

Comparative Study on Corrosion Behavior of 316 Stainless Steel and Ti6Al4V Alloy in Simulated Seawater

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Abstract The present work is a systematic investigation of the corrosion behavior of two materials, 316 stainless steel (316), and Ti6Al4V alloy (Ti6Al4V), in a simulated seawater (3.5 wt.% NaCl solution). This includes electrochemical tests, immersion experiments, scanning electron microscopy (SEM), energy disperse spectroscopy (EDS) analyses. The polarization curves demonstrate that passivation occurs in both alloys. The lower self-corrosion and passivation current densities of Ti6Al4V indicate that its corrosion resistance is superior to that of 316. However, the impedance spectrum of the 316 shows a larger capacitive arc radius, which is indicative of the presence of a more robust passivation film on its surface. The results of the immersion experiments demonstrate that 316 exhibits a high corrosion rate under static conditions, which can be attributed to the instability of the passivation film and environmental factors. However, under dynamic conditions, the corrosion rate is lower due to the effect of scouring. In contrast, Ti6Al4V demonstrated superior corrosion resistance in a variety of environmental conditions. In the context of a simulated seawater, both 316 and Ti6Al4V exhibited varying degrees of corrosion behavior. Consequently, when selecting corrosion-resistant materials, it is imperative to select suitable materials according to the specific use environment and requirements.