BENEMÉRITA UNIVERSIDAD AUTÓNOMA DE PUEBLA

INSTITUTO DE FÍSICA “Ing. Luis Rivera Terrazas”

SEMINARIO SEMANAL “Jesús Reyes Corona”

“MOF-DERIVED NI–CO–FE/CARBON–MXENE COMPOSITE AS A HIGHLY EFFICIENT ELECTRO CATALYST FOR THE HYDROGEN EVOLUTION REACTION”

Dr. Kannan Gothandapani

Resumen: The Development of effective and robust electrocatalysts for the hydrogen evolution process (HER) is crucial for promoting sustainable hydrogen production by water electrolysis. In this talk, I will present the synthesis of a novel Ni–Co–Fe/carbon MXene composite by combining a MOF-derived trimetallic Ni–Co–Fe/carbon framework with two-dimensional Ti_3C_2F MXene for applying as electrocatalysts for HER. The MOF-derived carbon matrix offers numerous exposed active sites, whereas the integration of MXene enhances electrical conductivity, accelerates charge transfer, and inhibits the aggregation of active metal species. Structural and morphological characterizations validated the successful creation of a well-dispersed heterostructure exhibiting high crystallinity and close interfacial contact between the MOF-derived catalyst and MXene. Electrochemical studies revealed that the optimized composite possess a markedly enhanced HER activity, necessitating a minimal overpotential to get a current density of 10 mA cm^{-2} and exhibiting a low Tafel slope value. The improved catalytic performance of the composite has been associated to the synergistic interplay among Ni, Co, and Fe active sites, the conductive carbon matrix, and the conductive MXene sheets, which collectively facilitate efficient electron transport, optimize hydrogen adsorption/desorption, and augment the electrochemically active surface area. Moreover, the composite exhibited exceptional long-term electrochemical stability with minimal performance deterioration under sustained operation. The findings indicate that MOF-derived Ni–Co–Fe/carbon MXene composites are promising noble-metal free electrocatalysts for efficient hydrogen production, which offer a viable strategy for the design of high-performance multifunctional catalysts for renewable energy conversion and storage applications.

Auditorio del Instituto

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