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The network of Horizon Europe Cluster 5 National Contact Point.



Novel catalysts for hydrogen evolution reaction

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European Hydrogen Week

Clean Hydrogen Partnership

European Hydrogen Week 2024
GREENET Pitch session
TechForum, 19th November 2024

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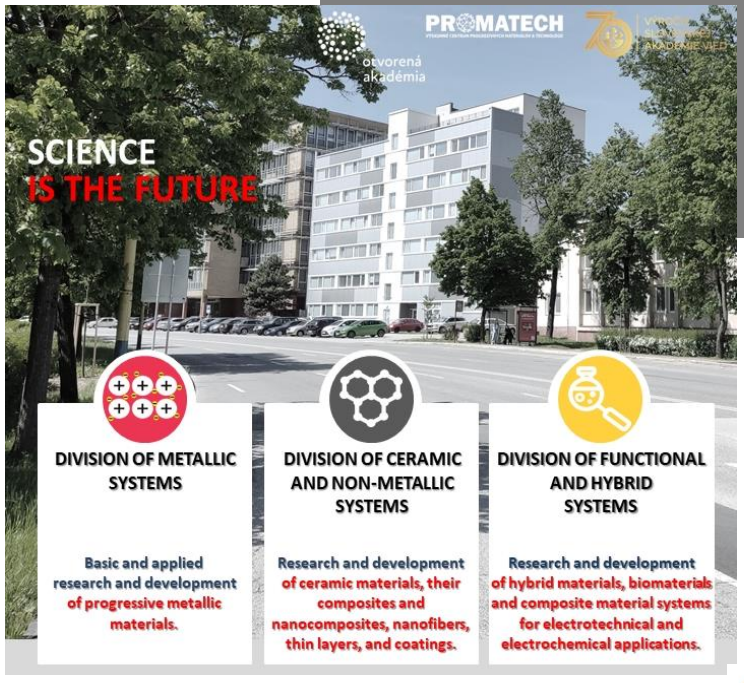


Institute of Materials Research

Slovak Academy of Science

Watsonova 47, Košice

- established in 1955, nearly 70 years of experiences in materials science and engineering

- advanced powder technologies
- modern steels
- modern construction and functional ceramics
- composite materials
- biomaterials
- catalytic materials for energetics

Collaborations

FACULTY OF SCIENCE
PAVOL JOZEF SAFARIK UNIVERZITY IN KOSICE

TECHNICAL UNIVERSITY IN KOSICE
FACULTY OF MATERIALS, METALLURGY AND RECYCLING

UNIVERSITY OF CHEMISTRY AND TECHNOLOGY PRAGUE

Infrastructure of IMR SAS for H_2 catalysts preparation

SEM/FIB – CrossBeam system AURIGA Compact

Nanospider NS Lab 200 for fiber production

XRD diffractometer Philips X`Pert Pro with high temperature chamber up to 1600 ºC

Transmission electron microscope JEOL JEM-2100F

DTA-DSC-TG analyzer Jupiter STA 449-F1

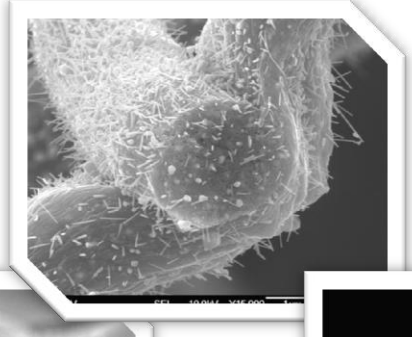
Potentiostat Vionic with RDE

The goal of the research:

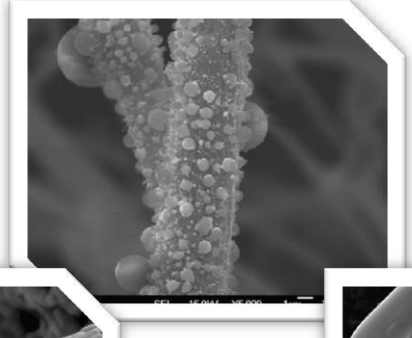
* **Production of hydrogen by water electrolysis as an alternative fuel for advanced electrolyzers and fuel cells**
* **Preparation of electrocatalysts based on non-noble metals in the different structures and morphologies as the main component for the membrane electrode assembly in electrolyzers**

* **Key task:** Development of bifunctional electrode materials for hydrogen evolution reaction (HER) and oxygen evolution reaction (OER) with emphasis on low costs and high efficiency

