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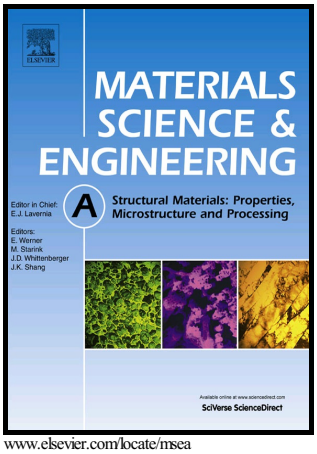

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Effects of concurrent strain induced martensite formation on tensile and texture properties of 304L stainless steel of varying grain size distribution

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Abstract

Ultrafine grained austenitic stainless steel, with two different types of grain size distributions, was studied for tensile deformation behavior. Tensile deformed specimens were analyzed by electron backscatter diffraction using scanning electron microscope. It was found from this study that uni-modal grained stainless steel (SS) having a larger fraction of submicron grains exhibited early fracture, which is attributed to the development of extensive strain localization. On the other hand, the microstructure of SS having bimodal grain size distribution showed a good combination of strength and ductility. EBSD analysis of the deformed region of these two samples revealed the presence of a distinct transition zone between undeformed or less deformed and extensively sheared regions. Multiple micro shear bands were found to be associated with the transition zone of unimodal type microstructure. The micro shear bands seen in the transition zone of unimodal SS led to the development of strain-induced martensite (SIM), which, in turn, is helpful in delaying the strain localization. However, in bimodal grained SS, the larger fraction of micron size grains undergoes a shape change, with a rotation towards [112] orientation, which results in the formation of a larger fraction of SIM having [112] orientation. The propensity for development of high SIM was found to prevent strain localization in bimodal grained SS.

Keywords: Texture; strain induced martensite; shear band; strain localization; grain size dispersion