Fe₇S₈/N-doped Graphene Foam Composite as Efficient Bifunctional Electrocatalysts for Overall Water Splitting

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Exploring and developing efficient and stable bifunctional electrocatalysts for overall water splitting is of great importance to alleviate the serious consumption of fossil energy sources. Herein, nano-constructed iron sulfide loaded on N-doped graphene foam (Fe₇S₈/NGF) was obtained by hydrothermal process and chemical vapor deposition (CVD) and used as a highly efficient electrocatalyst for HER (hydrogen evolution reaction) and OER (oxygen evolution reaction). The graphene foam with a three-dimensional porous structure not only improves the overall conductivity of the catalyst but also facilitates the in-situ growth of Fe₇S₈ nanoparticles and exposes more active sites, thereby optimizing mass and electron transfer. Therefore, the synergistic effect of transition metal sulfide and NGF has greatly enhanced its catalytic performance. In 1 M KOH, Fe₇S₈/NGF bifunctional electrocatalyst has excellent HER (197.8 mV, 10 mA·cm⁻²) and OER (450 mV, 100 mA·cm⁻²) catalytic ability as well as highly stability for long-term operation. Moreover, the Fe₇S₈/NGF catalyst exhibits excellent ability for overall water splitting, reaching a current density of 100 mA·cm⁻², requires an additional applied voltage of 2.21 V only, and maintains good stability during 12 hours of continuous work.

Keywords: Bifunctional electrocatalysts; Iron sulfide; N-doped graphene foam; Hydrothermal process; Chemical vapor deposition.

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