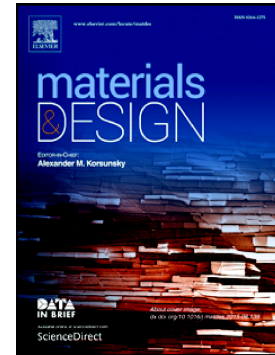


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Microstructure study of cold rolling nanosized *in-situ* TiB₂ particle reinforced Al composites

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Abstract

Nanosized TiB₂ particle reinforced Al matrix composites, cold-rolled at the true strain levels in the range from 0.9 to 3.0, were characterized by scanning electron microscopy (SEM) and electron backscatter diffraction (SEM/EBSD) and transmission electron microscopy (TEM) in order to examine microstructure evolution associated with the different deformed states. Two types of TiB₂ particle-distributions were observed, the majority of TiB₂ reinforcement particles were agglomerated along the grain boundaries forming particle-clusters and the rest was dispersed inside the grains. The TiB₂ particle-clusters were found to improve local grain refinement by locally increasing the density of high angle grain boundaries (HAGBs). The small submicrometer sized Al grains were observed next to the TiB₂ particle-clusters in which dynamic recrystallization mechanism was partially promoted. On the contrary, the presence of the fine TiB₂ particles within the primary coarse Al grains generally led to the reduction of HAGBs by hindering the generation of dislocation cell structures and microshear bands during deformation.

Keywords: Metal matrix composite, Aluminum, Nano TiB₂ particle, Cold rolling, High angle grain boundary, Dynamic Recrystallization

1. Introduction

Particulate-strengthened metal matrix composites (P-MMCs) have been widely used in aerospace, automotive and manufacturing industries due to their remarkable mechanical properties, such as high strength, high hardness and high modulus [1, 2].

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