

Mechanical and Corrosion Properties of TC18 Titanium Alloy under Complex Load

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Abstract The moving parts of titanium alloy and other metal materials under load often fail under the combined action of corrosion and complex load in their working environment during service. At present, the research on corrosion under the coupling of complex mechanical load and environment is mostly carried out under uniaxial stress, and the stress of parts in the service process of aircraft is often multiaxial. Therefore, the stress state of titanium alloy under tension-torsion composite loading is more complicated than that under uniaxial loading, and it is closer to the actual working condition. In this paper, the mechanical and corrosion properties of TC18 titanium alloy under different tension-torsion angles (0 °, 20 °, 40 °) were studied by changing the torsion angle of complex tension-torsion loads. The mechanical properties and corrosion fatigue properties of the alloy were characterized by slow strain rate tensile test, fatigue test, Scanning Electron Microscope (SEM) and metallographic microscope. The corrosion resistance of the alloy was characterized by electrochemical polarization and Electrochemical Impedance Spectroscopy (EIS) test. The results show that in the initial state, the grain arrangement of the alloy is relatively uniform. With the increase of the (pre) tension and torsion angle, the grain morphology changes from regular arrangement to disorder, and the grain boundary shape is elongated and the area decreases. Therefore, the fracture strength of the alloy increases, but the plastic deformation and corrosion fatigue life of the alloy are reduced. With the increase of pre-tension and torsion angle, the corrosion current density and passivation current density of the alloy in 3.5 % NaCl solution increase, and the low frequency impedance and solution resistance decrease, indicating that the corrosion resistance of the alloy decreases.

Keywords Complex load, Tension-torsion angles, Mechanical property, Corrosion

Reference

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