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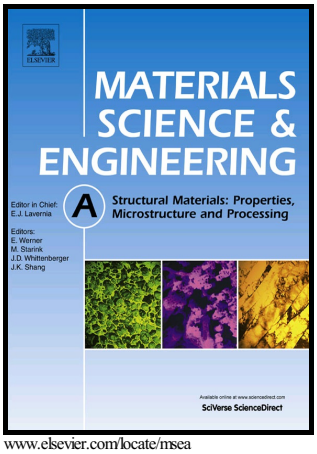

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Enhanced mechanical response of an ultrafine grained Ti-6Al-4V alloy produced through warm symmetric and asymmetric rolling

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Abstract:

An equiaxed ultrafine-grained (UFG) microstructure was successfully produced in a Ti-6Al-4V alloy with an average grain size of 110-230 nm through symmetric and asymmetric warm rolling of a martensitic starting microstructure. The UFG material displayed a combination of ultrahigh strength and ductility at room temperature. Compared with the conventional symmetric rolling, the asymmetric rolling process led to a more pronounced effect of microstructure refinement and a higher tensile ductility. The optimum mechanical response was obtained though the asymmetric rolling at 70% reduction, offering an ultimate tensile strength of 1365 MPa and a total elongation of ~23%. Apart from the magnitude of grain refinement, the inclination of basal texture component from the normal towards the rolling direction during asymmetric rolling and possible strain induced β to martensite transformation may concurrently contribute to a remarkable tensile strength-ductility balance.

Keywords: Titanium alloys; Asymmetric rolling; Grain refinement; Mechanical properties; Crystallographic texture

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