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论文

医用Mg-Ca和Mg-Li-Ca合金腐蚀研究

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摘要： 通过失重法、析氢实验、pH值测定和动电位电化学测试等方法, 研究了挤压态Mg-0.54Ca和Mg-1.33Li-0.6Ca合金在模拟体液中的腐蚀降解行为, 并利用OM和SEM对合金显微组织及腐蚀形貌进行了观察, 采用XRD对基体及腐蚀产物的相结构进行分析. 结果表明, Mg-1.33Li-0.6Ca合金的组织由α-Mg基体和Mg_2Ca及$CaLi_2$第二相组成, 而Mg-0.54Ca合金的组织由α-Mg基体和第二相Mg_2Ca组成; Mg-1.33Li-0.6Ca合金在Hank's溶液中浸泡初期的耐蚀性能略低于Mg-0.54Ca合金, 随着浸泡时间的延长, 其耐蚀性能明显优于Mg-0.54Ca合金, 主要原因是Li提高了Mg-1.33Li-0.6Ca合金腐蚀产物的致密性; Mg-1.33Li-0.6Ca合金的腐蚀产物为LiH, $Mg(OH)_2$, $MgCO_3$, $CaCO_3$, $CaMgCO_3$和$CaMgPO_4$, 而Mg-0.54Ca合金腐蚀产物为$MgCO_3$, $CaCO_3$和$CaMgPO_4$. Mg-0.54Ca和Mg-1.33Li-0.6Ca合金在模拟体液中的腐蚀类型都为点蚀和丝状腐蚀.

关键词： Mg-Li-Ca合金 生物材料 腐蚀 模拟人体体液 极化

STUDY ON CORROSION OF MEDICAL Mg-Ca AND Mg-Li-Ca ALLOYS

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Abstract: The corrosion behaviors of the extruded Mg-0.54Ca and Mg-1.33Li-0.6Ca alloys in simulated body fluids (SBFs) were investigated using weight loss, hydrogen evolution and pH value measurement as well as dynamic electrochemical technique. The microstructure and corrosion morphology of these alloys were discerned by means of OM and SEM, and their corrosion products were analyzed by XRD. The results show that the microstructure is composed of α-Mg matrix and secondary phases: Mg_2Ca and $CaLi_2$ for the Mg-1.33Li-0.6Ca alloy, while α-Mg and Mg_2Ca for the Mg-0.54Ca alloy. At the initial immersion stage, the corrosion rate of the Mg-1.33Li-0.6Ca alloy is slightly faster than that of the Mg-0.54Ca alloy, whereas at the subsequent period the Mg-1.33Li-0.6Ca alloy has a corrosion resistance higher than the Mg-0.54Ca alloy. Lithium let to the formation of a dense corrosion product layer, which consists LiH, $Mg(OH)_2$, $MgCO_3$, $CaCO_3$, $CaMgCO_3$ and $CaMgPO_4$ for the Mg-1.33Li-0.6Ca alloy, however, it consists of $MgCO_3$, $CaCO_3$ and $CaMgPO_4$ for Mg-0.54Ca. Pitting and filiform corrosions are the main corrosion types of these alloys in SBFs.

Keywords: magnesium-lithium-calcium alloy biomaterial corrosion simulated body fluid polarization

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