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Pt-Sn nanoparticles supported on carbon nanodots as efficient anode catalysts for direct alcohol fuel cells

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Alcohols are attractive fuels for sustainable energy systems since they are renewable, readily available, cheap and non-toxic Alcohols have high energy densities (8.0kWh/kg for ethanol and 6.0kWh/kg for methanol), hence, they are promising green fuels for direct alcohol fuel cells (DAFCs). However, complete alcohol oxidation to CO_2 has not been achieved exclusively on the surface of an anode material at temperatures that are compatible with proton exchange membrane fuel cell (PEMFC) technology due to the formation of CO-intermediates that poison the platinum anode catalyst. In practical fuel cell applications, the metal catalysts are usually dispersed on supports with high electrical conductivity, high stability, and large surface area. Carbon nanodots (CNDs) are a new class of carbon nanomaterials with sizes below 10nm. 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. Carbon nanodots were successfully synthesized with a cheap and green method using oats as a starting material. The Pt-Sn/CNDs electrocatalyst was synthesized by the alcohol reduction method. The synthesized materials were characterized by XPS, TEM, XRD, and ICP-EOS. The electrochemical oxidation of ethanol and methanol were studied by cyclic voltammetry and chronoamperometry. The Pt-Sn/CNDs electrocatalysts prepared by this method showed superior performance for ethanol and method electro-oxidation at room temperature.

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