

# 质子交换膜燃料电池双极板用金属改性的研究(PDF)

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Title: Research of Metal Bipolar Plates with Surface Treatment for Proton Exchange Membrane Fuel Cell

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关键词: [质子交换膜燃料电池](#); [金属双极板](#); [表面改性](#)

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摘要: 通过脉冲偏压电弧离子镀工艺, 在316L不锈钢表面上沉积出致密的Cr的氮化物梯度薄膜(Crx N)。表面改性后的不锈钢双极板界面导电性能良好, 在质子交换膜燃料电池电堆的组装力范围内, 与Toray碳纸的接触电阻为7.9~11.2 mΩ·cm<sup>2</sup>。双极板的耐腐蚀性能相对于未处理的316L不锈钢基体有了显著的增强: 在0.5 mol/L H<sub>2</sub>SO<sub>4</sub>+5×10<sup>-6</sup> mol/L F<sup>-</sup>的模拟电池环境腐蚀溶液中, 室温下改性后双极板的腐蚀电流约为10<sup>-7</sup> A/cm<sup>2</sup>, 比基体的小了2个数量级; 70 °C时在相同的腐蚀环境下, 虽然腐蚀电流有所增大, 但仍然比不锈钢基体的腐蚀电流小1~2个数量级。改性双极板有很高的表面能, 与水的接触角达90°, 这有利于电池内部液态水的排出。通过表面改性获得的具有耐蚀导电憎水综合性能的金属双极板材料, 在质子交换膜燃料电池中有很大的应用潜力。

Abstract: The stainless steel (316L) bipolar plate was coated with a film of Cr<sub>x</sub>N by the pulsed bias arc ion plating method. The bipolar plate showed low interfacial contact resistance after surface treatment. In the range of stack compacting pressures, the contact resistance between the bipolar plate and Toray carbon paper was 7.9-11.2 mΩ·cm<sup>2</sup>. The 316L stainless steel bipolar plate also showed improved corrosion resistance in simulated proton exchange membrane fuel cell (PEMFC) environment after surface treatment. The corrosion current density of the bipolar plate in 0.5 mol/L H<sub>2</sub>SO<sub>4</sub>+5×10<sup>-6</sup> mol/L F<sup>-</sup> was about 10<sup>-7</sup> A/cm<sup>2</sup>, two orders of magnitude lower than that of the base metal. The corrosion

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experiment conducted at 70 °C indicated that the corrosion current density of the bipolar plate was about one or two orders of magnitude lower than that of the base metal. In addition, the treated bipolar plate had very high surface energy. The contact angle of the bipolar plate with water was 90°, which is beneficial for water management of the stack. The present metal bipolar plate with good corrosion resistance, good interfacial conductivity and high surface energy might have great potential of application in PEMFC.

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