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研究报告

镁合金微弧氧化膜耐蚀性表征方法的对比研究

马颖^{1,2},冯君艳¹,马跃洲¹,詹华¹,高唯²

1. 兰州理工大学甘肃省有色金属新材料省部共建国家重点实验室 兰州 730050

2. Faculty of Engineering, University of Auckland, Auckland 1142, New Zealand

摘要: 制备结构、性能相近的AZ91D镁合金微弧氧化膜,通过浸泡、点滴及电化学实验表征膜层的耐蚀性,并结合SEM分析膜层腐蚀前后的表面形貌。本研究中6种耐蚀性检测方法的结果均表明:AZ91D镁合金经微弧氧化处理后耐蚀性显著提高;失重与增重现象的共存使浸泡实验不能准确评定微弧氧化膜层耐蚀性的优劣;点滴实验可以较快较准确地反映膜层的耐蚀性,但采纳点滴液开始变色的时间点为评价依据更合适,且测试耐蚀性较好的膜层时,点滴液中硝酸的含量提高到标准中的至少两倍时,才能达到快速检测的目的;循环伏安、Tafel极化、开路电位和电化学阻抗谱4种电化学实验能反映诸如腐蚀电位、腐蚀电流密度、阻抗值等更多的信息,可以进一步研究膜层的耐蚀原因。膜层的耐蚀性除了与膜厚、化学成分有关外,还与微观结构膜层内部和表面的密切相关。

关键词: 镁合金 微弧氧化 耐蚀性 浸泡实验 点滴实验 电化学实验

COMPARATIVE STUDY ON CHARACTERIZATION OF CORROSION RESISTANCE OF MICRO-ARC OXIDATION COATINGS ON MAGNESIUM ALLOYS

MA Ying^{1,2}, FENG Junyan¹, MA Yuezhou¹, ZHAN Hua¹, GAO Wei²

1. State Key Laboratory of Gansu Advanced Non-ferrous Metal Materials, Lanzhou University of Technology, Lanzhou 730050

2. Faculty of Engineering, University of Auckland, Auckland 1142, New Zealand

Abstract: Micro-arc oxidation (MAO) coatings were prepared on AZ91D magnesium alloys with same process. The corrosion resistance of coatings was characterized by immersion test, spot test and electrochemical tests, and the surface morphologies of coatings were observed with SEM. The results of six tests have shown that the corrosion resistance of magnesium alloys after MAO treatment is improved dramatically. The anti-corrosion ability of MAO coatings could not be presented properly with immersion test because it is hard to decide which evaluation criteria, weight loss or weight gain, should be taken due to corroded products that might be stuck in coatings with porous microstructure and were hardly eliminated completely. spot test has been considered as a quick way to detect the corrosion resistance of MAO coatings, but colour changing of drip liquid in the first place was adopted as proper counting point, and the concentration of nitric acid in drip liquid needed to be doubled when meeting coatings with good corrosion resistance in order to stimulate a corrosion action faster. Electrochemical tests have been considered to carry out the overall characterization of the corrosion resistance of MAO coatings properly, and more information such as corrosion potential, corrosion current and impedance etc could be obtained from the tests of cyclic voltammetry (CV), Tafel technique, open circuit potential (OCP) and electrochemical impedance spectroscopy (EIS), which in turn will enhance the further research on the corrosion behavior of coatings. Finally, the corrosion resistance of MAO coatings was closely related with the thickness and chemical composition of coatings and also with their internal and surface microstructure.

Keywords: magnesium alloy micro-arc oxidation corrosion resistance immersion test spot test electrochemical test

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作者简介: 马颖, 女, 1966年生, 教授, 硕士, 研究方向为镁合金加工及表面改性

通讯作者E-mail: mayingcn2008@163.com

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