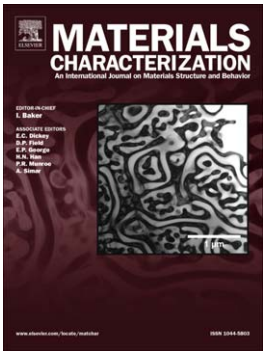

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Characterization and analysis of deformation heterogeneities in commercial purity titanium

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Abstract

The effects of solute oxygen, loading direction and strain level on the microscale plastic strain distribution in representative areas of commercially-pure titanium have been characterized by correlation of high resolution SEM images captured during *in situ* tensile tests. A spatial organization of highly-deformed bands was observed from the early stages of plastic flow and remained nearly unchanged as the materials were strained. The high strains close to grain boundaries were related to intense local slip activity, grain boundary sliding or kink bands formation. The plastic strain field was more homogeneous in the oxygen-rich material, which was attributed primarily to a smaller contribution of grain boundary sliding, due to the presence of hard β phase particles along the grain boundaries.

Keywords: Titanium; Digital image correlation; Strain heterogeneity; Grain boundary sliding; kink bands.

I. Introduction

Titanium and its alloys are widely used for aeronautics and naval construction, as well as for biomedical and dentistry applications, because of their high strength to weight ratio, resistance to corrosion and biocompatibility. Given the low symmetry of the H.C.P crystal structure, grain to grain interactions are especially important and lead to inhomogeneous deformation within the grains and in some cases, to intergranular damage. Despite its