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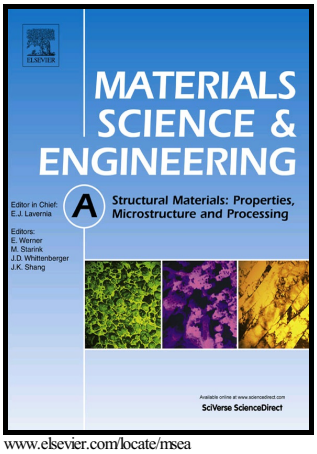

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Grain structure evolution, grain boundary sliding and material flow resistance in friction welding of Alloy 718

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Alloy 718 tubes were subjected to rotary friction welding to understand to the process fundamental and grain structure evolution during welding. The distribution of grain size, low-angle grain boundaries (LAGBs), and twin boundaries throughout the joints were quantitatively analyzed. The weld power, axial load, and weld temperature were monitored. The grain structure evolution during friction welding was clarified. The grain structure in the recrystallization zone (RXZ) of the weld was a result of competition between dynamic recrystallization and grain boundary sliding (GBS), which is controlled by the local deformation condition. The axial force during welding decreased with reducing the rotation rate from 1000 rpm to 500 rpm. This anomalistic phenomenon can be ascribed that a decrease in rotation rate resulted in finer grain size in the RXZ of the weld, which required lower applied force to enable GBS.

Keywords: Superalloy; Recrystallization; EBSD; Friction welding; Power; Axial force

1. Introduction

Alloy 718 is a nickel-based austenitic phase alloy. It can be used to make load-bearing structures at the very demanding conditions as this alloy features high strength at elevated temperatures as well as excellent corrosion, oxidation and creep resistance. Increased amount of these materials are being applied in aerospace, power station and chemical industries. Fusion welding of Alloy 718 may cause problems such as weld liquation related cracking and segregation of alloying elements [1, 2]. These problems can be avoid using solid state welding

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