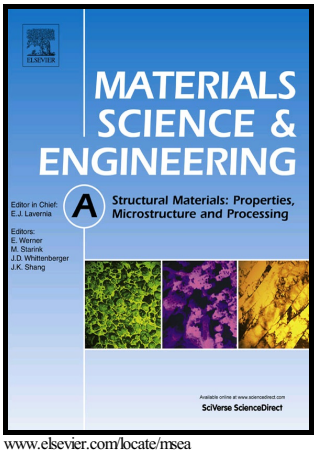
Investigation on microstructure development and mechanical properties of large-load and low-speed friction stir welded Cu-30Zn brass joint

Nan Xu, Qining Song, Yefeng Bao



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Nan Xu*, Qining Song, Yefeng Bao

College of Mechanical and Electrical Engineering, Hohai University, Changzhou 213022, China

*Corresponding author: Tel & fax: +86-519-85192039; xunan@hhu.edu.cn; xunan20032389@126.com

Abstract:

In this work, 2 mm thick Cu-30Zn brass plates were successfully joined by using large-load and low-speed friction stir welding. Heat-affected zone was eliminated due to the significantly improved thermal cycle. The stir zone exhibited ultra-fine grains, with high fraction of twin boundaries and low dislocation density. Also, several nano-scale twin boundaries were introduced into the stir zone. Grain structure refinement in the weld was attributed to the combination of discontinuous, continuous, geometric and shear-band-assisted dynamic recrystallization mechanisms. Consequently, the stir zone showed excellent strength-ductility synergy compared to that of the severe plastic deformed and the conventional friction stir welded Cu-30Zn brass. A feasible one-step strategy was developed herein, to increase the strength of the friction stir welded Cu-30Zn brass joint, while avoiding ductility loss. Moreover, this study offers a new insight and choice for joining metals or alloys with higher melting points, such as steel and titanium alloys.

Keywords: Brass; Friction stir welding; Recrystallization; Texture; Mechanical properties