H2 Production over Pt, Ag, Ni and Cu Modified Biochar/ Cazro3 Nanocomposites

Fahad Mohammed Alqahtani
Faculty of science, Department of Chemistry, King Abdulaziz University, Saudi Arabia

Abstract:

This research focuses on enhancing hydrogen production efficiency through the development of modified nanocomposites composed of platinum (Pt), silver (Ag), nickel (Ni), and copper (Cu) supported on a biochar/calcium zirconium oxide ($CaZrO_3$) matrix. The study aims to explore the synergistic effects of these metallic nanoparticles and the biochar-$CaZrO_3$ support in electrocatalytic hydrogen evolution reactions (HER). The nanocomposites were synthesized using environmentally friendly methods and characterized using techniques such as XRD, SEM, TEM, and Raman spectroscopy. Electrochemical performance was evaluated through linear sweep voltammetry and electrochemical impedance spectroscopy. The results demonstrate that the combination of noble and transition metals significantly improves catalytic activity, while the biochar and $CaZrO_3$ support materials enhance surface area, electrical conductivity, and structural stability. Among the synthesized catalysts, the Pt–Cu–biochar/$CaZrO_3$ composite exhibited the highest hydrogen evolution efficiency and durability. This study highlights the potential of low-cost, modified nanocomposites as sustainable and effective catalysts for green hydrogen production applications