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Improving the Oxygen Evolution Performance of Nickel Phosphide Nanoparticles with Satellite Nitrogen-doped Carbon Quantum Dots

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Abstract

A simple wet chemical method was used to deposit nitrogen-doped carbon quantum dots (N-C QDs) as satellites on the surface of nickel phosphide (Ni₂P) nanoparticles. The structure of the N-C QDs/Ni₂P composite was confirmed by TEM, XRD and XPS. The electrocatalytic activity of the N-C QDs/Ni₂P composite for OER in alkaline solution was evaluated by RDE measurements. The nanocomposite fabricated as such can significantly enhance the electrocatalytic properties of Ni₂P nanoparticles in the oxygen evolution reaction.

Keywords: Carbon quantum dots, nickel phosphide, oxygen evolution reaction

Introduction

The oxygen evolution reaction (OER) is the basis of water splitting applications and is also central to the operation of rechargeable metal-air batteries. The OER is kinetically sluggish under most operating conditions and can only be accelerated in the presence of electrocatalysts.¹⁻³ Precious metals and their oxides are known for their good OER activities but their scarcity and prohibitively high cost are limiting their suitability for large scale water-splitting and metal-air batteries. Nickel phosphide (Ni₂P) nanomaterials, which are used for the efficient catalysis of the hydrogen evolution reaction (HER),⁴⁻¹¹ were also found to be OER active by the Hu group.⁶ However, the relatively low conductivity of the as-prepared Ni₂P nanoparticles and

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