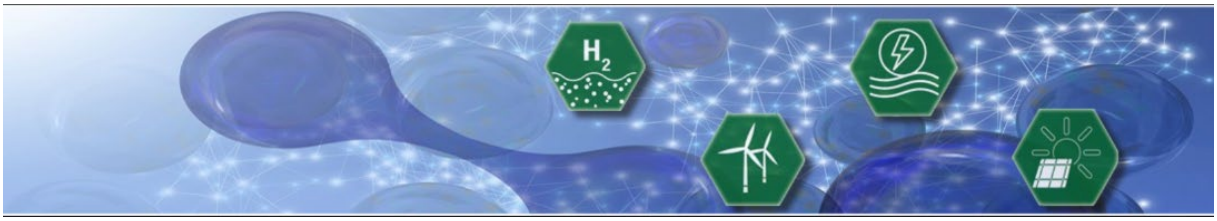
NOUVEAU



NOVEL ELECTRODE COATINGS AND INTERCONNECT FOR SUSTAINABLE AND REUSABLE SOEC

LET'S MEET THE PROJECT PARTNERS

NOUVEAU (NOVEL ELECTRODE COATINGS AND INTERCONNECT FOR SUSTAINABLE AND REUSABLE SOEC) is an HORIZON EUROPE research project to develop novel electrode materials, solide electrolyte and interconnects focusing on sustainable-by-design and recycling approaches and using advanced coating technologies and modelling tools. Economics, commercial and environmental impacts will be assessed to pave the way for a lower cost, resource & energy efficient and climate friendly SOC.

THE CONSORTIUM

The consortium includes 3 SME, 1 industry enterprise which is a large manufacturer of coating devices for fuel cells and batteries, 4 product-focused research and R&D organisations and 1 university.

VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK NV (VITO)

The Flemish Institute for Technological Research (VITO) is a leading independent European research and technology organisation in the area of cleantech and sustainable development. VITO develops innovative products and processes and delivers client-oriented research projects, building on its decades-long experience of multidisciplinary research.
VITO plays a vital economic and social role acting as a conduit between stakeholders from business, government and the research community.
More specifically, VITO's research and industrial consultancy is directed towards solving problems and technology transfer related to energy efficiency, sustainable materials, chemistry, health and environmental protection.
VITO's long-established Sustainable Materials Department (SuMAT) has gained international recognition as an important research facility for – among other things – sustainable materials development and clean technologies.
With a well-connected team of experienced researchers, and state-of-the-art laboratories, the department has unrivalled experience of developing innovative materials and technologies from the initial stages of materials preparation, through advanced shaping processes to materials characterisation. The department have delivered proven results in advanced materials processing into different structures and forms, including the production of spheres by droplet coagulation and spray drying; powder processing for technical ceramics; coating; biomedical scaffolds; 3D-structured catalysts and adsorbents for chemical production; mixed conductor membranes for gas separation.

VITO's department Health has been providing research and high-level consultancy services in the chemicals safety domain for industrial and governmental stakeholders, including communication and science to policy translation at regional, national and EU level. In the area of sustainable health, the Health team has extensive experience in the field of toxicological hazard assessment used for classification and labelling as well as assessment of health risks and the establishment of health-based indicators and standards to support policy making in the chemicals domain. Quantitative assessments including statistical analyses and biological interpretation are used in epidemiological studies, site-specific as well as for use in general frameworks. With in-depth knowledge on EU chemicals legislation (a.o. CLP and REACH), studies for human health and environmental hazard and exposure assessment with priority to non-animal testing and modelling approaches, the experts have a track record in projects covering Safe and Sustainable By Design (SSBD) goals to support industrial innovation.

Forschungszentrum Jülich GmbH (JÜLICH)

Forschungszentrum Jülich GmbH (JÜLICH) is one of the leading research institutions in Germany with nearly 7,000 employees, belonging to the Helmholtz Association (HGF), Germany's largest research organization. Energy technology is one of the main research topics with an involvement of approx. 450 person-years.
The SOC cross-cutting group at JÜLICH is one of the world's largest and has produced several world record achievements in the past years, including an SOFC short stack that reached more than 100,000 h operating time with a low degradation rate.

