

The Effect of Predeformation History Under Complex Loading on the Yield Surface Evolution of Titanium Alloy: An Experimental Investigation

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Abstract: The main goal of this work was to describe the evolution of the yield surface using an experimental investigation dealing with the pre-deformation effects executed by the axial tension and proportional cyclic torsion on tubular specimens. The analysis of material behavior beyond the yield point was supported by the concept of yield surface, in which the description of the initial and subsequent yield surfaces receives special emphasis. The yield surface has been determined by the technique of sequential probes of the single specimen along 17 different strain-controlled paths in the plane stress state. It was found, that for the defined plastic offset strain, as-received specimen exhibits anisotropic behavior that could have resulted from the metal production process or the specimen manufacturing process. Furthermore, the yield surface size of pre-deformed specimen was reduced in all directions, except of that representing axial tension.

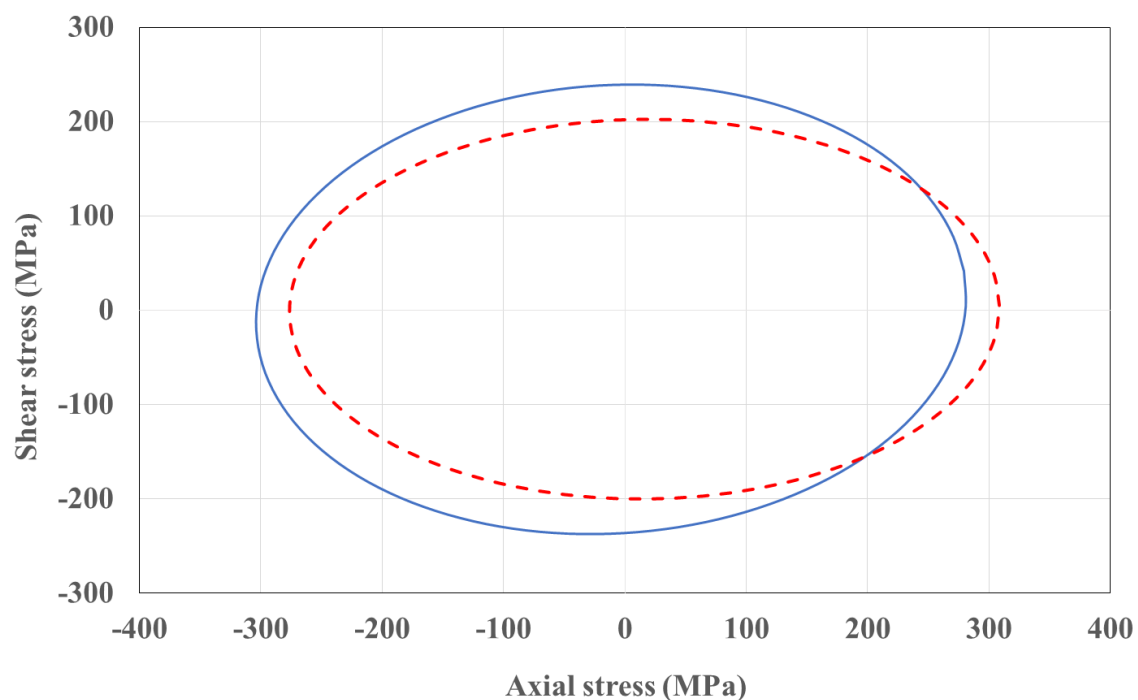


Figure 1. Yield surfaces (1×10^{-4} offset strain) for the pure titanium in as-received state (blue continuous line) and in the pre-deformed state due to simultaneous monotonic axial tension up to permanent strain equal to 1% and proportional cyclic torsion of strain amplitude $\pm 0.4\%$ at 0.5 Hz frequency (red broken line).

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