ABSTRACT

Magnesium alloys are potential biocompatible materials due to their remarkable mechanical properties that are comparable to human bone, excellent bioactivity, and non-toxicity. However, the low corrosion resistance of these alloys limits their use in biomedical applications. In this work, annealing heat treatment was employed to improve the corrosion resistance of the Mg AZ31 alloy. The samples of Mg AZ31 were annealed at 100 °C, 250 °C, and 400 °C for 90 minutes in air using a high-temperature furnace. X-ray diffraction (XRD) measurements were conducted to analyze the impact of annealing on the crystallite size of the Mg alloy. Micro-hardness testing of the samples was carried out using a Vickers hardness tester. Electrochemical analysis of the alloy before and after annealing was performed using the Potentiodynamic Polarization method in a NaCl solution. Pre- and post-corrosion morphology of unannealed and annealed samples was studied through scanning electron microscopy (SEM). XRD results showed Mg peaks along various planes in both the unannealed and annealed samples. The average crystallite size of the Mg alloy was decreased after annealing at 100 °C and 250 °C and then increased at the higher temperature of 400 °C. The hardness of the Mg AZ31 alloy increased at 100 °C and then began to decrease with further increases in annealing temperature. The corrosion rate and current density of the Mg alloy were decreased after annealing at 100 °C and 400 °C. However, at 250 °C, the corrosion rate and current density were higher than those of the unannealed sample. The post-corrosion SEM micrographs validated the corrosion testing results of the unannealed and annealed samples. The decrease in the corrosion rate of the Mg AZ31 alloy after annealing was attributed to the formation of MgO and the reduction in surface defects.