22nd International Conference on
Diffusion in Solids and Liquids
22 TO 26 JUNE 2026 | RHODES, GREECE

ABSTRACT:

HER Catalyst Development from Non-Conventional Synthesis to Scalable Electrodeposition for Near-Industrial Performance

Alvaro Seijas Da Silva[1], Eugenia Miguel-Casañ[1], Delia Belleza[1], Jose Gracia[1], Jorge Romero[1,2], Gonzalo Abellán[1,2].

[1]Matteco Team S.L. Carrer de Les Noves Tecnologies, 6, 46980 Paterna, Valencia, Spain.

[2]Instituto de Ciencia Molecular (ICMol), Universidad de Valencia, Catedrático José Beltrán 2, 46980, Paterna, Valencia, Spain.

The development of advanced catalysts for the hydrogen evolution reaction (HER) requires innovative synthesis strategies that combine rapid discovery with scalability. In this work, we present a non-conventional pathway integrating wet chemical synthesis and electrodeposition to accelerate catalyst optimization and enable industrial translation. Initially, a innovative wet chemistry route[1] combined with thermal treatment was employed to generate a wide range of metallic compositions, allowing fast screening under three-electrode configurations. This approach enabled identification of promising candidates within a short timeframe (~4 months), with significant reductions in overpotential. Despite its effectiveness, this method presented limitations in energy consumption and scalability. The process was therefore transitioned to an electrodeposition-based approach, enabling direct catalyst growth onto conductive substrates and improving control over morphology, loading, and interfacial properties.
Optimization of deposition parameters, together with controlled tuning of the catalytic composition, led to enhanced performance, improved stability, and high reproducibility. The resulting materials demonstrate stable operation and achieve single-cell voltages around 1.8 V at 1 A/cm2, approaching industrial targets. This work highlights how non-conventional synthesis strategies bridge laboratory screening and scalable manufacturing.

[1] J. R. Pascual, G. A. Sáez, Alvaro Seijas-Da Silva, EP4621888A1, 2024.