Effect of Solution Heat Treatment on Microstructure and Wear and Corrosion Behavior of a Two Phase β -Metastable Titanium Alloy

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A low cost beta titanium (LCB Ti) alloy with a composition of Ti-6.62Mo-4.53Fe-1.45Al-0.14O was subjected to solution heat treatment process at two different temperatures, namely 650 °C and 750 °C. Each heat treated process was followed by ageing at 500 °C for 4 hrs. The obtained microstructures were studied and their influence on the mechanical and chemical properties of the LCB Ti-alloy was reported. The Ti alloy that is heat treated at 650 °C (designated here as alloy I), showed a fine microstructure with 15% volume fraction of fine continuous α -phase at the β -grains. The microstructure of the Ti alloy when heat treated at 750 °C (alloy II) was coarse with 10% of discontinuous α -phase formed at the β -grains. A high tensile strength of 1492 MPa was obtained for alloy I due to its fineness microstructure. However, alloy II recorded a low strength of 1295 MPa due to its coarse α - β microstructure. The uniform corrosion characteristics of alloys I and II was studied in 3.5% NaCl solutions employing Tafel polarization, linear polarization resistance (LPR), and electrochemical impedance spectroscopy (EIS) techniques. The anodic behavior of these materials was also assessed adopting potentiodynamic anodic polarization and chronoamperometry measurements. The corrosion behavior of a spring steel alloy was also included for comparison. Alloy II recorded the highest (superior) corrosion resistance among the tested alloys. Microstructure features and spontaneous passivation of alloys I and II were used to account for their high corrosion resistance, as compared with spring steel.

Keywords: Corrosion, Wear, LCB Titanium alloys, Solution treatment, α -phase.

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