J Appl Mech Eng 2018, Volume 7
DOI: 10.4172/2168-9873-C1-018



## Simulation of non-Newtonian flow in the shot sleeve of semi-solid die casting processes

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This work deals with a numerical study of the flow of metal in the semi-solid state in the shot sleeve of horizontal die casting machine during the injection process. In the semi-solid state, metallic alloys consist of solid particles suspended in a liquid Newtonian matrix and consequently modeling approaches known from classical suspension rheology can be applied. In the equilibrium state, semi-solid alloys are shear-thinning and different descriptions in the form of material equation are used in literature. In the present work, the Herschel-Bulkley model, which contains a yield stress and a shear-thinning viscosity, was used in order to demonstrate the effect of the nonlinear viscosity to the flow pattern in the shot sleeve. The used numerical model, which considers the problem as two-dimensional, is based on the conservation equations of mass and momentum, and describes the free surface using the volume-of-fluid method. The motion of the plunger is simulated by using a layering dynamic mesh method. The numerical results are obtained by using a computational fluid dynamics (CFD) code that is based on the finite volume method. The influence of different parameters as yield stress, the power law index and the temperature in the flow dynamics is to be discussed. A comparison between a Herschel-Bulkley fluid and a shear-thinning fluid with no yield stress limit is presented.

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