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Chemical routes to materials

Electrodeposition of palladium-dotted nickel nanowire networks as a robust self-supported methanol electrooxidation catalyst

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ABSTRACT

Mass activity and long-term stability are two major issues in current fuel cell catalyst designs. While supported catalysts normally suffer from poor long-term stability but show high mass activity, unsupported catalysts tend to perform better in the first point while showing deficits in the latter one. In this study, a facile synthesis route towards self-supported metallic electrocatalyst nanoarchitectures with both aspects in mind is outlined. This procedure consists of a palladium seeding step of ion track-etched polymer templates followed by a nickel electrodeposition and template dissolution. With this strategy, free-standing nickel nanowire networks which contain palladium nanoparticles only in their outer surface are obtained. These networks are tested in anodic half-cell measurements for demonstrating their capability of oxidising methanol in alkaline electrolytes. The results from the electrochemical experiments show that this new catalyst is more tolerant towards high methanol concentrations (up to 5 mol L^{-1}) than a commercial carbon supported palladium nanoparticle catalyst and provides a much better long-term stability during potential cycling.

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