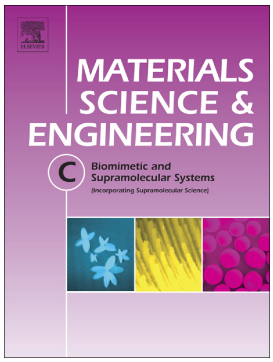

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Investigation of the Wear and Corrosion Behaviors of Ti5Al2.5Fe and Ti6Al4V Alloys Produced by Mechanical Alloying Method in Simulated Body Fluid Environment

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ABSTRACT

In this study, wear and electrochemical corrosion behaviors of the Ti5Al2.5Fe and Ti6Al4V alloys produced with the mechanical alloying method were examined in simulated body fluid environment. Ti5Al2.5Fe and Ti6Al4V powders were produced by grinding elemental powders in the mechanical alloying device for 120 min. The sintered alloys were characterized SEM, XRD, hardness and density measurements. Wear tests were performed in simulated body fluid environment using a pin-on-disk type wear testing device, under three different loads at four different sliding distances with 1 ms^{-1} sliding speed. Corrosion tests were performed using the potentiodynamic polarization technique and a cyclic polarization measurement. The density of the MA'ed Ti5Al2.5Fe and Ti6Al4V alloys respectively was measured as 4.314 g/cm^3 and 4.427 g/cm^3 and its hardness was found as 706.6 HV and 630 HV. Also, it was found dominant α-Ti phase in the alloys' structure. The wear resistance of Ti5Al2.5Fe alloy is higher than that of Ti6Al4V alloy. According to the corrosion test results, the I_{corr} value of the Ti5Al2.5Fe alloy was measured to be 18.24 mA/cm^2, and the I_{corr} value of the Ti6Al4V alloy was measured to be 43.58 mA/cm^2. The corrosion resistance of Ti5Al2.5Fe alloy is higher than that of Ti6Al4V alloy. After corrosion tests, formation of pits of different sizes on the surface of Ti5Al2.5Fe and Ti6Al4V alloys was found to dominate the pitting corrosion mechanism.

Keywords: Corrosion; mechanical alloying; microstructure; Ti5Al2.5Fe alloy; Ti6Al4V alloy; wear.