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Numerical Simulation and Experimental Validation of Free Surface Flows during Low Pressure Casting Process

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ABSTRACT

The present work analyzes the free surface flow characteristics during mold filling in a low pressure casting process (LPC) through water model experiments and numerical simulations. The flow patterns visualized through the water analogue experiments using different input pressure sequences have been verified with numerical simulation results for the entire LPC process. The benchmarked numerical model has been further used to study the impact of different in-gate shapes on fluid free surface behavior inside the mold cavity. The mold filling and solidification simulation is then carried out using Magnesium alloy as liquid for the same geometry and the same input pressure profile to highlight the effect of thermo physical properties of actual melts on the free surface flow behavior.

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Key words: water model experiments, free surface flow, numerical simulation, low pressure casting process, FLOW 3D^{TM}.

1. Introduction

The transient behavior of the melt free surface has considerable impact on integrity of the cast components. As per the study on entrainment defects by Campbell (2006), melt surface turbulences lead to entrainment defects which impair the