Over the past 25 years JÜLICH has been involved in several national programs as well as in several European projects co-operating with research institutes (ECN, Risø National Laboratory / DTU, VTT, CEA, KIT etc.) and industries (Haldor Topsoe, H. C. Starck, Wärtsilä, Sulzer / Hexis, Rolls Royce Fuel Cell Systems, Convion, AVL, Bosch, BMW, ElringKlinger etc.). The IEK (German abbreviation for Institute of Energy and Climate Research) consists of fifteen individual sub-institutes covering either single applications like photovoltaics or troposphere, or crosscutting issues within e.g. the IEK-1 (Materials Synthesis and Processing) or IEK-2 (Microstructure and Properties). The latter two are part of the NOUVEAU project. Additionally, two so-called Helmholtz- Institutes, located at a German university (U Münster and FAU Erlangen-Nürnberg), but organizationally integrated into the Forschungszentrum, complete the R&D portfolio.
The role of IEK-1 within the NOUVEAU project lies in the development and manufacturing of alternative steels for interconnects, combined with a suitable coating material and its coating technology.
Therefore, in the first step conventional stainless steels with a reduced Cr-content will be determined and coated with the state-of-the-art coating material (MCF) as well as suitable alternatives. Different coating techniques (as WPS, APS and AD) are intended to be investigated. In the next step, as a new approach, the manufacturing of interconnects by powder metallurgical processes (e.g. MIM and pressing) is striven, followed by the deposition of suitable coatings via screen printing as well as the development of potentially necessary thermal treatments. The evaluation of the resulting samples is focusing on the occurrence of cracking and the achievable densities, primarily via SEM and XRD.
Within the NOUVEAU project, IEK-2 is responsible for the evaluation and modelling of degradation of the coated interconnect steel components. For this purpose, oxidation in controlled atmospheres simulating various SOC operating conditions and at different temperatures are performed. The tests include short time thermogravimetry and long-time cyclic oxidation exposures. Extensive characterization of the oxidized material is performed using a range of analytical techniques including XRD, GDOES, SEM/EDX/EBSD and, if necessary, TEM. Based on the testing and analytical results the lifetime of coated components limited by oxidation (primarily by Cr-depletion in the steels) and coating degradation will be modelled.

MARION TECHNOLOGIES (MTEC)

MARION TECHNOLOGIES is essentially dedicated to formulation, development and «custom-made» production of nano-structured materials and ceramic powders for industrial use. Materials synthesized by “soft chemistry” point out better original and technical properties than the same materials synthesized by classical manufacturing processes. MARION TECHNOLOGIES is in charge of providing, for a specific application, a global response to a “Material” problem. The company carries out the process implementation, the development and the scaling-up. MARION TECHNOLOGIES currently has a minimum production capacity of 40 tons.

Powders and suggested materials are specifically optimized for each application, especially ceramic powders, from simple oxides to the most complex multi-elements. There are many applications: electronic ceramics, coatings, catalysis, energy storage, loads for paintings, cosmetics etc…

Besides, MARION TECHNOLOGIES also has a wide range of facilities in its own Analysis Laboratory: X-Ray diffractometer, BET specific surface analyser, Secondary Electron Microscope, Inductive Coupled Plasma (ICP-AES), Laser Granulometer, Nanosizer.

Coatema Coating Machinery GmbH

Coatema Coating Machinery GmbH designs and produces Sheet-to-Sheet and Roll-to-Roll equipment for the coating, printing and laminating sectors.

For more than 40 years Coatema has designed and built laboratory equipment and pilot/production plants for traditional markets such as the textile sector and the materials converting market.

