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Optimizing carbonaceous nanostructure composition as a substrate to grow Co electrocatalysts

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Abstract
Global warming and other adverse environmental effects of fossil fuels have forced humans to consider clean and renewable energy resources. In this context, hydrogen production from water splitting reaction is a key approach. In order to reduce required overpotential for water oxidation reaction, it is necessary to use low cost electrocatalysts like Ni, Co, Cu, Fe, Mn, and Zn nanostructures. Herein, cobalt nanostructures developed on steel-mesh substrate were applied. Electrochemical method was used for Co nanoflakes growth because of its simplicity and scalability for commercial approach. Surely, the substrate condition is crucial in electrocatalysts efficiency. Therefore, using carbonaceous support layers including nanomaterials such as graphene oxide and carbon nanotubes, can reduce overpotential and increase efficiency of the electrocatalyst. According to the results, 40 wt% of graphene oxide and 60 wt% of carbon nanotubes in the prepared carbon paste led to better growth for cobalt oxide nanoflakes. For the mentioned layer, cobalt was detected in metallic crystalline phase and the overpotential and electrical resistances were measured to be 305 mV and 20 Ω, respectively.

Keywords: electrocatalyst, Co nanoflakes, graphene oxide sheets, carbon nanotubes, overpotential

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