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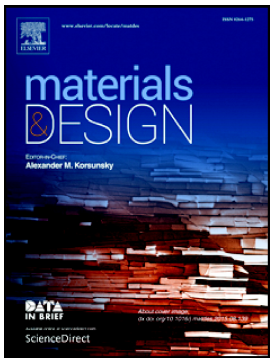


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# Microstructure study of cold rolling nanosized *in-situ* $TiB_2$ particle reinforced Al composites

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## Abstract

Nanosized $TiB_2$ 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 $TiB_2$ particle-distributions were observed, the majority of $TiB_2$ reinforcement particles were agglomerated along the grain boundaries forming particle-clusters and the rest was dispersed inside the grains. The $TiB_2$ 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 $TiB_2$ particle-clusters in which dynamic recrystallization mechanism was partially promoted. On the contrary, the presence of the fine $TiB_2$ 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 $TiB_2$ 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].