

Numerical Investigation of Material Behavior During Non-Equal Channel Multi Angular Extrusion

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Abstract : The current study uses finite element modeling to investigate and analyze a modified form of the from the conventional equal channel multi-angular pressing (ECMAP), using non-equal channels, on the workpiece material plastic deformation. The modified process non-equal channel multi-angular extrusion (NECMAE) is modeled using two-dimensional plane strain finite element model built using the commercial software ABAQUS. The workpiece material used is pure aluminum. The model was first validated by comparing its results to analytical solutions for single-pass equal channel angular extrusion (ECAP), as well as previously published data. After that, the model was used to examine the effects of different % of reductions of the area (for the second stage) on material plastic deformation, corner gap, and required the load. Three levels of reduction in the area were modeled; 10%, 30%, and 50%, and compared to single-pass and double-pass ECAP. Cases with a higher reduction in the area were found to have smaller corner gaps, higher and much uniform plastic deformation, as well as higher required loads. The current results are mainly attributed to the back pressure effects exerted by the second stage, as well as strain hardening effects experienced during the first stage.

Keywords : non-equal channel angular extrusion, multi-pass, sever plastic deformation, back pressure, Finite Element Modelling (FEM)

Conference Title : ICMME 2015 : International Conference on Mechanical and Materials Engineering

Conference Location : London, United Kingdom

Conference Dates : February 16-17, 2015