The laboratory and pilot machinery product lines were expanded more than 20 years ago making Coatema a market leader in emerging technologies such as advanced batteries, solar, prepregs, medical and pharmaceuticals, fuel cells and printed electronics. New and evolving technologies are a primary focus of Coatema’s Lab2Fab concept, offering significant advantages to customers wanting to upscale initial prototypes all the way to production of mature, marketable products.

In the Nouveau project, Coatema is Work package 3 leader and will upscale the coating process for the water based inks as developed by partner Fiaxell.

Eindhoven University of Technology (TU/e)

Eindhoven University of Technology (TU/e) is a research university specializing in engineering science & technology. Our education, research and knowledge valorization contribute to science for society:

- solving the major societal issues and boosting prosperity and welfare by focusing on the Strategic Areas of Energy, Health and Smart Mobility
- science for industry: the development of technological innovation in cooperation with industry
- science for science: progress in engineering sciences through excellence in key research cores and innovation in education

The research group Sustainable Process Engineering, is part of the faculty of Chemical Engineering and Chemistry at the Eindhoven University of Technology. The main objective of the research group is the development of novel integrated reactor concepts (such as Membrane Reactors, micro reactors, structured catalysts and reactors) based on improved fundamental knowledge using validated advanced (multi-phase) reactor models. This is achieved by employing a combination of state-of-the-art numerical models (at different levels of detail using the multi-level modelling approach), advanced (non-invasive) experimental techniques and experimental demonstration of novel reactor concepts (proof of concept).

QSAR Lab Ltd

The foundation of the QSAR Lab Ltd. business is transferring chemistry from traditional laboratories to virtual space. The company's offer includes several specialized services in the field of computational chemistry and (eco)toxicology. Using in silico methods, data analysis, machine learning and artificial intelligence, the R&D Team helps our partners increase the efficiency of the research, optimize the technical processes, reduce costs, and boost innovation. We support the process of designing greener materials and chemicals, using the sustainability-by-design approach.

QSAR Lab's research and development activities primarily concern the development of innovative computer methods for the design and health risk assessment of technologically advanced nanoparticles and nanomaterials. QSAR Lab is a pioneer in computer modeling of biological activity / (eco)toxicity / physicochemical properties of nanomaterials. QSAR Lab Experts were the first to adapt the QSAR / QSPR methodology to the specificity of nanoparticles.

Main activities are a synergy of digitization and Green Deal assumptions in the field of computational chemistry. As a result of international research projects continued in cooperation with partners from Europe, North America and Asia, our Scientists participate in the creation of legislation and research standards regarding chemical safety in Poland, Europe, and the wider world.

Among the R&D projects listed in the first part of the tender documentation, an important focus of QSAR Lab development are projects that develop computer tools to assess the risk posed by nanomaterials to human health and life.

IMDEA Energy

IMDEA is a research initiative driven by the Regional Government of Madrid (Spain) and formed by a network of 7 independent R&D centres which operate as public non-profit foundations. IMDEA Energy is part of the IMDEA network since its creation in November 2006.

IMDEA Energy mission is the promotion of R&D activities in energy, with emphasis on topics related to sustainable energy technologies, including their analysis from technical, economic, environmental and social perspectives.

In this regard, the Systems Analysis Unit of IMDEA Energy has a strong background in the techno-economic, environmental and social assessment of a wide range of energy systems, especially hydrogen-related energy systems. The research team is composed by a group of experts on the development and use of modelling and simulation tools, life cycle sustainability assessment, ecodesign, and prospective analysis.

CNRS - IMN

The Institute of Materials was created in 1988 by the renowned French chemist Jean Rouxel. Bringing together chemists, physicists and materials engineers from the CNRS and the University of Nantes, with over 150 researchers and support staff, it now represents one of the largest materials research centers in France. Research projects are various, including collaborations with industry, and other national and international research organizations.
At the IMN we develop a fundamental understanding of the science of materials and their properties from the atomic scale upwards.

