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研究报告

等离子喷涂耐冲刷陶瓷涂层的性能研究

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**摘要:** 采用等离子喷涂工艺在高锰铝青铜基体上制备了  $Al_2O_3$ -13% $TiO_2$  和  $Cr_2O_3 \cdot 5SiO_2 \cdot 3TiO_2$  两种耐冲刷复合涂层, 利用扫描电子显微镜(SEM)、激光扫描显微镜 (LSM)等手段观察分析了两种涂层的组织形貌, 测试了两种涂层的显微硬度和结合强度, 用电化学测量和失重测量分别研究了两种涂层在3.5%NaCl溶液中的电化学行为以及耐海水冲刷腐蚀性能。结果表明,  $Cr_2O_3 \cdot 5SiO_2 \cdot 3TiO_2$  涂层组织致密, 无明显层状结构; 陶瓷涂层在3.5%NaCl溶液中的电化学腐蚀行为主要取决于涂层的孔隙率;  $Cr_2O_3 \cdot 5SiO_2 \cdot 3TiO_2$  涂层试样在动态海水中的冲刷腐蚀失重约为基体试样的1/9, 表现出较 $Al_2O_3$ -13% $TiO_2$ 涂层更优异的耐海水冲刷腐蚀性能。

**关键词:** 等离子喷涂 电化学 陶瓷涂层 冲刷腐蚀

## PERFORMANCE OF EROSION-RESISTANT CERAMIC COATINGS DEPOSITED BY PLASMA SPRAYING

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**Abstract:**  $Al_2O_3$ -13% $TiO_2$  and  $Cr_2O_3 \cdot 5SiO_2 \cdot 3TiO_2$  erosion-resistant ceramic coatings were deposited on Al-bronze alloy using plasma spraying process. The morphologies of the two coatings were investigated by means of scanning electron microscope (SEM) and laser scanning microscope (LSM). Microhardness and adhesion strength have been evaluated, respectively. The corrosion behavior of two coatings in 3.5% NaCl solution were characterized by potentiodynamic polarization and electrochemical impedance spectroscopy. SEM analysis of corroded surface and weight loss technique were used to study the erosion-corrosion of coated samples and uncoated sample in flowing seawater. The results indicated that  $Cr_2O_3 \cdot 5SiO_2 \cdot 3TiO_2$  coating has a much dense microstructure and the laminar microstructure was not obviously observed. The corrosion behavior of ceramic coatings was mainly related to the porosity of the coatings. Due to higher microhardness and adhesion strength, the weight loss of  $Cr_2O_3 \cdot 5SiO_2 \cdot 3TiO_2$  coated sample was nearly 1/9 of that of uncoated one, indicating better resistance to erosion-corrosion in flowing seawater than  $Al_2O_3$ -13% $TiO_2$  coating.

**Keywords:** plasma spraying electrochemistry ceramic coating erosion-corrosion

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## 参考文献:

- [1] Niebuhr D. Cavitation erosion behavior of ceramics in aqueous solutions [J]. Wear, 2007, 263(1-6)

