Influence of the Metallic Load of Pt/C and Pt_{0.6}-Ru_{0.4}/C Nanowires on the Electrochemical Oxidation of Methanol in Acid Medium

Gláucia R.O. Almeida^{1,2}, Eliana M. Sussuchi³, Cristiano T. de Meneses⁴,
Giancarlo R. Salazar-Banda^{1,2}, Katlin I.B. Eguiluz^{1,2,*}

¹ Programa de Pós-Graduação em Engenharia de Processos, Universidade Tiradentes, 49032–490, Aracaju, SE, Brasil.

² Laboratório de Eletroquímica e Nanotecnologia, Instituto de Tecnologia e Pesquisa (ITP), 49032–490, Aracaju, SE, Brasil

³ Departamento de Química, Universidade Federal de Sergipe, 49100-000, São Cristóvão, SE, Brasil.

⁴ Departamento de Física, Universidade Federal de Sergipe, 49506-036, Itabaiana, SE, Brasil.

*E-mail: katlinbarrios@gmail.com

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This work aimed on the development of platinum and platinum-ruthenium nanowires supported on carbon powder, via chemical reduction using formic acid as a reducing agent, and the study of electrooxidation of methanol in acidic medium on these catalysts. The metal load of the nanowires in relation to the substrate was varied from 20, 30 and 40% and their composition for the Pt–Ru/C nanowires was maintained at 60:40. The nanocatalysts were characterized by X-ray diffraction, X-ray fluorescence, transmission electron microscopy (TEM) and cyclic voltammetry, showing that the nanowires have the cubic face-centered structure of platinum. The chemical composition of the catalysts is close to nominal. The TEM images showed that Pt/C and Pt_{0.6}Ru_{0.4}/C nanowires were successfully synthesized by the chemical reduction method presenting nanowires with a diameter between 4 and 13 nm and a length between 15 and 20 nm. The Pt_{0.6}Ru_{0.4}/C 20% catalytic composite exhibit the lowest CO oxidation onset potential (0.34 V) which is 0.3 V more negative than the obtained for a commercial Pt/C catalyst. The current density of the CO-stripping peak at the Pt_{0.6}Ru_{0.4}/C 20% catalytic composite is also 3 times higher than for the commercial Pt/C. The incorporation of ruthenium in the Pt/C nanowires and their decrease in metallic loading increased their efficiency towards the electrooxidation of methanol. The nanowires Pt_{0.6}Ru_{0.4}/C are thus promising materials as anodes for use in direct methanol fuel cells.

Keywords: nanowires; methanol electrooxidation; direct methanol fuel cell; Pt-Ru electrocatalysts.

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