11th. World Congress on Computational Mechanics (WCCM2014)
5th. European Conference on Computational Mechanics (ECCM V)
6th. European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

FLOW PREDICTION IN SEMI-SOLID FORGING PROCESS BY MOVING PARTICLE EXPLICIT METHOD

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Key words: Semi-Solid Forging, Moving Particle Explicit method, short shot experiments, temperature-viscosity dependency, box cavity, high viscous flow

ABSTRACT

Flow behaviour of semi-solid materials is essential to assist the industrial application in Semi-Solid Forging (SSF) technology. From last decade, mesh free methods have grown to simulate high viscous flow pattern with large deformation. In this study, a moving particle explicit method is used to simulate liquid and semi-solid phases of aluminium alloy applied to an impression-die SSF process in a box cavity. Thermal and flow simulation programs based on Lagrangian method are combined considering temperature-viscosity dependency. The morphology of semi-solid material is temperature dependent; it is described by a high viscous model that undergoes plastic deformation. The material flow behaviour in SSF process is investigated for various values of die speed, die temperature, friction and aluminium slurry weight. The deformation characteristics were found in good agreement with the short shot experiments performed. Particularly, the flow pattern corresponding to the die shape and temperature would lead to more accurate prediction of material flow behaviour and required weight to forge the semi-solid material. Further development of the mathematical model and numerical calculation techniques is necessary for flow prediction, die design and investigation of material behaviour when SSF is employed with arbitrary die.

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