AIMS Materials Science, 6(3): 441–453.
DOI: 10.3934/matersci.2019.3.441
Received: 31 March 2019
Accepted: 29 May 2019
Published: 31 May 2019

http://www.aimspress.com/journal/Materials

Research article

Influence of process parameters on the workability characteristics of sintered Al and Al–Cu composites during cold deformation

Mohammed Nizam Khan[1], Sumesh Narayan[2,*] and Ananthanarayanan Rajeshkannan[2]

[1] School of Mechanical Engineering, College of Engineering, Science & Technology, Fiji National University, Samabula Campus, PO Box 3722, Samabula, Fiji
[2] Mechanical Engineering, School of Engineering and Physics, Faculty of Science, Technology & Environment, The University of the South Pacific, Laucala Campus, PO Box 1168, Suva, Fiji

*** Correspondence:** Email: sumesh.narayan@usp.ac.fj; Tel: +6799332496.

Abstract: An experimental investigation on the process parameters affecting the workability characteristics of sintered aluminium (Al) and aluminium–copper (Al–Cu) composites during cold forging has been carried out. Cylindrical billets of Al, Al–3%Cu and Al–6%Cu with height to diameter ratio (aspect ratio) of 0.45 and 0.9 were cold deformed under three different frictional conditions (nil/no lubricant, graphite lubricant and zinc stearate lubricant). As such, some important process parameters influencing the workability of these composites such as the initial preform geometry and different volume percent of Cu addition to the Al composite preforms on the relative density, R and physical parameters such as stresses affecting the workability stress index, β have been investigated. Also, the effects of the different frictional conditions on the same are presented. It was established that the nil/no lubricant condition and preforms of the lower aspect ratio yielded improved densification, higher values of stresses and better workability. Furthermore, Al–Cu composites were developed to yield better combined properties such as improved densification and workability than monolithic Al. However, the addition of Cu reduced the axial strain to fracture. As such, a decrease in the densification and the workability characteristics was noted with an increase in the volume percent of Cu.

Keywords: workability; composites; cold forging; height to diameter ratio; relative density