



NOVEL ELECTRODE COATINGS AND INTERCONNECT FOR SUSTAINABLE AND REUSABLE SOEC

UPDATES ON ACTIVITIES at M27

The consortium of NOUVEAU is running for already two years! In this fourth Newsletter, we proudly introduce our two new **associated partners** of NOUVEAU, namely **VDM Metals and Acerinox Europa**. We also present the project progress of **TU/e**. In addition, an update on the **attended conferences** by the project partners is given and we would like to highlight our second NOUVEAU **physical meeting**, which took place **at the IMDEA Energy Institute** in Madrid.

Enjoy the reading!

Meet the NOUVEAU associated partners ACERINOX and VDM Metals

Acerinox Europa was the first integrated stainless steel factory in the world and it was founded in 1970. This factory is in a privileged location of southern Spain, next to the strait that links the Atlantic with the Mediterranean, and has 1746 employees (2024).



The factory of Acerinox Europa has a melting shop capacity of one million tonnes. This factory supplies mainly flat products (sheet, plates) to the European continent and material for producing long products in other plants of the Acerinox Group.

Acerinox Europa is committed to sustainability and encourages eco-practices during manufacturing, such as circular economy, waste recovery and novel technologies that ensure the decarbonization of this factory.

On the other hand, Acerinox Europa is running around 28 R+D projects on sustainability and new alloys development. Recently, 5 hydrogen related projects have started in order to develop materials towards hydrogen application and the replacement of natural gas with green hydrogen in the annealing furnaces of this factory.

Role of Acerinox Europa in the project: Supply samples of different grades of thin/medium-thickness ferritic stainless steels to study the viability of these commercial materials as interconnectors in SOECs devices. Certification of the materials sent in terms of chemical composition, mechanical properties and surface properties. Advice to the consortium on the materials that should or can be evaluated for the specific application based on the expected service conditions and the known properties of the materials considered.

VDM Metals is one of the world's leading manufacturers of nickel alloys and high-alloy special stainless steels located in Germany and the USA. High-performance materials from VDM can be found in many different applications, including the oil and gas as well as chemical process industry, energy and environmental technology sectors, automotive and aerospace industry, etc. One of VDM core competencies lies in the research and development of new high-performance materials that are able to withstand extreme conditions.



Materials are available as plate, strip, bar, wire or powder. The company's processing plants and machinery are tailored to specific production requirements and equipped with state-of-the-art process data acquisition systems, ensuring high productivity and production reliability.

VDM Metals has been active in the development and production of materials for interconnectors for solid oxide cells for more than 20 years.

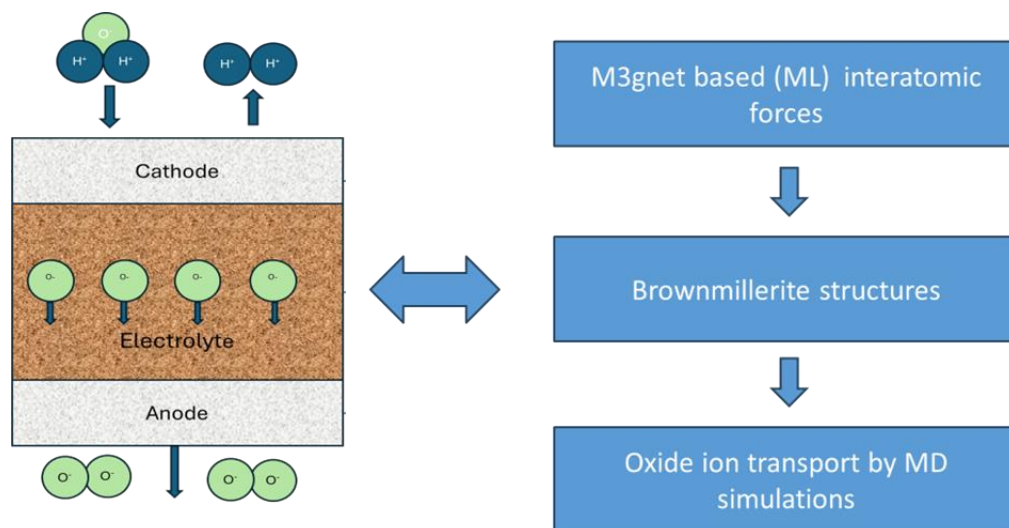
Role of VDM Metals in the project: VDM will provide state-of-the-art ferritic stainless steels specifically designed for SOC applications and the respective materials know how.

UPDATES ON ACTIVITIES

RESEARCH ON MODELLING: TU/e

At the Technical University of Eindhoven (TU/e), the NOUVEAU project is advancing multiscale modeling techniques to enhance Solid Oxide Electrolysis Cell (SOEC) efficiency. Our team is focusing on innovative, lanthanum-free materials with enhanced electrochemical properties such as thermal coefficients and ionic conductivities, that are crucial for advancing SOEC performance.

