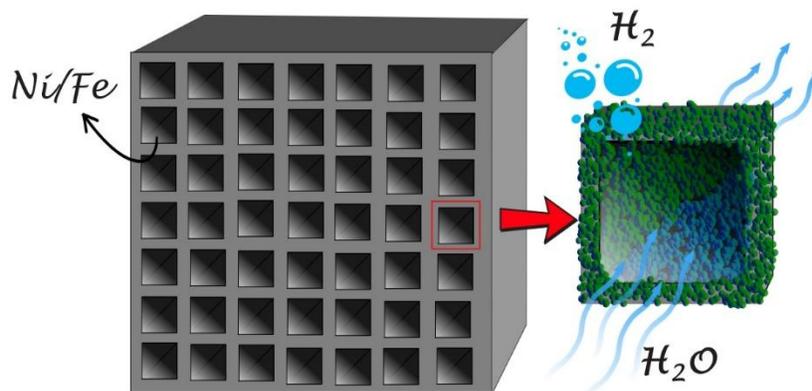


Project “NICE”

Additively Manufactured Nickel- and Iron-based Structures as Cobalt-free Electrocatalysts for Flow Reactors

In the face of a deepening climate and energy crisis, the transition toward low-emission and efficient energy technologies has become one of the key challenges of our time. Hydrogen, as a clean fuel, can play a vital role in this transition, especially when produced in an environmentally friendly way. The greatest potential lies in so-called green hydrogen, produced from water via electrolysis powered by renewable energy sources. However, for this technology to become widely adopted, it is essential to develop cheaper and more accessible materials to replace the currently used, expensive and hard-to-obtain platinum group metals (PGMs) and cobalt.

The innovative solution proposed in this project involves the fabrication of 3D porous supports from widely available metals – nickel and iron – using additive manufacturing (commonly known as 3D printing). This approach enables not only precise control over the geometry and microstructure of the material but also easy scalability of the process. The surface of these supports will be further modified by the deposition of active compounds – oxides or selenides – also based on nickel and iron. As a result, the developed materials will offer high catalytic activity and resistance to degradation, contributing to improved durability and overall efficiency. Additionally, the experimental work will be supported by theoretical modeling to better understand the influence of the metallic support on the reaction environment at the electrode surface. Ultimately, the materials will be tested in so-called flow reactors, which can be implemented in industrial installations where water flow is already a natural part of the system. This solution may bring us closer to the practical, economically viable, and sustainable use of hydrogen as a fuel of the future.



In summary, the project aims to develop 3D porous supports with customizable geometry and microstructure, coated with catalytically active layers, using simple, scalable, and relatively low-cost materials and methods. This technology has strong potential for implementation in flow systems and may significantly improve the economic viability of hydrogen-based technologies.