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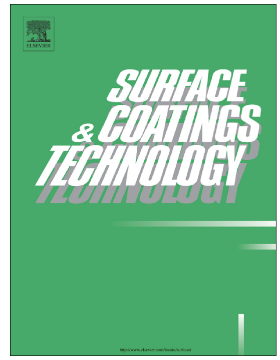

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An insight into the effect of buffer layer on the electrochemical performance of MgF_2 coated Magnesium alloy ZK60

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Abstract

Magnesium (Mg) has emerged as potential implant material owing to its property of biodegradation. The roadblock to the commercial use of Mg as implant material is its fast degradation in body fluids. The degradation of the Mg and its alloys can be retarded by surface coatings. In this work, the potential of MgF_2 coating on the surface of Mg alloy ZK60 (Mg-6.9Zn-0.8Zr) was evaluated for its corrosion properties. Two-step chemical conversion process was used to coat MgF_2 on the surface of ZK60 alloy. In the first step, a secondary layer of $Mg(OH)_2$ was introduced by boiling the samples in NaOH solution. In the second step, these samples were immersed in hydrofluoric acid to obtain MgF_2 coating. SEM, IR Spectroscopy, and XRD were employed to confirm the formation of $Mg(OH)_2$ and MgF_2. The wettability tests showed an increase in surface hydrophobicity as a result of conversion treatment. The potentiodynamic polarization tests exhibited an improvement in the corrosion potential from -1.52 V vs. SCE to -1.49 V vs. SCE after two-step conversion treatment. Moreover, coated sample witnessed a noticeable drop in hydrogen evolution compared to untreated ZK60. For a better insight, the results were compared to the MgF_2 coatings achieved on the surface of ZK60 without any buffer layer. The coating of MgF_2 with a buffer layer of $Mg(OH)_2$ on the surface of ZK60 exhibited a noble corrosion potential, controlled degradation, and nominal hydrogen evolution compared to the untreated ZK60.