

The Continuous Casting Mold and Steel Cleanliness

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Inclusions in steel cause many problems in the final products, such as surface slivers and lower fatigue life. Inclusions arise during steelmaking, ladle refining, casting, and transfer operations, and come from many different sources, including reoxidation and slag entrainment. Research conducted through the Continuous Casting Consortium has shed light on many of those mechanisms that occur during the continuous casting process, by combining computational models with laboratory and plant measurements. Fluid flow in the mold greatly affects inclusion entrapment, which can lead to both internal and surface defects. Eleven different mechanisms have been identified for slag entrainment alone. Computational models of transient turbulent flow in the liquid pool are applied to predict the transport and entrapment of particles into the solidifying interface. For example, the application of electromagnetic forces can greatly alter the fluid pattern, leading to fewer surface level fluctuations, less flow penetration, transverse flow across the solidification front, and consequently fewer inclusions, but it can cause unstable flow and worse problems if applied incorrectly. Finally, methods to optimize operations to lessen inclusion entrapment are discussed.

Dr. Brian G. Thomas recently joined the Colorado School of Mines as Professor of Mechanical Engineering and is Director of the Continuous Casting Center, and Gauthier Professor Emeritus at the University of Illinois at Urbana-Champaign. His research efforts focus on computational modeling of the continuous casting of steel. He received his Bachelors of Metallurgical Engineering from McGill University, (Montreal, Canada) in 1979 and Ph.D. in Metallurgical Engineering in 1985 from the University of British Columbia, Canada. He has worked in the Research Departments of Algoma Steel, Sault Ste. Marie, Canada and BHP in Melbourne, Australia. Dr. Thomas has authored or coauthored over 350 papers, and been recognized with numerous awards including 14 best paper awards. He has given over 200 presentations worldwide and co-instructed many short courses to industry, including the annual Brimacombe Continuous Casting Course.