ABSTRACT

Artificial aging effects on structure, surface morphology, hardness and electrochemical corrosion of Al-Zn-Mg (Al-7075) alloy were studied in this work. The artificial aging of Al-7075 specimens was performed in a muffle furnace at different temperatures (ranging from 120 to 190 °C for 3h) and time durations (0.5 to 8 hours at 170 °C). After the heat treatment, the samples were immediately cooled down in a cold water. The un-aged and aged specimens were characterized by different techniques such as x-ray diffraction (XRD), scanning electron microscope (SEM), Vickers hardness tester and Potentiodynamic polarization (PDP). Formation of $MgZn_2$ precipitates in the aged Al-7075 alloy was confirmed through the XRD data. The lattice parameter of aluminum and size of $MgZn_2$ precipitates indicated an increasing trend with increase of the aging temperature and time. The surface morphology results showed the formation of precipitates that were uniformly distributed over the whole surface. The shape, size and amount of these precipitates were changed with increase of the aging temperature. The average Vickers hardness of the Al-7075 alloy was increased from 125 to 172 HV with increase of the aging temperature from 120 to 170 °C. However, the increase of aging temperature from 170 to 190 °C resulted in a decrease in the hardness value. The hardness was also increased with increase of the aging time up to 8h (180 HV). The electrochemical tests of un-aged and aged specimens were conducted in 3.5 wt. % NaCl solution to find out the corrosion rate and current density. The PDP tests were carried out at different aging temperatures and the obtained results revealed a decrease in the corrosion rate and current density of the Al-7075 alloy after its artificial aging up to 170 °C. The corrosion rate and density then started increasing with further increase of the aging temperature. Similarly, the corrosion potential became less negative after aging the specimens up to 150 °C. The variations in hardness and corrosion parameters of Al-7075 alloy were associated with the formation of $MgZn_2$ precipitates in it.