

ENERGY AND MATERIALS RESEARCH

December 06-07, 2017 Dallas, USA

Pt-Sn/CNDs electrocatalyst for direct alcohol fuel cells

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Direct alcohol fuel cells (DAFCs) are potential energy sources for portable electronics owing to their quiet operation at ambient temperatures. Ethanol is promising fuel in DEFCs, it is abundant, environmentally friendly and has a high energy density. However, its electro-oxidation to CO₂ has not been achieved exclusively on the surface of any anode material at temperatures that are compatible with proton exchange membrane fuel cell (PEMFC) technology due to the difficulties in C-C bond breaking and the formation of CO-intermediates that poison the platinum anode catalyst. The challenges hindering the commercialization of DAFCs include the inefficiency of supports materials and the high cost of platinum, hence, it is recommended to alloy platinum with a cheaper metal to reduce Pt loading and improve the activity. Carbon nanodots (CNDs) are a new class of carbon nanomaterials with sizes below 10 nm. They are abundant, cheap, non-toxic and easy to functionalize. In the present work we demonstrate that Pt-Sn nanoparticles supported on carbon nanodots can act as efficient anode catalysts for direct alcohol fuel cells. The Pt-Sn/CNDs electrocatalyst was synthesized by the alcohol reduction method. The synthesized electrocatalyst was characterized by XPS, TEM, XRD and ICP-EOS. The electrochemical oxidation of ethanol and methanol was studied by cyclic voltammetry and chronoamperometry. The electrochemical tests proved that the Pt-Sn/CNDs electrocatalyst exhibited high current densities and lower poisoning rates compared to the Pt/CNDs and commercial Pt/C electrocatalysts.

Biography

Sandile Surprise Gwebu is a Masters' student specializing in direct alcohol fuel cells. My work entails preparation of catalysts for Alcohol Oxidation Reactions and Oxygen Reduction Reactions. In my research group, we are exploring the chemistry of carbon nanomaterials. We then use them as support materials for supporting alloys of Pt or Pd. These nano composites are used as electrocatalysts for direct alcohol fuel cells.

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