Synthesis of cerium oxide nanopowders for improving catalysts electroactivity in direct ethanol fuel cells

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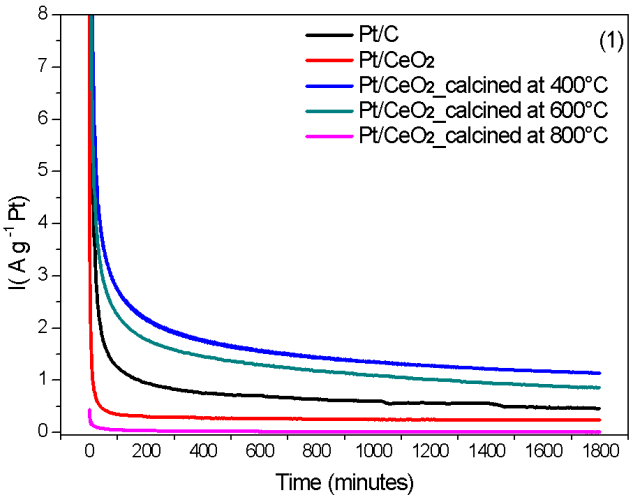
Key Words: *nanocatalysts, cerium oxide, electrocatalysis*

The search for alternative direct ethanol fuel cell catalyst supports to improve platinum electrocatalysis requires the development of novel nanostructured conducting materials. In order to boost energy conversion efficiencies, high surface-area supports with enhanced oxophilicity have been addressed. This procedure might aid breaking the C–C bond and the poisoning of platinum by strongly adsorbed species coming from the dissociative adsorption of ethanol. In the present work, synthetic cerium oxide nanopowders were compared to state-of-the-art carbon black supports for the ethanol oxidation reaction (EOR). Cerium oxides were prepared via a simple chemical precipitation method using ammonium hydroxide as a precipitant agent and the effect of thermal treatment of the synthesized nanopowders was investigated. Microstructural analyses revealed an increase in crystallite size from 8.1 to 25.7 nm after heating from 400 to 800 °C, respectively. Supported catalysts containing 20 wt.% Pt were prepared by a sodium borohydride impregnation–reduction method, in aqueous solution, at room temperature. Electrochemical measurements of the EOR showed highest electrocatalytic activity over samples calcined at 400 °C as a result of a combinantion between an appropriate nano-scaled structure and oxygen transport in cerium oxide.



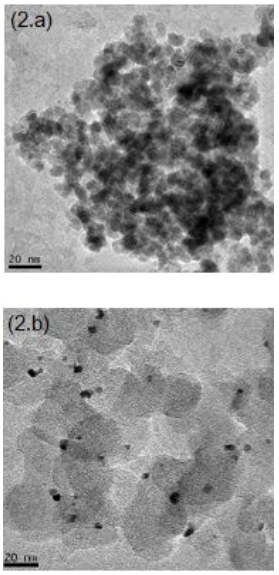


Fig. 1. Chronoamperometry comparing different samples. Fig. **2. (a)** TEM_ Pt/CeO2 calcined at 400°C. **(b)** TEM_ Pt/C.