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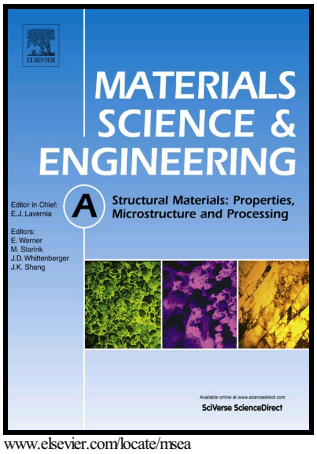

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Biaxial Tension-Torsion Fatigue Behavior of Gradient Nano-grained Pure Titanium Fabricated by Surface Nanocrystallization

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Abstract

A gradient nanostructured surface layer was fabricated in the commercial-purity titanium (Ti) thin-wall tubular sample using the modified surface nanocrystallization (SNC) technique. Biaxial tension-torsion fatigue behavior of the SNC Ti was investigated. The SNC Ti shows significant longer biaxial fatigue lives than the coarse grained Ti (CG Ti) at the same cyclic equivalent stress amplitude. Both CG and SNC Ti display hardening during cyclic deformation, and the hardening level in the SNC Ti is larger than that of the CG one. Microstructural analysis reveals that the SNC Ti shows hierarchical deformation mechanisms in different areas across the wall-thickness of tubular samples during biaxial fatigue. In the nano/ultrafine grain region, the stress-driven nanograin growth is the primary deformation mechanism. In the deformed grain region, the interaction between lamella structure and dislocations is observed. In the coarse grain region, prismatic slip is main deformation mode. The initiation of