Modeling the Influence of Stool Volume on Flow Behavior and Defect Formation in a 20 MT Steel Ingot

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Abstract.

The mold geometry directly influences the final quality of steel parts made from large cast ingots. During the casting of large steel ingots, changes in mold geometry appear to have a significant impact on reducing defects such as shrinkage cavities, porosity, and piping. In this study, the effect of stool volume was analyzed. A three-dimensional and transient finite element model of a 20 MT ingot was used to predict the liquid steel flow and the evolution of solute transport during the filling and solidification phases. The established multi-domain model was used to simulate the thermal and thermomechanical behavior of the metal during solidification. Two cases, with a stool volume of 32 L and a larger replica of 64 L, were compared and simulated using THERCAST® (FEM) software. The evolution of temperature and liquid velocity inside the ingot was discussed. The simulation results provide a understanding of the influence of the stool on reducing the risk of microporosity formation in the centerline and shrinkage cavities. A correlation was established for the liquid flow between the ingot stool dimensions.

Keywords: Finite Element Modeling, Ingot casting, Stool, Liquid velocity, Microporosity, Shrinkage cavity