METHANOL OXIDATION ON PLATINUM-CERIA CATALYSTS

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Aside from hydrogen-gas fuel cells, direct alcohol fuel cell (DAFC) is another potential solution to reduce CO_2 emission from hydrocarbon combustion vehicles. Besides, DAFC generates higher power density than hydrogen fuel cells[1]. Therefore, in this study, novel catalyst materials with low loading of Pt nanoparticles on ceria-carbon black substrate were synthesized.

Fluorite structure of ceria has interesting characteristics and has synergistic effect with platinum to reduce/eliminate the methanol oxidation intermediates at active sites[2]. The use of histidine to direct the shape of ceria particles during urea solvothermal synthesis is employed widely[2]. Following those findings, this study optimizes synthesis parameters to achieve various Pt/His-CeO_2-C(Ketjen Black) materials. Pt was deposited by the refluxing and/or microwave assisted method.

About the results, X-ray diffractograms confirm the presence of Pt and CeO_2 in materials synthesized. The Scherrer analysis reveals that the crystallite sizes of Pt and CeO_2 are from 2.4 to 6 nm and around 16 nm, respectively. Platinum and Ce contents are confirmed by ICP-MS around 12% content is 2-6%, respectively. Electrochemical measurement in 0.5 mol dm^{-3} H_2SO_4 showed that ECSA is 50 m_{Pt}^2 g_{Pt}^{-1}. After the addition of 1 mol dm^{-3} CH_3OH into the electrolyte, the anodic specific current peak is 280 A g_{Pt}^{-1} in cyclic voltammogram. The chronoamperometric current is 0.5 A g_{Pt}^{-1} at 0.5 V vs RHE after 30 minutes and is stable. The results are similar to Pt/CeO_2-Vulcan[3].

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