

ADVANCED CASTING SIMULATIONS

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Abstract

Beyond simply identifying shrinkage porosity and filling problems, numerical tools have been further developed to predict stresses, microstructures, defects and to model specific processes that can be used effectively by the foundry early in the manufacturing process to save significant time and cost. More specifically this paper will address the following topics:

- Stress and deformation - what is the final shape of the cast component? What about fatigue life of the die? Can heat transfer variation due to gap formation between the casting and the die be taken into account? Can hot tears defects be predicted?
- Micro and gas porosity - what about the integrity of the part? Can porosity be compensated by graphite expansion? What about the initial gas content in the liquid?
- As-cast mechanical properties-can local mechanical properties be predicted such as yield strength and hardness?

Keywords

FEM, casting simulation, stress, deformation, gas porosity, microstructure, mechanical properties, graphite expansion, ProCAST, QuikCAST.

Introduction

With the generalization of CAD 3D design, the increase of computing performance and now almost 20 years of experience in casting modelling, foundry simulation software have reached a state where a relevant input for the design of a die or a mould can be given to the process engineers. Gating systems, overflows, venting channels, risers can be optimized using numerical simulation. Solidification related defects like hot spots can also be predicted taking into account chills or die cycling so as to accurately reproduce production conditions.

Today, most of the casting simulation packages in the market can handle solidification and fluid flow in the casting with satisfactory accuracy. However, the foundry industry wants to focus on more advanced predictions such as stress and deformation, microstructure determination, as-cast mechanical properties and microporosity indication.