Corrosion behavior of Sn-Zn alloys

Žaneta Gerhátová, Paulína Babincová, Marián Drienovský, Ivona Černičková, Róbert Havlík, and Marián Palcut

Slovak University of Technology, Faculty of Materials Science and Technology, J. Bottu 25, 91724 Trnava, Slovakia

In the present work, the microstructure, phase constitution and corrosion behavior of binary Sn - xZn alloys (x = 5, 8.9 and 15 wt.%) have been investigated. The alloys were prepared by melting Sn and Zn lumps in an induction vacuum furnace under a protective argon atmosphere. The phase constitution of the alloys was studied by room temperature X-ray diffraction. The microstructure of the as-cast alloys was examined using a JEOL JSM 7600F scanning electron microscope. The chemical composition of each constituent was determined by quantitative EDX analysis using a Si(Li) detector X-Max 50 mm^2. The Sn-8.9Zn alloy had a eutectic microstructure. The Sn-5Zn and Sn-15Zn alloys were found to be composed of dendritic Zn(ss) or Sn(ss) and the Sn+Zn eutectic. The corrosion testing of the materials was carried out by means of an electrochemical potentiodynamic corrosion test in a standard three-electrode cell with working, reference, and counter electrodes. The corrosion behavior was studied in aqueous HCl (1 wt. %) and NaCl (3.5 wt. %) at room temperature. Corrosion potentials and corrosion current densities for each alloy were obtained by Tafel extrapolation of the polarization curves. Subsequently, the corrosion rates were calculated using Faraday's laws of electrolysis. It was found that the corrosion rate of the alloys increases with increasing zinc concentration. Furthermore, the corrosion rate of the alloys increases with decreasing pH of the electrolyte. The results have been compared with those of metallic Zn and Sn. A corrosion mechanism is suggested, and implications for practical applications of the Sn-Zn alloys are provided.

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