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论文

钢基铝镀层转化为陶瓷层的演变规律研究

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摘要

热浸镀铝钢经等离子体电解氧化(Plasma Electrolytic Oxidation, PEO)处理后, 表面铝镀层转化为陶瓷层. 实验对阳极电压变化、陶瓷层生长规律、涂层截面形貌和成分等进行了研究. 结果表明: 在PEO初期, 热浸铝试件的阳极电压变化趋势与纯铝试件相同, 在PEO后期电压有下降趋势. 铝镀层消耗和陶瓷层厚度增长近似为线性变化. 当铝镀层完全陶瓷化后, FeAl层参与PEO反应, 但陶瓷层生长速率变慢, 在界面处出现大量裂纹; 陶瓷层主要成分为Al、Si、O元素, 相结构主要为γ-Al_2O_3与莫来石相, 在PEO后期出现α-Al_2O_3相. 复合陶瓷层硬度呈区域性分布, 陶瓷层最高硬度可达HV1800.

关键词 热浸铝镀层 等离子体电解氧化 陶瓷层 转化规律

分类号 TG174

Evolution of Aluminium Layer Transformed into Ceramic Coating on Steel Substrate

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Abstract

The external aluminium layer was transformed into a ceramic coating by the treatment of plasma electrolytic oxidation (PEO) on aluminized steel. Characteristics of anodic voltage, thickness growth regularity, cross-sectional morphologies and compositions of the ceramic coating were investigated. The results show that the anodic voltages of aluminized steel and pure aluminum vary similarly at the initial PEO stage, but the voltage of aluminized steel decreases at later PEO stage. The aluminium layer is consumed, and the ceramic-coating thickness increases linearly. The FeAl layer begins to participate in PEO process as the aluminium layer is transformed completely into the ceramic coating. Nevertheless, the ceramic coating grows slowly and many micro-cracks are observed at the Al_2O_3/FeAl interface. The ceramic coating is mainly composed of Al, Si and O elements. It consists of γ-Al_2O_3, mullite, and α-Al_2O_3 phase appearing only at the last PEO stage. The hardness distribution of the coating is regional and the maximum is about HV 1800.

Key words hot-dip aluminum plasma electrolytic oxidation ceramic coating transforming regularity

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