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Ru-Doped Platelet-Like Ni_2P Nanostructure for Electrocatalytic HER and ORR Applications

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Extended Abstract

In this work, for the first time, a unique Ru-doped platelet-like Ni_2P nanostructure, was successfully prepared based on a simple one-pot synthesis method. Due to its particular platelet-like structure, the as-synthesized Ru-doped Ni_2P catalyst not only exhibits a remarkably enhanced electrocatalytic hydrogen evolution reaction (HER) performances with an onset potential of 35 mV, tafel slope of 34 mV dec^{-1} and long-term stability, but also possesses superior oxygen evolution reaction (OER) properties with an onset potential of 1.54 V and robust durability, exceeding the performance of an individual Ru or Ni_2P component and comparable to that of commercial 20% Pt/C, IrO_2 catalysts. As confirmed by HRTEM, line-scan, elemental-mapping and electrochemical analysis, the superior electrocatalytic bifunctionality of Ru-doped Ni_2P nanostructure can be attributed to the combined influence of the following factors: (1) The good intrinsic electrocatalytic properties for the exposed abundant (001) planet of Ni_2P[1-4]; (2) The special platelet-like structure ensures larger specific surface area compared to simple flat or hollow nanosheets, along with more accessible active sites caused by defects, facilitating their electrocatalytic process; (3) The introduced metallic Ru enables faster electron transfer rate of semiconductor Ni_2P and moderate hydrogen adsorption energy, and thus are responsible for their remarkable electrocatalytic bifunctionality[5],[6]. In summary, such platelet-like Ru-doped Ni_2P nanostrufcture is expected to serve as a new kind of robust catalyst for HER and OER applications. This study opens up new avenues for the design of novel high-efficiency bifunctional electrocatalysts for use in water-splitting, fuel cells and other renewable energy technology fields.

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