中国腐蚀与防护学报 >>2012 >>32 >>(2)

中国腐蚀与防护学报 2012, **32**(2) 90-94 **DOI**: **ISSN**: 1005-4537 **CN**: 31-1421/TG

研究报告

熔模铸造ZA93镁合金的化学镀镍工艺研究

肖伟[1,2],单大勇[1],陈荣石[1]

1. 中国科学院金属研究所 金属腐蚀与防护国家重点实验室 沈阳 110016
2. 沈阳理工大学材料科学与工程学院 沈阳 110168

摘要： 以熔模铸造Mg-9 mass%Zn-3 mass%Al（ZA93）镁合金为基底，分别研究碘离子、乳酸和氟化氢铵对化学镀镍的镀液稳定性和镀层沉积速度的影响规律及其反应机理，并在此基础上优化了镀液配方。用扫描电子显微镜（SEM）、能谱（EDX）和X射线衍射（XRD）等方法对优化镀液中试镀得到的Ni-P镀层的显微组织、相结构以及元素组成进行了分析。结果表明，碘离子与氟化氢铵在一定浓度范围内，可以同时提高镀液的稳定性和镀层沉积速度，但乳酸对镀液的影响机制较为复杂。优化配方镀液的稳定性相对原镀液有了明显的提高，同时保持了较高的镀速，得到的镀层组织均匀、致密和结合良好，为非晶态结构。

关键词： ZA93镁合金 熔模铸造 化学镀 稳定性 镀速

EFFECT OF PROCESS OF ELECTROLESS PLATING ON INVESTMENT CASTING ZA93 MAGNESIUM ALLOY

XIAO Wei[1,2], SHAN Dayong[1], CHEN Rongshi[1]

1. State Key Laboratory for Corrosion and Protection, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016
2. College of Materials Science and Engineering, Shenyang Ligong University, Shenyang 110168

Abstract: The effects of the concentration of iodine ion, ammonium bifluoride and lactic acid on the stability and deposition rate of Ni plating solution have been investigated using investment casting ZA93 alloy as base material. The composition of the plating solution was also optimized. SEM, EDX and XRD have been applied to analyze the microstructure, phase identification, and the elements distribution of the coating. The results showed that the ammonium bifluoride and iodine ion increased both the stability of the plating solution and the deposition rate, but the effect of lactic acid on the plating solution was more complicated. Compared to the former one, the optimized plating solution showed higher deposition rate and was much more stable. The coating was homogeneous, compact with good adhesion to the base and the structure was amorphous.

Keywords: ZA93 magnesium alloy investment casting electroless plating stability deposition rate

收稿日期 2011-01-06 **修回日期** 2011-03-09 **网络版发布日期** 2012-04-16

DOI:

基金项目:

国家科技支撑计划项目（2011BAE22B05）资助

通讯作者: 陈荣石

作者简介: 肖伟，男，1985年生，硕士生，研究方向为铸造镁合金

通讯作者E-mail: rschen@imr.ac.cn

参考文献：

[1] Zhang J, Zhang Z H. Magnesium Alloy and Its Application[M]. Beijing: Chemical Industry Press, 2004

[2] Liu X K, Xiang Y H, Hu W B. The cohesion mechanisms of chemical plating on magnesium alloy[J]. J. Chin. Soc. Corros. Prot.,2002, 22(4): 233-236

刘新宽, 向阳辉, 胡文彬.镁台金化学镀镍层的结合机理[J]. 中国腐蚀与防护学报, 2002, 22(4):233-236) 浏览

[3] Zhao H, Huang Z H, Cui J Z. A novel method of electroless plating on AZ31 magnesium alloy sheet[J]. J. Mater. Proc. Technol.,2008, 203: 310-314

[4] Yoon J W, Park J H, Shur C C, et al. Characteristic evaluation of electroless nickel-phosphorus deposits with different phosphorus contents[J]. Microelectr. Eng., 2007, 84(11): 2552-2557

[5] Vignati P. Electroless nickel: deposit properties, specifications and applications[M]. Product Finishing, 2003

[6] Zhao H, Huang Z H, Cui J Z. Electroless plating of copper on AZ31 magnesium alloy substrates[J]. Microelectr. Eng., 2008, 85:253-258

[7] Zhang D J, Shao H H, Jiang X Yl. Investigation of electroless plating on AZ31 magnesium alloys[J]. Surf. Technol.,2007, 36(4): 54-56

张道军, 邵红红, 蒋小燕.AZ31镁合金化学镀工艺研究[J]. 表面技术, 2007, 36(4): 54-56)