- [2] Li X Y, Yan Y G, Ma L, et al. Cavitation erosion and corrosion behavior of copper-manganese-aluminum alloy weldment [J]. Mater. Sci. Eng., 2004, A382: 82-89
- [3] Wood R J K. The sand erosion performance of coatings [J]. Mater. Des. 1999, 20: 179-191 
- [4] Wood R J K, Speyer A J. Erosion-corrosion of candidate HOVF aluminium-based marine coatings [J]. Wear, 2004, 256(5): 545-556 
- [5] Bolelli G, Cannillo V, Lusvardi L, et al. Wear behaviour of thermally sprayed ceramic oxide coatings [J]. Wear, 2006, 261(11-12): 1298-1315 
- [6] Celik E, Avci E, Yilmaz F. Evaluation of interface reactions in thermal barrier ceramic coatings [J]. Surf. Coat. Technol., 1997, 97: 361-365 
- [7] Celik E, Ozdemir I, Avci E, et al. Corrosion behaviour of plasma sprayed coatings [J]. Surf. Coat. Technol., 2005, 193: 297-302 
- [8] Tao S H, Yin Z J, Zhou X M, et al. Sliding wear characteristics of plasma-sprayed  $\text{Al}_2\text{O}_3$  and  $\text{Cr}_2\text{O}_3$  coatings against copper alloy under severe conditions [J]. Tribol.Int., 2010, 43: 69-75 
- [9] Li C F, Wang R, Niu Y H, et al. Influence of doped nanoparticles on the anticorrosion performance of the plasma spraying of  $\text{Al}_2\text{O}_3$ -13% mass  $\text{TiO}_2$  coatings [J]. J. Chin. Soc. Corros. Prot., 2008, 28(6): 331-335  
李春福, 王戎, 牛艳花等. 纳米掺杂对  $\text{Al}_2\text{O}_3$ -13%  $\text{TiO}_2$  等离子喷涂涂层耐蚀性能的影响 [J]. 中国腐蚀与防护学报, 2008, 28(6): 331-335
- [10] Zhang J X, He J N, Dong Y C. Microstructure characteristics of  $\text{Al}_2\text{O}_3$ -13%  $\text{TiO}_2$  coating plasma spray deposited with nanocrystalline powders [J]. J. Mater. Process. Technol., 2008, 197: 31-35 
- [11] Li Z D, Wu Z J, Zeng L K, et al. Study on properties of plasma sprayed nanostructured  $\text{Cr}_2\text{O}_3 \cdot 5\text{SiO}_2 \cdot 3\text{TiO}_2$  coating [J]. Nonferrous Met., 2007(Suppl.): 72-74
- [12] Tian W, Wang Y, Zhang T, et al. Sliding wear and electrochemical corrosion behavior of plasma sprayed nanocomposite  $\text{Al}_2\text{O}_3$ -13%  $\text{TiO}_2$  coatings [J]. Mater. Chem. Phys., 2009, 118: 37-45 
- [13] Wang Y, Tian W, Zhang T, et al. Microstructure, spallation and corrosion of plasma sprayed  $\text{Al}_2\text{O}_3$ -13%  $\text{TiO}_2$  coatings [J]. Corros.Sci., 2009, 10: 1016-1023
- [14] Penttinen I M, Korhonen A S, Harju E, et al. Comparison of the corrosion resistance of TiN and (Ti, Al) N coatings [J]. Surf. Coat. Technol. 1992, 50: 161-168 
- [15] Yang H G, Zhu X M, Lei M K. Evaluation of porosity of hard coating by corrosion electrochemistry [J]. Corros. Sci. Prot. Technol., 2005, 17(6): 413-417  
杨海钢, 朱雪梅, 雷明凯. 腐蚀电化学方法评价硬质涂层孔隙率 [J]. 腐蚀科学与防护技术, 2005, 17(6): 413-417 [浏览](#)
- [16] Tato W, Landolt D. Electrochemical determination of the porosity of single and duplex PVD coatings of titanium and titanium nitride on brass [J]. J. Electrochem.Soc. 1998, 145: 4173-4181 
- [17] Creus J, Mazille H, Idrissi H. Porosity evaluation of protective coatings onto steel through electrochemical techniques [J]. Surf. Coat. Technol. 2000, 130: 224-232 
- [18] Cao C N, Zhang J Q. An Introduction to Electrochemical Impedance Spectroscopy [M]. Beijing: Science Press, 2002, 151-166
- [19] Hu J M, Zhang J T, Zhang J Q, et al. A novel methods for determination of diffusion coefficient of corrosive species in organic coating by EIS [J]. J. Mat.Sci. 2004, 39: 4475-4479 
- [20] Guo J H, Wu J W, Ni X J. Electrochemical behavior of Fe-based coating containing amorphous phase prepared by electric arc spraying [J]. Acta Metall. Sin., 2007, 43(7): 780-784  
郭金花, 吴嘉伟, 倪晓俊. 电弧喷涂非晶相的Fe基涂层的电化学行为 [J]. 金属学报, 2007, 43(7): 780-784

#### 本刊中的类似文章

1. 吴琴, 沈承金, 胡光伟, 张健康, 刘亚楼. 混凝土表面硅烷防水膜的电化学噪声谱分析[J]. 中国腐蚀与防护学报, 2011, 23(3): 261-265
2. 田俐 黄可龙. 纳米LiFePO<sub>4</sub>/C复合正极材料的溶剂热合成[J]. 中国腐蚀与防护学报, 2011, 25(3): 321-326
3. 史艳华, 陈吉. 三价铬硫酸盐体系电镀Fe-Ni-Cr合金镀层的耐蚀性研究[J]. 中国腐蚀与防护学报, 2011, 23(2): 163-167
4. 张金民, 郑申清. 冲刷腐蚀致纯铜表面纳米晶化的研究[J]. 中国腐蚀与防护学报, 2011, 23(2): 168-170
5. 宗广霞, 彭晓. 电弧法制备的Cr纳米粉与Ni共沉积行为的电化学研究[J]. 中国腐蚀与防护学报, 2011, 23(2): 111-115
6. 雍兴跃, 吉静, 张雅琴, 李栋梁, 张占佳. 空化作用下奥氏体不锈钢空泡腐蚀的过程与AFM形貌[J]. 中国腐蚀与防护学报, 2011, 23(2): 116-120
7. 田惠文, 李伟华, 侯保荣. 纳米SiO<sub>2</sub>改性环氧涂层电化学阻抗谱研究[J]. 中国腐蚀与防护学报, 2011, 23(2): 125-132
8. 董方, 蔡国君, 储少军. 铈的添加对1Cr18Mn8Ni5N不锈钢腐蚀电化学行为的影响研究[J]. 中国腐蚀与防护学报, 2011, 23(2): 147-150
9. 康今哲, 于宏. 银纪念币表面滋生白斑机理研究[J]. 中国腐蚀与防护学报, 2011, 23(2): 186-190
10. 林继月, 刘光明, 陈刚. DDS含量对有机硅/SiO<sub>2</sub>杂化涂层性能的影响[J]. 中国腐蚀与防护学报, 2011, 31(2): 116-120