

Brief Information about the Project

Title	AP25793577 Electrocatalytic behavior of carbon electrode modified with metal nanoparticles toward hydrogen evolution reaction at high current density
Relevance	<p>In recent decades, the demand for energy has increased rapidly, reflecting the dynamics of societal progress and population growth. In this context, the electrocatalytic reduction of water to hydrogen via the hydrogen evolution reaction (HER) has emerged as an efficient and sustainable technology, where water serves as the only reactant and by-product in the hydrogen economy cycle. A highly efficient and stable HER electrocatalyst is crucial for achieving large-scale hydrogen production.</p> <p>After decades of research, scientists have made significant progress in the development and investigation of new HER electrocatalysts. However, most of these electrocatalysts have been studied under low current density conditions. To adapt the developed electrocatalysts to high current density applications, it is essential to gain a deep understanding of the fundamental mechanisms and limiting factors affecting their activity.</p> <p>Therefore, the main objective of this project is to investigate the mechanism of the hydrogen evolution reaction on a shungite-based carbon electrode modified with metal nanoparticles under high current density conditions.</p>
Aim	The objective of the project is to investigate the electrocatalytic behavior of a carbon electrode modified with metal nanoparticles toward the hydrogen evolution reaction (HER) under high current density conditions.
Tasks	<p>To achieve the stated objective, the following tasks have been defined:</p> <ol style="list-style-type: none">1) Fabrication of a carbon support from shungite and modification of its surface with metal nanoparticles;2) Investigation of the morphological and structural characteristics of the fabricated electrodes;3) Electrochemical study of the modified electrodes, including detailed determination of all parameters related to the hydrogen evolution reaction;4) Optimization of the carbon support modification conditions to enhance its electrocatalytic properties for efficient operation under high current density.
Expected and Achieved Results	The main expected results of the project are as follows:

	<p>1) Fabrication of carbon electrodes modified with metal nanoparticles;</p> <p>2) Investigation of the morphological, structural, and electrocatalytic characteristics of the fabricated electrodes;</p> <p>3) Study of the hydrogen evolution reaction mechanism on the fabricated carbon electrodes under high current density conditions;</p> <p>4) Optimization of the fabrication conditions for the modified carbon electrodes to ensure stable operation under high current density.</p> <p>As a result of the conducted research, it is planned to publish at least two (2) articles in journals ranked in the top three quartiles by impact factor in the Web of Science database or with a CiteScore percentile of at least 50 in the Scopus database. One of the target journals for open-access publication is the <i>International Journal of Hydrogen Energy</i> (Q1, IF 8.1), the official journal of the International Association for Hydrogen Energy. The second article is planned to be published in <i>Electrochimica Acta</i> (Q1, IF 8.1), the official journal of the International Society of Electrochemistry (ISE).</p>
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