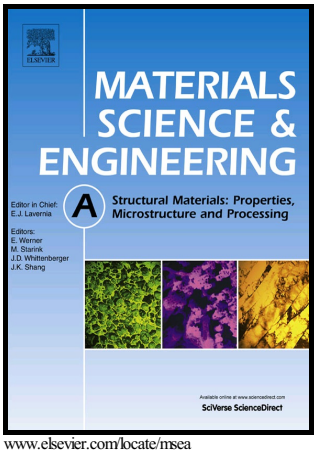
Solution treatment: A route towards enhancing tensile ductility of SiC_p/6061Al composite via powder thixoforming and comparison of micromechanical strength modeling

X.Z. Zhang, T.J. Chen



www.elsevier.com/locate/msea

PII: S0921-5093(17)30560-9
DOI: http://dx.doi.org/10.1016/j.msea.2017.04.090
Reference: MSA34991

To appear in: *Materials Science & Engineering A*

Received date: 2 November 2016
Revised date: 31 March 2017
Accepted date: 22 April 2017

Cite this article as: X.Z. Zhang and T.J. Chen, Solution treatment: A route towards enhancing tensile ductility of SiC_p/6061Al composite via powder thixoforming and comparison of micromechanical strength modeling, *Material Science & Engineering A,* http://dx.doi.org/10.1016/j.msea.2017.04.090

Solution treatment: A route towards enhancing tensile ductility of SiC_p/6061Al composite via powder thixoforming and comparison of micromechanical strength modeling

X.Z. Zhang, T.J. Chen*

State Key Laboratory of Advanced Processing and Recycling of Nonferrous Metals, Lanzhou University of Technology, Lanzhou 730050, China.

chentj1971@126.com
chentj@lut.cn

*Corresponding author. Tel.: +86 931 2976573; fax: +86 931 2976578. (T.J.Chen).

Abstract

In this study, SiC particles (SiC_p) with a mean size of 6.94μm were well dispersed in the 10vol% SiC_p/6061Al composite prepared by powder thixoforming that combines the merits of powder metallurgy and thixoforming. The composites had evidently strengthened tensile strength while possessed a low elongation. However, a tailored solution treatment at 560℃ for 6 h can compensate the ductility loss to a large degree (169.2% increment in elongation as compared to the as-fabricated composite) besides an acceptable increment in tensile strength (20% and 67.2% increments in ultimate tensile strength and yield strength, respectively), due mainly to the improved ductile matrix and the enhanced interfacial bonding strength resulting from the disappearance of eutectic phases. According to the comparison results of the existing micromechanical strengthening models, the strength increments resulting from load transfer mechanism and solid solution strengthening contributed most to the yield strength, revealing the significance of SiC_p addition and solution treatment. However, the strengthening efficiency of SiC_p was largely affected by their failure fraction during tensile test and the model that was previously proposed by the authors had a better agreement with the experimental results than the other models. These results not only provided a pathway to achieve high strength SiC_p/6061Al composites with enhanced ductility, but also shed light on a more reasonable model for the strength prediction of solutionized composites.