

Highly efficient hydrogen evolution catalysts based on Mo-compounds on CNT-graphene hybrid support

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Development of efficient electrocatalysts for hydrogen evolution reaction (HER) with non-precious materials is the crucial challenge for practical large-scale hydrogen production from renewable energy by electrochemical and photoelectrochemical water splitting. Molybdenum compounds are attracting great attention recently as such materials replacing Platinum. Here we synthesized molybdenum carbide, nitride, and sulfide nanocrystals on CNT-graphene hybrid support via modified urea-glass route and their electrochemical activities for HER are systematically investigated. By changing the amount of urea or replacing urea with thiourea, it was possible to control the final phases of the products from nitride, carbide to sulfide. Among the prepared catalysts, Mo₂C/CNT-graphene shows the highest activity for HER with a small overpotential of 62 mV and Tafel slope of 58 mV/dec as well as an excellent stability in acid media. The performance represents one of the best among recently reported Mo-based electrocatalysts. Vastly improved electron transfer characteristics by incorporating CNT-graphene hybrid are mainly responsible for the excellent activity.