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Design and Fabrication of Equal Channel Angular Extrusion Process Analysis for Non-Ferrous Materials

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ABSTRACT

"Equal Channel Angular Extrusion (ECAE)" is a significant method in industrial forming applications, which is the most important method for production of ultrafine grained bulk samples, high plastic strains are introduced into the bulk material without any change in cross section. Equal channel angular extrusion has different die channel angles from which an optimum die channel angle should be identified. So that competent mechanical properties will be obtained from the extruder. This work is focused on the plastic deformation behavior of Al alloys by developing ECAE process and also studied the finite element analysis. For the simulation, the whole ECAE setup was modeled using CATIA and converted into STL file format. The STL files of ECAE imported into DEFORM-3D for simulations. The experiments are performed by fabricating the ECAE tools such as die, punch and billet. A series of experiments were carried out for the die angles of 115°, 125°and 135° and outer corner angle of 6°, billet diameter 9mm and height 70mm was used. A detailed analysis of the strains introduced by ECAP in a single passage through the die is noted. The experiments were conducted by attaching the ECAE tools to the Universal Testing Machine on aluminum alloy. From the experiment and simulation results, load, displacement, and punch force are evaluated and compared with each other.

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