



Prediction of Temperature Distribution during Semi-Solid Forward Extrusion by Using Finite Volume Method

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◆ Abstract

Today the development of innovative production technologies has become a major factor in global competition. One of these innovative production technologies in metal forming field is semi-solid forming (SSF). Especially for metals that are difficult to process with conventional technologies, semi-solid metal forming offers the possibility of significant gains in product quality and productivity of the forming process. In current study, one of the most conventional procedures between semi-solid forming processes, i.e. thixo forward extrusion, has been analyzed. In fact this process has been simulated by using the SupperForge software that is based on the finite volume method. As one of the purposed results of simulation, temperature distribution in whole workpiece at different steps of forming process has been studied. Based on simulated process results, temperature distribution can be influenced by different process parameters including on extrusion ratio, die angle and punch velocity.

Keywords: Semi-solid forward extrusion, Temperature distribution, Finite volume method, Aluminum alloys





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Abstract

Today the development of innovative production technologies has become a major factor in global competition. One of these innovative production technologies in metal forming field is semi-solid forming (SSF). Especially for metals that are difficult to process with conventional technologies, semi-solid metal forming offers the possibility of significant gains in product quality and productivity of the forming process. In current study, one of the most conventional procedures between semi-solid forming processes, i.e. thixo forward extrusion, has been analyzed. In fact this process has been simulated by using the SupperForge software that is based on the finite volume method. As one of the purposed results of simulation, temperature distribution in whole workpiece at different steps of forming process has been studied. Based on simulated process results, temperature distribution can be influenced by different process parameters including on extrusion ratio, die angle and punch velocity.

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1 Introduction

According to literature, using semi-solid forming (SSF) causes to save a number of stages in production, to reduce raw materials and energy consumption, as well as to increase productivity and significantly lowers investment costs [1].

In fact in the SSF because of the bonding force of the grain boundary is lower than that in conventional forming processes, its fluidity is good and its flow stress low, hence the applied force can be reduced compared with that of conventional technologies [2].

The processing of semi-solid forming is based on the principles of conventional but the material is processed in the semi-solid state which allows to benefit from the particular properties of semi-sold metals for the forming process [3].

Semi-solid forming or thixofforming processes as conventional forming technologies posses different types such as thixoextrusion, thixoforging, thixocasting and so on.

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