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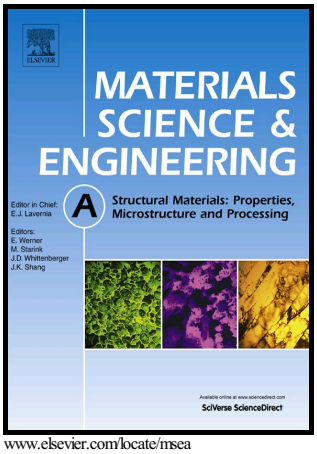

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Abstract

The fatigue properties and life prediction of 2219 friction stir welded joints are studied based on the microstructure-based modeling. The joint macro-micro model containing the crystal characteristics is established. The stress and strain responses of the grains are obtained through the crystalline plastic theory. The phenomena of stress and strain concentration easily appear at the grain boundaries. The maximum average cumulative shear strain is in the weld nugget zone (WNZ). The maximum shear stress appears in the heat affected zone. The lower initial yield shear stress of crystals in the WNZ makes the slip system activation being liable to happen at the WNZ. It is confirmed that the weak area of the joint is the WNZ based on the analysis of the shear strain and stress distributions and the initial yield shear stresses in the joint. The fatigue life is predicted based on the established joint model.

Key words: Friction stir welded joint; Representative volume element; Fatigue property; Crystalline plastic theory; Weak area

1. Introduction

The crystal structure characteristics in the friction stir welded joint have an influence on the mechanical performance of the joint [1-7]. The texture distribution of the weld nugget zone (WNZ) effects the mechanical properties of the friction stir welded (FSW) joint [8-10]. The strain field is not homogeneous in each texture band of the WNZ for AA2050-T3 friction stir welded joint [6]. The weld nugget zone of AA2024-T3 friction stir welded joint has the most high-angle grain boundaries [7].