

论文摘要

中国有色金属学报

ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO

第17卷 第5期 (总第98期) 2007年5月

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文章编号: 1004-0609(2007)05-0800-07

热镀锌层上磷酸锌转化膜的生长与耐蚀性

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摘要: 热镀锌钢板在pH 3.0、45 °C的磷酸锌溶液中磷化2-600 s, 用扫描电镜、能谱仪和X射线衍射仪分析磷化膜的组织形貌和成分, 并探讨膜层的生长行为。结果表明: 磷酸锌晶体在锌晶粒内及晶界处均可成核, 开始是以接近平行的片状生长, 并逐渐向多方向生长成扇骨状的晶片。随着磷酸锌晶体的成核和生长, 磷化膜的覆盖率增加, 但晶体之间的孔隙难以完全消除; 长大的磷酸锌晶片容易折断脱落, 导致磷化后期膜层的质量增量减小; 磷化膜主要由 $Zn_3(PO_4)_2 \cdot 4H_2O$ 组成。热镀锌钢板经磷化处理后, 耐蚀性显著提高, 磷化膜的耐蚀性随磷化时间和膜层覆盖率的增加而提高。

关键字: 热镀锌层; 磷酸锌转化膜; 生长行为; 耐蚀性; 磷化

Growth and corrosion resistance of zinc phosphate conversion coatings on hot dip galvanized steel

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Abstract: The morphology and composition of zinc phosphate conversion coatings on hot-dip galvanized steels that were phosphorized in pH 3.0 zinc phosphate solution for 2-600 s were investigated by scanning electron microscopy, energy dispersive spectrometer and X-ray diffractometry. The growth process of phosphate coatings was also discussed. The results show that the zinc phosphate crystals can be nucleated at the intra-grains and the grain boundaries of zinc. The zinc phosphate crystals firstly are flaky and grown approximately parallel, and latterly develop to several orientations as fan-shaped wafers. With the nucleation and growth of zinc phosphate crystals, the coverage of phosphate coatings increases gradually. However, the pores among the phosphate crystal sheets can not be eliminated completely. The bigger phosphate crystals will be broken off, resulting in the decrease of mass gain of phosphate coatings. The phosphate coatings are mainly composed of $Zn_3(PO_4)_2 \cdot 4H_2O$. The corrosion resistance of HDG steels is greatly improved by phosphating and increases with the phosphating time and coverage of phosphate coatings.

Key words: hot dip galvanized steel; zinc phosphate conversion coatings; growth process; corrosion resistance; phosphorizing

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