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# One-step electrodeposition synthesis of a Ni–Fe–Sn electrode for hydrogen production in alkaline solution<sup>1</sup>

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**Abstract:** A Ni–Fe–Sn electrode was synthesized by a one-step electrodeposition method. Compared with Ni–Fe electrode, Ni–Fe–Sn electrode exhibited higher electrocatalytic activities towards the hydrogen evolution reaction (HER) in 30wt.% KOH solution with a small overpotential of 333 mV (at 10 mA·cm<sup>-2</sup>), a high exchange current density of  $1.42 \times 10^{-3}$  mA·cm<sup>-2</sup>, and a small Tafel slope of 47.3 mV·dec<sup>-1</sup>. The excellent catalytic activity of the Ni–Fe–Sn electrode can be attributed to the high surface area and enhanced charge transport efficiency of this material upon the addition of Sn.

**Keywords:** Ni–Fe–Sn electrode; Electrodeposition; Energy storage and conversion.

## 1. Introduction

Hydrogen is a clean and sustainable energy source that can displace traditional fossil fuel energy sources <sup>[1, 2]</sup>. Electrochemical water splitting is the easiest and cleanest way to produce hydrogen <sup>[3, 4]</sup> and advanced electrocatalysts are required to accelerate the hydrogen reaction <sup>[5]</sup>. Pt is the

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