

Evolution and corrosion resistance of passive film with polarization potential on TC18 alloy under simulated marine environment

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Abstract Titanium alloys have been extensively employed in aerospace, marine and automobile industries because of their high specific strength, excellent fatigue performance, and especially good resistance to seawater and marine atmosphere [1, 2]. Usually, a compact and regenerable passive film spontaneously forms on the surface of titanium alloys, which can effectively isolate the titanium alloy matrix from the corrosive medium and provide good protection for the alloy [3]. However, the passivation behavior of titanium alloys is affected by many factors, such as the presence or absence of applied potential [4, 5], and the corrosive environment in which they are exposed [6], etc.

In the present work, to investigate the evolution and corrosion resistance of passive film with polarization potential on TC18 alloy in the marine environment, a 3.5 wt.% NaCl solution was used, and potentials based on the potentiodynamic polarization curve were selected. The surface compositions and corrosion resistance of these polarized specimens were explored, and the effect of applied potential on the corrosion resistance was verified indirectly by AFM, optical microscope, contact angle measuring instrument and molecular dynamics simulation methods. Finally, a schematic diagram of the potential dependence of characteristics of the specimens after polarization in 3.5 wt. % NaCl solution was proposed.

Keywords Titanium alloy TC18, Electrochemical passivation, Passive film evolution, Corrosion resistance, Molecular dynamics

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