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研究论文

碳载体的O_3处理对直接甲醇燃料电池Pt-Ru/C催化剂性能的影响

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摘要 为了提高直接甲醇燃料电池阳极催化剂的催化活性, 利用O_3处理的Vulcan XC-72碳黑为载体, 制备Pt-Ru/C催化剂, 并与未经处理的Vulcan XC-72为载体制备的Pt-Ru/C催化剂的性能进行比较. 采用XPS和BET测试了O_3处理后碳粉表面的含氧浓度和比表面积, 结果表明, 随处理时间延长, 碳表面含氧浓度先减少后增加, 比表面积减小; 而随着处理温度升高, 比表面积增加, 含氧浓度先减少后增加. XRD, TEM方法对催化剂的结构及形貌的表征结果表明: O_3处理的碳黑为载体制备的Pt-Ru/C催化剂粒径均匀、分散性好. 在0.5 mol/L CH_3OH和0.5 mol/L H_2SO_4溶液中, 利用粉末微电极测试了循环伏安和稳态极化曲线, 结果表明: O_3处理碳粉为载体的催化剂比未经处理的碳粉为载体的催化剂的活性高. 研究了O_3处理碳粉的时间和温度对催化剂性能的影响, 电化学测试表明: 140 ℃处理6 min的碳粉为载体制备的催化剂对甲醇的电催化氧化活性最佳.

关键词 直接甲醇燃料电池 Pt-Ru/C催化剂 碳载体 O_3处理

分类号

Effects of Ozone Treatment of Carbon Support on the Performance of Pt-Ru/C Catalysts for Direct Methanol Fuel Cell

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Abstract This research was aimed to increase the utilization of platinum-ruthenium alloy (Pt-Ru) catalysts and thus to lower the cata-lyst loading in anodes for methanol electrooxidation. The Vulcan XC-72 carbon black supported platinum-ruthenium cata-lysts were prepared by chemical reduction method. The support was pretreated by ozone at different temperatures and time. The specific surface area of the samples was evaluated by standard BET method. The oxygen concentration in carbon was determined by XPS. It showed that the oxygen concentrations in carbon were decreased and then increased with pretreating time, and specific surface area of carbon was decreased with the time at the same temperatures. The specific surface area of the carbon was increased with increased temperature, and oxygen concentrations in it were decreased and then increased with increased temperature at the same time. Pt-Ru/C catalysts supported on untreated and treated carbons black were char-acterized and tested for methanol electrooxidation. Transmission electron microscopy and X-ray diffraction were used to characterize the influence of carbon treated with ozone on Pt-Ru/C catalysts. It was found that ozone treatment resulted in a more homogeneous distribution of the Pt-Ru alloy in carbon. In 0.5 mol/L CH_3OH and 0.5 mol/L H_2SO_4 solution, cyclic voltammetry and stationary polarization were used for methanol elec-trooxidation on Pt-Ru/C catalysts, showing that the catalytic activity of Pt-Ru/C catalysts supported on ozone treated carbon was higher than on untreated one. The effects of time and temperature of ozone treatment on the performance of Pt-Ru/C catalysts were discussed. Electrochemical measurements showed that the catalyst supported on carbon after ozone treatment for 6 min at 140 ℃ had the best performance.

Key words direct methanol fuel cell Pt-Ru/C catalyst carbon support ozone treatment

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