

Binder-free metal loaded graphene aerogel for electro-oxidation of alcoholic fuels from a one-step, mild, and green preparation

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Abstract:

Binder-free palladium loaded graphene aerogel on nickel foam (Pd/GA/NF) hybrid composite was successfully synthesized by a one-step, and green reaction under mild condition (Figure 1). The Pd particles size and overall loading (weight %) in the composite was controlled by the initial Pd concentration in the raw metal/graphene oxide mixture based on the electron microscopic characterization and X-ray fluorescence analysis. The hybrid composite was used as a binder-free anode for methanol and ethanol electrooxidation under room temperature. The cyclic voltammetry (CV) result showed that Pd/GA/NF exhibit strong electrocatalytic activity in ethanol and methanol oxidation, with a current density over 400 A g^{-1} and strong toxic tolerance ($I_f/I_b > 2$) in both kind of reactions. However, its performance was strongly dependent on the loading of Pd in the electrode, it was especially obvious in methanol oxidation. Pd/GA/NF anode also showed superior stability in ethanol electrooxidation when compared to that in methanol electrooxidation throughout the 15 h CV operation (Figure 2). The peak current density in ethanol oxidation can keep almost constant over 500 cycles with low current density depreciation rate after 1000 cycles of operation when compared to that in methanol oxidation. This work provided an alternative way for the low cost fuel cell electrode, or even the fuel cell device parts production in the commercialization development.

Keywords: Graphene, aerogel, palladium, fuel cell, ethanol, methanol, nickel foam.

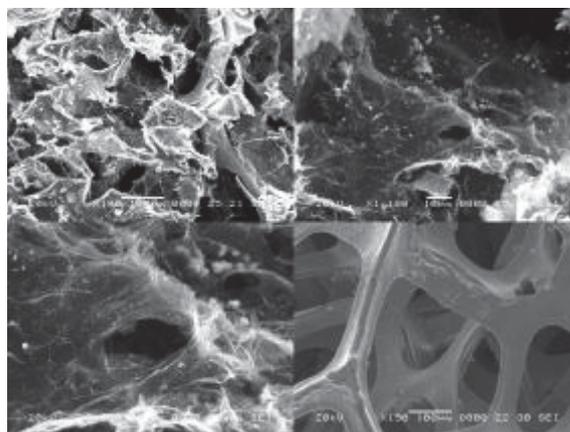


Figure 1: Microscopic images of Pd/GA/NF as catalytic electrode in alcohol electrooxidation, Pd/GA was covered on NF surface.

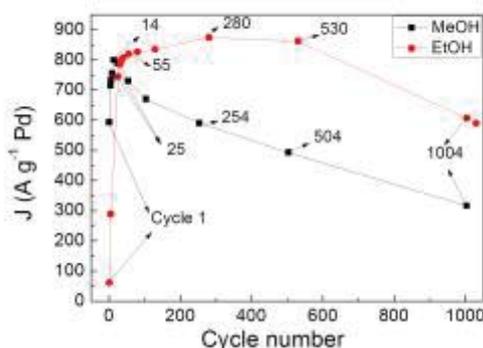


Figure 2: Figure illustrating the excellent electrocatalytic performance of the Pd/GA/NF as catalytic electrode in alcohol electrooxidation, especially the ethanol oxidation was showed the graphene aerogel high stability and activity.

References:

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