

Project Abstract – Sustain-FIT Fellowship

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Magnetically Recyclable Nanocatalysts for pH-Universal Hydrogen Evolution

Abstract

The development of sustainable hydrogen production techniques is essential for advancing to a clean, low-carbon energy future. Although water electrolysis presents an attractive pathway, the high cost and poor stability of traditional electrocatalysts, particularly in the presence of pH fluctuations, continue to hinder their widespread use.

In order to effectively and consistently drive the hydrogen evolution reaction (HER) in acidic, neutral, and alkaline conditions, this research seeks to develop a novel class of magnetically recyclable nanocatalysts. The strategy involves developing intelligent core-shell nanostructures, in which the shell offers strong catalytic activity and the magnetic core facilitates simple recovery and reuse. To enhance charge transport and maintain structural integrity, a molecular interface will be employed.

The project will focus on:

- Producing strong, pH-universal HER catalysts
- Achieving effective charge transfer and catalytic performance
- Ensuring reusability and magnetic separability
- Examining stability over an extended period under different electrolytic conditions

Performance will be evaluated using advanced synthesis and characterization techniques, along with electrochemical testing. Scaling and integrating these materials into actual hydrogen production systems will be facilitated by industrial secondment. This project supports the objectives of the EU Green Deal and the Sustain-FIT program's dedication to sustainable innovation by addressing significant challenges in clean hydrogen generation.