Application of a Mixed Fluid/Structure Model for Ingot Casting Simulation and Macro-segregation Prediction

O. JAOUEN[1], N. POULAIN[2],
J. DEMURGER[3], D. POIRIER[3], M. STOLTZ[3]

[1]TRANSVALOR S.A. 950 avenue Roumanille, 06904 Sophia Antipolis cedex, France
[2]TRANSVALOR AMERICAS, 17 North State Street, Suite 1700, Chicago IL 60602, USA
[3]ASCOMETAL, Centre de Recherche CREAS, BP 70045, 57301 Hagondange Cedex, France

[1] Corresponding author: olivier.jaoeun@transvalor.com – phone: +33 492 92 42 22
[2] nicolas.poulain@transvaloramericas.com - phone: +1 312 348 7615
[3] joelle.demurger@ascometal.com - phone: +33 387 70 73 14
[3] delphine.poirier@ascometal.com - phone: +33 387 70 73 02

ABSTRACT

In the process of ingot casting, multiple considerations related to metal solidification, porosities, segregation and grain structure are definitively of prime concern, as they directly impact the final properties of the subsequent forged or rolled component. This paper focuses on a recent 3D fluid/structure model implemented into the so-called commercial software THERCAST®. The model involves a turbulent fluid flow and the solid constitutive equation. Because of the coupling with the behavior equations, the solidification structure can be accurately modelled as well.

In that context, the French steelmaker Ascometal has conducted FEM simulations based on 3D fluid/structure model to validate the design of larger than usual ingots and to guarantee an optimal quality. Comparisons between experiment and simulation results are presented including central porosities together with the influence of the ingot size over macro-segregation phenomena.