J MATER RES TECHNOL. 2018;xxx(xx):xxx–xxx

Available online at www.sciencedirect.com

jmr&t Journal of Materials Research and Technology

www.jmrt.com.br

Original Article

Strain hardening analysis and modelling of its parameters for sintered Al and Al-1%C preforms during cold upsetting

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ARTICLE INFO

Article history:
Received 23 May 2018
Accepted 8 December 2018
Available online xxx

Keywords:
Stress
Strain
Modelling
Composites
Temperature
Lubricant
ANOVA
Upsetting

ABSTRACT

An attempt has been made to model strain hardening parameters for sintered aluminium and aluminium-1%carbon preforms that are subjected to cold upsetting. In addition to compositions, the sintering temperatures and lubricants are considered as variables. The 2k factorial design has been considered to design the experiment and subsequently Yate's algorithm is utilized to construct the model. The model has further been refined using analysis of variance and model adequacy is determined through correlation coefficient which is predicted to follow near unity. Thus, this model can be utilized to predict strain hardening parameters such as strength coefficient, K, and strain hardening exponent, n, subsequently to design the process parameters to inculcate the required strain hardening characteristics within the range of process parameters specifications that are considered in the present investigation.

1. Introduction

Powder metallurgy (P/M) gives several benefits such as near-net shape production, economical and green production, superior properties, improved modulus, strength and creep resistance, hence, every effort towards further improving the strength and other properties of P/M materials is worthwhile [1,2]. The P/M primary process involves blending/mixing, compaction and sintering steps and if necessary for high strength application secondary deformation process is taken. One of the most common secondary deformation process is open die cold forging process [3,4]. The purpose of the secondary deformation process is to reduce the porosity levels in the preforms after the primary P/M process. The cold upsetting depends on many factors of which sintering temperature, composition and frictional conditions (lubricants) are taken for the analysis in the current study. The cold forging of Al/SiC composites having 5–13 weight percent of reinforcement and varying geometry was studied by Verma et al. [5]. They reported that the deformation characteristics as well as formability increased with increasing reinforcements in the

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https://doi.org/10.1016/j.jmrt.2018.12.009

Please cite this article in press as: Ananthanarayanan R, et al. Strain hardening analysis and modelling of its parameters for sintered Al and Al-1%C preforms during cold upsetting. J Mater Res Technol. 2018. https://doi.org/10.1016/j.jmrt.2018.12.009