In the initial phase of our research, we performed molecular dynamics (MD) simulations on brownmillerite-based calcium iron oxides ($\text{Ca}_2\text{Fe}_2\text{O}_5$) as well as on structures doped at the A and B sites. These simulations were aimed at obtaining critical electrochemical parameters, including the diffusion coefficients and ionic conductivities of these doped brownmillerite materials. Our comprehensive simulations, covering 165 unique material compositions, allowed us to identify promising materials with significantly enhanced electrochemical properties.



Looking ahead, the next phase will involve testing these shortlisted materials in a simulated SOEC cell. By coupling our molecular-scale data with transport modeling techniques such as computational fluid dynamics (CFD), we aim to gain a deeper understanding of how these materials can improve SOEC efficiency in practical applications.

EVENTS ATTENDED

SSI24 London

Last July 2024, it has been a pleasure for people from Unit of Catalysis and Solid State Chemistry (Unité de Catalyse et Chimie du Solide, UMR CNRS 8181) to present the latest data they obtained on promising air electrode for Solid Oxide Electrolyser Cells with less amount of critical element at the 24th international Conference on Solid State Ionics. This year; the conference took place in London. It was headed by Prof John Kilner and Stephen Skinner. A very good opportunity to meet academic and industry SOEC/SOFC key players in the field and for the PhDs to discuss with the best people in the field (<https://ssi24.scito.org/>).



CMCEE Budapest

In August 2024, Valentin Brad from IMN (CNRS) and Marijke Jacobs from VITO participated in the 14th International Conference on Ceramic Materials and Components for Energy and Environmental Systems (CMCEE) in Budapest, Hungary. Valentin delivered an insightful presentation titled “**Selective Separation Method for Re-use of Solid Oxide Electrolyser & Fuel Cell Materials,**” which sparked valuable discussions and garnered constructive feedback from the global SOFC/SOEC community. These exchanges are set to drive significant advancements in the field. Meanwhile, Marijke was invited to share her cutting-edge research on **developing tuned SOEC electrodes by spray coating**. With a dedicated session focused on high-temperature fuel cells and electrolysis, CMCEE provided an exceptional platform for networking and collaboration within this dynamic scientific domain.



RMIS Brussels

On October 9th, 2024, Marijke Jacobs, project coordinator of NOUVEAU, participated in the RMIS workshop organized by the European Commission. This event fostered continued dialogue between the EC, HaDEA, and EU-funded projects, with a focus on integrating project outcomes into the RMIS framework to better support policy development.

The two-day hybrid workshop began with discussions involving policy representatives and key stakeholders, addressing challenges related to critical and strategic materials. The second day spotlighted the role of advanced materials in reducing dependency on these resources, highlighting the latest scientific and technical advancements and contributing to the creation of a robust research agenda. Marijke showcased the NOUVEAU project's progress by presenting its general poster, further strengthening its visibility and alignment with policy objectives.



MATSUS NanoGe, Lausanne

On November 12, 2024, the NOUVEAU project team from Eindhoven University of Technology (TU/e) presented important research findings at the **Materials for Sustainable Development (MATSUS NanoGe)** conference held in Lausanne, Switzerland.

The research focuses on improving the efficiency of Solid Oxide Electrolysis Cells (SOECs) by developing lanthanum-free materials with enhanced electrochemical properties, such as optimized thermal coefficients and ionic conductivities. These properties are essential for advancing SOEC performance and efficiency.

In this study, molecular dynamics (MD) simulations were conducted on brownmillerite-based calcium iron oxides ($\text{Ca}_2\text{Fe}_2\text{O}_5$), including structures doped at the A and B sites. A total of 165 unique material compositions were analyzed to determine key electrochemical parameters, such as diffusion coefficients and ionic conductivities. These simulations led to the identification of promising materials with significantly improved properties.



NOUVEAU Consortium Meeting

On October 1st and 2nd, we hosted our second physical consortium meeting at the IMDEA Energy Institute in Madrid. This gathering marked a warm and productive reunion for all partners following our initial physical meeting. Each partner provided updates on their respective research activities, initiating insightful discussions and collaborations.

A key highlight of the event was the inaugural meeting of the NOUVEAU Advisory Board, further enriching the exchange of ideas and perspectives as we continue driving the project forward.



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FRANCE
<https://www.mariontechnologies.com/en/home/>



Eindhoven University of Technology (TU/e)
NETHERLANDS
<https://www.tue.nl/en/>



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SPAIN
<https://energia.imdea.org/en/>



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<https://fiaxell.com/>



VDM Metals
GERMANY
<https://www.vdm-metals.com/en>

CONTACT US



PROJECT COORDINATOR
Marijke Jacobs
- Researcher
- VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK NV (VITO)



marijke.jacobs@vito.be



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