In situ Synthesis of MoP Nanoflakes Intercalated N-doped Graphene Nanobelts from MoO₃-Amine Hybrid for High-Efficient Hydrogen Evolution Reaction

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Abstract
Molybdenum phosphide (MoP) is a promising non-noble-metal electrocatalyst in the hydrogen evolution reaction (HER) but practical implementation is impeded by the sluggish HER kinetics and poor chemical stability. Herein, we report a novel high-efficiency HER electrocatalyst comprising MoP nanoflakes intercalated nitrogen-doped graphene nanobelts (MoP/NG), which are synthesized by one-step thermal phosphiding organic-inorganic hybrid dodecylamine (DDA) inserted MoO₃ nanobelts. The intercalated DDA molecules are in situ carbonized into the NG layer and the sandwiched MoO₃ layer is converted into MoP nanoflakes which are intercalated between the NG layers forming the alternatingly stacked MoP/NG hybrid nanobelts. The MoP nanoflakes provide abundant edge sites and sandwiched MoP/NG hybrid enables rapid ion/electron transport thus yielding excellent electrochemical activity and stability for HER. The MoP/NG shows a low overpotential of 94 mV at 10 mA cm⁻², small Tafel slope of 50.1 mV dec⁻¹, and excellent electrochemical stability with 99.5% retention for over 22 h.

References