

SYNTHESIS AND CHARACTERIZATION OF NICKEL TUNGSTEN CATALYST

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Hydrogen is widely recognized as a key energy carrier for the transition toward a sustainable energy system [1,2]. However, the majority of hydrogen production currently relies on non-renewable fossil resources, resulting in significant carbon emissions [3]. While carbon capture technologies enable the transition from gray to blue hydrogen, truly sustainable green hydrogen production remains commercially limited [4]. As a result, alternative hydrogen generation routes that avoid direct CO₂ emissions are of considerable interest. One promising approach is the hydrolysis of borohydrides, which enables efficient hydrogen release without carbon byproducts [5]. The effectiveness of this process strongly depends on the availability of cost-efficient and active catalysts, particularly those based on non-noble metals. In this context, electrolessly deposited nickel–tungsten catalysts supported on copper substrates represent a viable and scalable solution for borohydride-based hydrogen generation.

In the present study, the synthesis of Ni₉₃W₇/Cu, Ni₉₁W₉/Cu, Ni₈₉W₁₁/Cu, Ni₈₇W₁₃/Cu, and Ni₈₅W₁₅/Cu catalysts was accomplished through the chemical method of metal deposition. The surface morphology, internal structure and chemical composition of the obtained catalysts were analyzed using field emission scanning electron microscopy, X-ray photoelectron spectroscopy and inductively coupled plasma optical emission spectroscopy. It was determined that the prepared coating particles consist of oval-shaped agglomerates. The composition of the catalysts was analysed, showing Ni loading ranging from 252.0 to 603.5 μg/cm² and W ranging from 43.0 to 64.9 μg/cm².

Table 1. The elemental composition and metal loading of the prepared NiW/Cu coatings analyzed via ICP–OES.

Catalyst	Element, wt.%		Element Loadings, μg cm ⁻²		
	Ni	W	Ni	W	Ni + W
Ni ₉₃ W ₇ /Cu	92.94	7.09	603.5	46.0	649.5
Ni ₉₁ W ₉ /Cu	91.13	8.87	483.7	47.1	530.8
Ni ₈₉ W ₁₁ /Cu	89.04	10.96	527.0	64.9	591.9
Ni ₈₇ W ₁₃ /Cu	86.88	13.12	373.9	56.5	430.4
Ni ₈₅ W ₁₅ /Cu	85.40	14.60	252.0	43.0	295.0

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