[8] Zhang W X, He J G, Jiang Z H, et al. Electroless Ni-P layer with a chromium-free pretreatment on AZ91D magnesium alloy[J].Surf. Coat. Technol., 2007, 201: 4594-4600

[9] Song Y W, Shan D Y, Han E H. Corrosion behaviors of electroless plating Ni-P coatings deposited on magnesium alloys in artificial sweat solution[J]. Electrochim. Acta, 2007, 53(4):2009-2015

[10] Liu Z, Gao W. Electroless nickel plating on AZ91 Mg alloy substrate[J]. Surf. Coat. Technol., 2006, 200: 5087-5093

[11] Huo H W, Li Y, Wang F H. Corrosion of AZ91D magnesium alloy with a chemical conversion coating and electroless nickel layer[J]. Corros. Sci., 2004, 46: 1467-1477

[12] Ying H G, Yan M, Ma T Y, et al. Effects of NH_4F on the deposition rate and buffering capability of electroless Ni-P plating solution[J]. Surf. Coat. Technol., 2007, 202(2): 217-221

[13] Song Y W, Shan D Y, Han E H. High corrosion resistance of electroless composite plating coatings on AZ91D magnesium alloys[J].Electrochim. Acta, 2008, 53: 2135-2143

[14] Jiang X X, Shen W. The Fundamentals and Practice of Electroless Plating[M]. Beijing: National Defense Industry Press,2000: 1-20

[15] Dean J A, Translated by Shang J F. Lange's Handbook of Chemistry[M]. Beijing: Science Press, 1991

[16] (Dean J A. 尚久方译. 兰氏化学手册[M]. 北京: 科学出版社, 1991)

[17] Vafaeimakhsoos E, Thomas E L. Electron-microscopy of crystalline and amorphous Ni-P electrodeposited films-Insitu crystallization of an amorphous solid[J]. Metall. Trans. A-Phys.Metall. Mater. Sci., 1978, 9(10): 1449-1460

[18] Yu H S, Luo S F, Wang Y R. A comparative study on the crystallization behavior of electroless Ni-P and Ni-Cu-P deposits[J]. Surf. Coat. Technol., 2001, 148(2-3): 143-148

[19] Hentschel T, Isheim D, Kirchheim R, et al. Nanocrystalline Ni-3.6 at.% P and its transformation sequence studied by atom-probe field-ion microscopy[J]. Acta Mater., 2000,48(4): 933-941

[20] Yamasaki T, Izumi H. The microstructure and fatigue properties of electroless deposited Ni-P alloys[J]. Scr. Metall.,1981, 15(2): 177-180.

本刊中的类似文章

1．丁杰,张本革,闫明珍,刘佳.添加稀土元素对Ni-P/PVDF化学复合镀层耐蚀性的影响[J]. 中国腐蚀与防护学报, 2012,32(2): 123-126

2．李均明,薛晓楠,王爱娟,马安博,符致昭.镁合金微弧氧化预处理化学镀镍研究[J]. 中国腐蚀与防护学报, 2012,32(1): 23-27

3．石玉峰 许庆彦 柳百成.定向凝固共晶生长的元胞自动机数值模拟[J]. 中国腐蚀与防护学报, 2012,48(1): 41-48

4．邢琳琳，郑雁军,崔立山,孙茂虎,邵明增,卢贵武.水蒸汽影响氧化铝膜生长的研究新进展[J]. 中国腐蚀与防护学报, 2011,31(6): 409-413
5．申晓妮,赵冬梅,任凤章,田保红.添加剂对四羟丙基乙二胺（THPED）化学镀厚铜的影响[J]. 中国腐蚀与防护学报, 2011,31(5): 362-366
6．姚志燕, 徐宏, 侯峰, 戴玉林, 闫操.化学镀Ni-W-P合金工艺开发及其耐蚀性能[J]. 中国腐蚀与防护学报, 2011,23(4): 353-357
7．邝刘伟,范希梅,郝军,张会广.化学镀Ni-B合金镀层性能[J]. 中国腐蚀与防护学报, 2011,31(4): 315-318
8．赵力宁 林鑫 黄卫东.较低剪切速率下过冷熔体非枝晶组织的形成与演化[J]. 中国腐蚀与防护学报, 2011,47(4): 403-409
9．刘彤 朱亚蓉 张同文 张涛.加压退火对$Gd_{36}La_{20}Al_{24}Co_{20}$块体非晶合金晶化行为和热稳定性的影响[J]. 中国腐蚀与防护学报, 2011,47(4): 502-506
10．王长罡 董俊华 柯伟 陈楠.硼酸缓冲溶液中pH值和Cl^-浓度对Cu腐蚀行为的影响[J]. 中国腐蚀与防护学报, 2011,47(3): 354-360