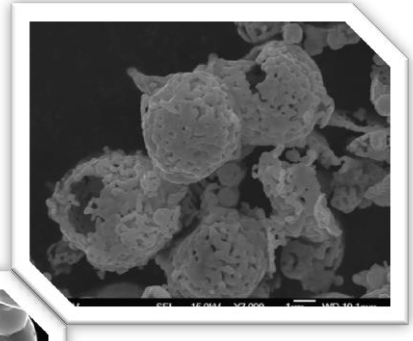
Carbon fibres with Co lames

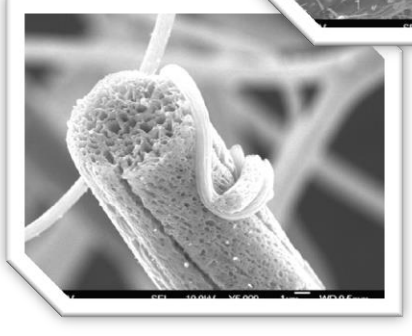


Carbon fibres with NiFeP particles

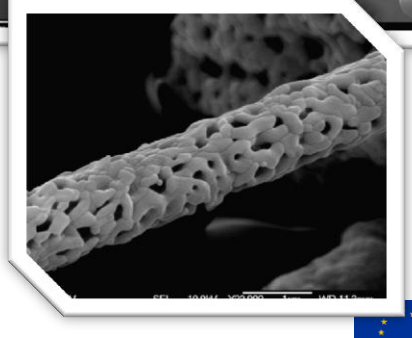


MoFeCoP spheres

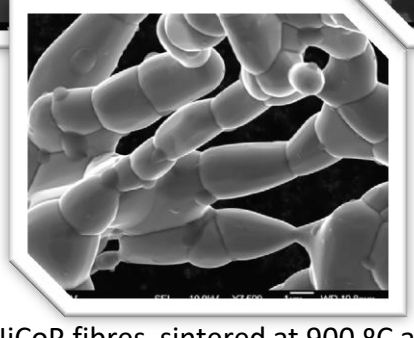




Porous carbon fibres



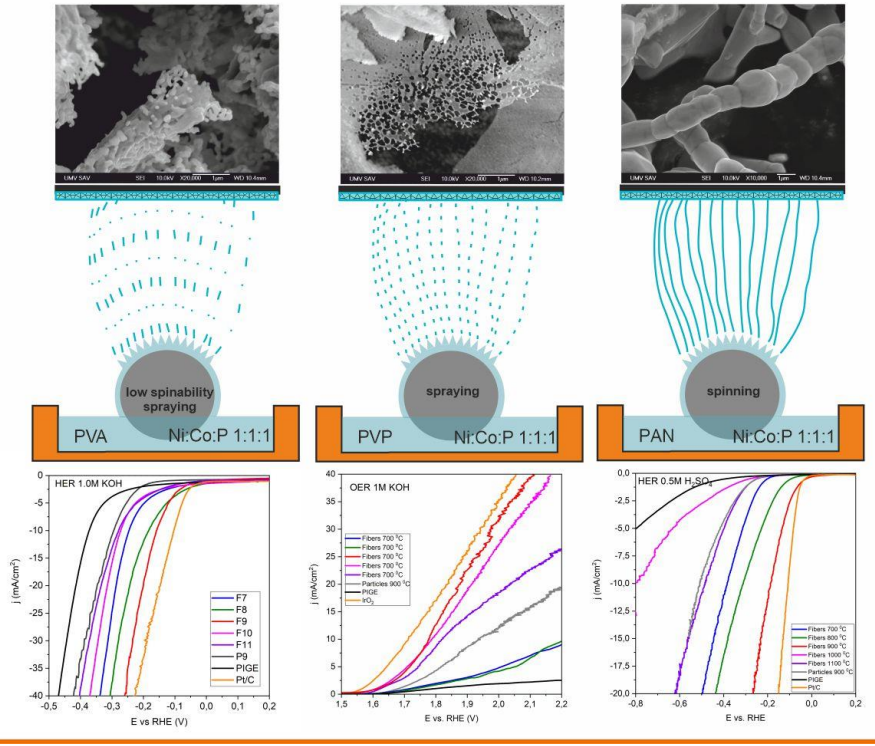
NiCoP fibres sintered 700 ºC air, 780 H_2



NiCoP fibres sintered at 900 ºC air, 780 H_2

Results

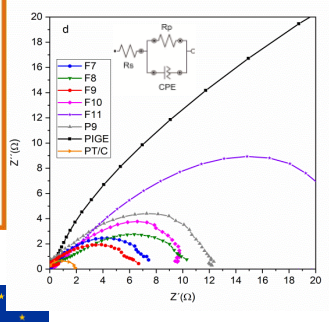
NiCoP fibers as electrocatalyst for HER

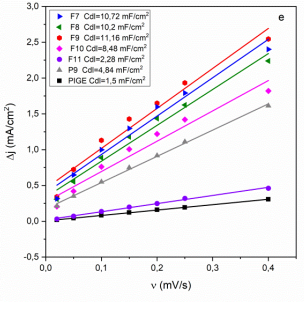


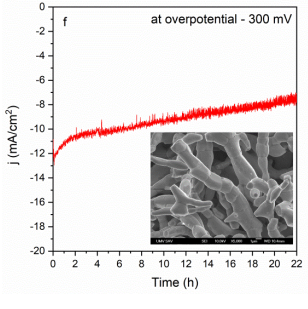
Advantageous electrochemical parameters

- Low overpotential
- Low Tafel slopes and high exchange current density j_0
- Long-term stability at high currents
- High faradaic efficiency
- High ECSA
- Low resistance (EIS analysis)

NiCoP fibres	Drying in air (°C)	Sintering in air (°C)	Sintering in Ar/H_2 (°C)
F7	270	**700**	100/700
F8	270	**800**	100/700
F9	270	**900**	100/700
F10	270	**1000**	100/700
F11	270	**1100**	100/700
P9	270	**900**	100/900 lit







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Acknowledgement:

Thank you for your attention

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RECOVERY AND RESILIENCE PLAN

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