improved properties and quality of steel by significant reduction or elimination of inclusions
- Reduced steel production costs through reduced pouring nozzle clogging and improved hot working capability of steel

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Liquid steel flows from the ladle into the tundish.
Project Description

Goal: To determine the potential for delivery of molten steel with significantly reduced inclusion content from the tundish to the continuous casting mold.

The project will have three major areas of investigation: 1) modifying a commercially available Computational Fluid Dynamics (CFD) code for the specific flow conditions of the project; 2) modeling dispersed liquid metal/particle turbulent flow in corrugated channels; and 3) preparation of corrugated channels and their evaluation at laboratory scale and field testing in sponsoring steel companies’ tundishes.

The overall time required for the project is estimated to be 5 years from start date, June 1998.

Progress and Milestones

This project has focused on the following:
- Project start date, May 1998.
- Literature review and examination of MgO and Al₂O₃ reactions to form spinel has been completed.
- The bonding of spinel forming powders to a 70% alumina castable used in the tundish is being examined.
- Flow through a submerged entry nozzle is being simulated.
- Project review meeting planned for May 2000.
- A computational model is being developed to calculate trajectories of inclusion particles.
- Several models are being developed.

Future major milestones:
- Completion of laboratory scale testing, September 2002.
- Completion of initial field testing and adjustments to model, March 2003.
- Completion of testing in steel tundish, June 2003.
- Final project report, end of June 2003.
- Project completion date, June 2003.

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