

# Ru-DECORATED Co/C CATALYST FOR EFFICIENT HYDROGEN EVOLUTION REACTION

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The accelerated evolution of renewable energy technologies has prompted extensive research into advanced catalytic materials that can facilitate efficient and sustainable energy conversion processes. A significant challenge in this field pertains to the extensive reliance on catalysts composed of pure noble metals. The high cost and limited availability of these metals hinder their large-scale deployment. In order to address this issue, current research efforts are focusing on reducing noble metal content by designing composite catalysts based on earth-abundant d-block metals, metal oxides, or their hybrids. These catalysts can provide comparable catalytic activity through synergistic effects [1-3].

Hydrogen has emerged as a clean and environmentally friendly energy carrier, and electrochemical water splitting represents a promising pathway for its sustainable production. The hydrogen evolution reaction (HER) is of particular significance in the context of green hydrogen generation. However, the effective catalysts required to surmount kinetic limitations are not yet available.

In this study, a Ru-decorated Co/C catalyst was synthesized to combine the high intrinsic activity of ruthenium with the cost-effectiveness of a cobalt-based support. The synergistic interaction between Ru and Co, combined with the high surface area and conductivity of the carbon support, is expected to promote favorable hydrogen adsorption and accelerate reaction kinetics [1-3]. Ru nanoparticles were deposited onto a Co/C substrate via a chemical reduction method using sodium borohydride as the reducing agent. The composition and morphology of prepared RuCo/C catalyst were characterized by Field Emission Scanning Electron Microscopy (FESEM) method and inductively coupled plasma optical emission spectroscopy (ICP-OES). The electrocatalytic properties of the RuCo/C catalyst were investigated toward the hydrogen evolution reaction by using linear sweep voltammetry.

It has been found that prepared RuCo/C catalyst with reduced amount of noble metal exhibited excellent HER overpotential of 70 mV at a current density of 10 mA cm<sup>-2</sup> at the temperature of 25 °C.

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