材料研究学报 2009, 23(5) 529-533 DOI: ISSN: 1005-3093 CN: 21-1328/TG

研究论文

在高速电镀锌钢板表面磁控溅射铝镁合金

顾训雷[1], 单玉桥[1], 刘常升[1], 于晓中[2]

1.东北大学材料各向异性与结构工程教育部重点实验室 沈阳 110004
2.东北大学金属防护中心 沈阳 110004

摘要：

采用双靶直流磁控溅射工艺, 在高速电镀锌基片上制备了铝镁合金镀层. 用SEM、EDS和XRD方法分析了镀层的形貌和组分, 借助电化学试验和中性盐雾(NSS)试验研究了靶功率和衬底温度对镀层耐蚀性的影响. 结果表明: 随着衬底温度升高, 镀层趋于致密, 但球状颗粒增多, 自腐蚀电流密度略有增加; 铝靶的功率为900 W, 镁靶的功率为200 W, 衬底温度为150℃时镀层的耐蚀性最优, 自腐蚀电流密度约为4 μAcm^{-2}, 耐中性盐雾时间为120 h, 经分析, 镀层组分主要为$Al_{12}Mg_{17}$.

关键词： 材料失效与保护 铝镁合金镀层 腐蚀电化学 耐蚀性 磁控溅射

Research of magnetron sputtered Al–Mg alloy coatings on high-speed electro-galvanizing steel

GU Xunlei[1], SHAN Yuqiao[1], LIU Changsheng[1], YU Xiaozhong[2]

1.Key Laboratory for Anisotropy and Texture of Materials, Ministry of Education, Northeastern University, Shenyang 110004
2.Metal Protection Center of Northeastern University, Shenyang 110004

Abstract:

The Al–Mg alloy coatings were deposited on high-speed electro-galvanizing steel by double-target DC magnetron sputtering process. The morphologies and compositions were analyzed, and the influences of target power and substrate temperature on corrosion-resistance properties were investigated by electrochemical measurement and neutral salt spray test. The results show that the coatings distribute dense with increasing the substrate temperature, but excessively high temperature cause more granular particles and slightly higher corrosion current density. The optimal corrosion-resistance properties can be achieved by synthetic adjustment of target power and substrate temperature. The corrosion current density is approximately 4 μAcm^{-2} and anti–salt spray time is 120 h. The structure of coatings is determined to be $Al_{12}Mg_{17}$.

Keywords: material failure and protection Al-Mg alloy coatings corrosion electrochemistry corrosion-resistance property magnetron sputtering

收稿日期 2009-02-17 修回日期 2009-07-31 网络版发布日期 2009-10-10

DOI:

基金项目:

长江学者和创新团队发展计划资助项目IRT0713.

通讯作者: 顾训雷

作者简介:

作者Email: csliu@mail.neu.edu.cn

参考文献：

1 B.A.Shedden, M.Samandi, B.Window, Stoichiometry of unbalanced magnetron sputtered Al-Mg alloy coatings, Surf. Coat. Technol., 97, 557(1997)
2 B.Enders, H.Martin, G.K.Wolf, Corrosion and wear properties of multipurpose coatings deposited by ion-beamassisted deposition, Surf. Coat. Technol., 60, 556(1993)
3 P.J.Kelly, R.D.Arnell, Magnetron sputtering: a review of recent developments and applications, Vacuum, 56, 159(2000)
4 R.D.Arnell, R.Bates, The deposition of highly supersaturated metastable aluminium-magnesium alloys

by unbalanced magnetron sputtering from composite targets, Vacuum, 43(1-2), 105(1992)
5 K.R.Baldwin, R.I.Bates, R.D.Arnell, C.J.E.Smith, Aluminium-magnesium alloys as corrosion resistant coatings for steel, Corros. Sci., 38(1), 155(1996)
6 R.I.Bates, R.D.Arnell, Microstructure of novel corrosionresistant coatings for steel components by unbalanced magnetron sputtering, Surf. Coat. Technol., 89, 204(1997)
7 K.L.Moore, J.M.Sykes, S.C.Hogg, P.S.Grant, Pitting corrosion of spray formed Al-Li-Mg alloys, Corros. Sci., 50, 3221(2008)
8 John A.Thornton, The microstructure of sputterdeposited coatings, J. Vac. Sci. Technol. A, 4(6), 3059 (1986)
9 O.Lunder, J.E.Lein, T.Kr.Aune, K.Nisancioglu, The role of Mg17Al12–phase in the corrosion of Mg alloy AZ91, Corrosion, 45(9), 741(1989)
10 Zhao Mingchun, Liu Ming, Song Guangling, A.Atrens, Influence of the β–phase morphology on the corrosion of the Mg alloy AZ91, Corros. Sci., 50, 1939(2008)
11 K.L.Moore, J.M.Sykes, S.C.Hogg, P.S.Grant, Pitting corrosion of spray formed Al–Li–Mg alloys, Corros. Sci., 50, 3221(2008)

本刊中的类似文章

1．曾荣昌, 韩恩厚, 刘路, 徐永波, 柯伟 .时效对AZ80腐蚀疲劳寿命的影响[J]. 材料研究学报, 2004,18(6): 561-567
2．许淳淳, 张新生, 胡钢 .拉伸变形对304不锈钢应力腐蚀的影响[J]. 材料研究学报, 2003,17(3): 0-314
3．李春东, 杨德庄, 何世禹 .质子、电子综合辐照作用下Teflon FEP/Al辐照损伤效应研究[J]. 材料研究学报, 2003,17(4): 0-426
4．谢德明, 胡吉明, 童少平 .多道环氧涂层在NaCl溶液中的电化学阻抗谱[J]. 材料研究学报, 2004,18(1): 96-
5．王再友, 朱金华 .Fe-25Mn-6Si-7Cr形状记忆合金空蚀研究[J]. 材料研究学报, 2003,17(1): 0-44
6．程晓英, 万晓景, 沈嘉年 .Ti-45Al-10Nb合金的高温氧化行为[J]. 材料研究学报, 2003,17(1): 0-54
7．张杰, 于振花, 李焰 .Zn-55%Al-Si合金镀层钢丝在海水中的耐蚀性能[J]. 材料研究学报, 2008,22(4): 347-352
8．岳明, 刘卫强, 王公平, 张久兴, 李涛 .放电等离子烧结NdFeB磁体的氧化和腐蚀行为[J]. 材料研究学报, 2004,18(2): 167-170
9．周邦新, 刘文庆, 李强上海大学, 姚美意 .LiOH水溶液提高Zr--4合金腐蚀速率的机理[J]. 材料研究学报, 2004,18(3): 0-231
10．多树旺, 李美栓, 张亚明 .空间材料的原子氧侵蚀理论和预测模型[J]. 材料研究学报, 2003,17(2): 0-121

文章评论

反馈人		邮箱地址	
反馈标题		验证码	8478