Pt supported on C-TiO₂ and C-ZrO₂ Composite Materials and Their Evaluation in the Anodic Oxidation of Ethanol

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C-TiO₂ and C-ZrO₂ composite materials were prepared with different metal oxide contents (C-TiX and C-ZrX series with X = 5, 23 and 50 wt. % TiO₂ or ZrO₂, respectively) to modify their surface acidity and to evaluate their effects on the Pt catalyst activity for the oxidation of ethanol in acid medium. Pt catalysts were synthesized via incipient impregnation. The supports were characterized by X-ray diffraction (XRD) and UV-Vis diffuse reflectance spectroscopy (UV-Vis DRS). The electrical conductivity was analyzed in a two-electrode cell. The surface acidity of the supports was determined by potentiometric titration with n-butylamine. The electrocatalytic activity for ethanol oxidation was evaluated through cyclic voltammetry and electrochemical impedance spectroscopy. The XRD results showed that the metal oxides were not introduced into the carbon structure. The UV-Vis-DRS and conductivity results showed that the electronic properties of the C-TiX and C-ZrX supports were modified by the metal oxide content. TiO₂ and ZrO₂ incorporation into the support formulation decreased the total surface acidity strength but increased the concentration of acid sites, which had a positive effect on the electrocatalytic activity observed as a reduction in the charge-transfer resistance. The Pt/C-Ti23 and Pt/C-Zr23 catalysts were the most active of the tested composites.

Keywords: Pt/C-TiO₂, Pt/C-ZrO₂, ethanol electro-oxidation, support acidity, DAFC.

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