This allows the design, characterization and optimization of new materials for a diverse range of high technology applications, including next generation solar cells, fuel cells & hydrogen production, electric car batteries, nanotechnology, smart materials, materials for microelectronics, photonic and optical materials. Some research works are devoted to Electrochemical storage and conversion of electricity (ST2E).
The activity of the ST2E team is based on the synthesis and characterization of materials and on the analysis of the mechanisms that occur in the operation of electrochemical devices for energy storage or transformation. The team is structured in 3 research topics: batteries, supercapacitors, fuel cells & electrolyzers. ST2E brings together 18 permanent researchers and about 30 non-permanent researchers with expertise in the fields of the physical-chemistry of oxides, inorganic and organic chemistry, electrochemistry, modeling and materials science. The main research activities focus on mixed ionic and / or electronic conducting electrode materials and solid ionic conducting electrolytes with the objectives of improving the energy performance, reliability, lifetime and safety of current or future devices. Expanding the operating temperature range, changing existing materials, designing new materials and controlling all interfaces are some examples. Recycling and eco-design aspects are also treated.

Concerning fuel cells and electrolysers, the research deals with "high temperature" (~700°C) Solid Oxide Fuel Cells (SOFC) and "intermediate temperature" (400°C) Proton Ceramic Fuel Cells (PCFC) for which the electrolyte is either a O^{2-} or a H^{+} ion conductor in the form of a ceramic oxide material. The enlargement of the operating conditions of fuel cells devices, such as the direct use of natural gas, but also of gaseous mixtures issued from wastes, but also seawater electrolysis, are major technological objectives of IMN research. Its contribution to the NOUVEAU program will be the eco-design and recycling of fuel cell components developed by the consortium.

CNRS - UCCS

The Unit of Catalysis and Solid State Chemistry, UCCS, located near Lille in North of France is a research unit of the Centre National de la Recherche Scientifique in France, belonging to the University of Lille, University of Artois and Centrale Lille Institute. Its research activity mainly focuses on three main topics: energy, environment and sustainable development upon three scientific departments: Catalysis and Molecular Chemistry, Heterogeneous Catalysis, and Solid State Chemistry.

With about 300 people and 150 permanent people; the UCCS research efforts are mainly towards catalytic upgrading of biomass, fine chemistry, plant chemistry, pollution abatement, new fuels, nuclear fuel and wastes, fuel cells, eco-friendly materials…
It is member of the French Research Network on Hydrogen Energy (FRH2, FR2044). The group involved in the NOUVEAU project has an experience of more than 30 years in the research and characterisation of oxide ion conductors for use as electrode or electrolyte in Solid Oxyde Fuel Cells, electrolyser cells and membrane for gas separation. Located on the campus at Cité Scientifique in Villeneuve d'Ascq, people involved belong to Centrale Lille, University of Lille and CNRS. As solid state chemists, the work their carried out is mainly focused on the evidence of innovative materials. Their contribution to the NOUVEAU programme will be the research and development of RE-free oxides as anode for Solid Electrolyser Cell.

FIAXELL SOFC TECHNOLOGIES

Over the past ten years, Fiaxell, a Solid Oxide Fuel Cell company has developed processes for cell fabrication, specialty screen printing inks, tape casting slurries, flexible testing devices for high temperature measurements and has now provided customers worldwide. Thanks to our intergated steamer, the Fiaxell button cell tester can immediately switch from SOFC to SOEC co-electrolysis mode as a reversible solid oxide fuel cell and transform water (H2O) and carbon dioxide (CO2) into hydrogen (H2) and carbon monoxide (CO).

To complement our core competences, we identified highly skilled manufacturers of electronics (power supply & EIS), kilns, gas control, liquid management, gas detection, hydrogen generators and are working closely with them. Fiaxell, as solid oxide fuel cell (SOFC / SOEC) manufacturer & supplier is now in the position to provide a complete turnkey solution for all your high temperature development challenges.

CONSORTIUM

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