National Press Release **17/03/2025**

A research-corporate collaboration for green hydrogen production

- Hydrogen production currently accounts for over 2% of global CO_2 emissions. Green hydrogen, which remains challenging to implement on an industrial scale, constitutes less than 5% of total global production.
- Michelin, the CNRS, Université Grenoble Alpes (UGA), Université Savoie Mont Blanc (USMB) and Grenoble INP - UGA are pooling their expertise to develop a low-carbon and sustainable hydrogen (H_2) production.
- To this end, the partners aim to develop an anion-exchange membrane water electrolysis, known as AEMWE. They aim at designing next-generation materials composed of Earth-abundant elements.

Michelin, the CNRS, Université Grenoble Alpes, Grenoble INP - UGA and Université Savoie Mont Blanc launched their new partnership on 14 March 2025. Over a period of four years, the research teams will strive to develop sustainable hydrogen production technology using water. The joint laboratory is the third LabCom pooling Michelin and CNRS expertise and deploying green hydrogen production technologies.

At the present time, we are still to find a method for producing hydrogen[1] on a large and sustainable scale. To address this major challenge, the research teams at the Alcal'Hylab joint laboratory are teaming up to design next generation materials capable of boosting green hydrogen production using water, in a low-carbon and sustainable manner, and on an industrial scale.

Currently, the majority of hydrogen produced in the world is qualified as grey, as it is generated from fossil resources such as natural gas. Although this type of hydrogen is the least costly to produce, it is also one of the least eco-friendly. When combined with black hydrogen, obtained via coal gasification, their production generates more than 2% of global carbon dioxide (CO_2)[2] emissions. While less polluting alternatives exist, such as blue hydrogen, which is generated from fossil fuels with the capturing of CO_2 emissions, there is still no satisfactory method for producing hydrogen sustainably in industrial quantities. Despite the existence of different

production methods for green hydrogen using solar and wind power or hydroelectricity, this currently represents less than 5% of total global production.

Water: a promising avenue for hydrogen production

There are now several methods for producing green hydrogen using water. The first is alkaline water electrolysis, known as AWE[3], which was first discovered over 200 years ago. This process produces hydrogen by circulating an electrical current through a potassium hydroxide solution, using catalysts composed of non-noble metals[4] such as nickel, iron or steel. Although it is widely used in industry, this technology does not produce ultra-pure hydrogen at a high rate and is difficult to couple with renewable energies.

To overcome these hurdles, a new type of water electrolyzer, which uses a polymer membrane, impermeable to gas (hydrogen and oxygen) was developed in the last few decades: PEMWE[5] technology. While this results in ultra-pure gas production with a higher yield, this technology is nevertheless accompanied by new constraints: a reliance on rare and noble metals (platinum, iridium and titanium) and the generation of pollutants linked to the membrane used, such as fluorine.

Developing materials for next generation electrolyzers

With support from the Michelin R&D Center in Clermont-Ferrand, the research teams at the Laboratory of Electrochemistry and Physical-Chemistry of Materials and Interfaces (CNRS/ Université Grenoble Alpes/Grenoble INP - UGA/Université Savoie Mont Blanc), under the aegis of CNRS researcher, Frédéric Maillard, hope to develop water electrolysis technology combining the best of both worlds. The aim is to leverage the advantages of AWE technology (using non-noble metals that abound in the Earth's crust) and PEMWE (using a polymer membrane to achieve high hydrogen production rate, to pressurize the gases produced, with a high gas purity and to couple the electrolyzer with renewable energies).

This new technology, called Anion-Exchange Membrane Water Electrolyzer (AEMWE), will require the development of nanocatalysts comprising metals that are abundant in the Earth's crust including nickel, and an anion exchange membrane that is more environmentally compliant.

"The creation of AlcalHylab, the tenth joint research laboratory between Michelin and the CNRS, is another illustration of the mutual trust between our two institutions. This work, which also involves our academic partners – Université Grenoble Alpes, Grenoble INP - UGA and Université Savoie Mont Blanc– will help to consolidate our long-term partnership and our shared interest advancing our hydrogen technologies", declared Jacques Maddaluno, Director of CNRS Chimie.

"The Michelin group has shown an interest in hydrogen for over 20 years, recognizing its potential for reducing CO_2 emissions and for energy transition, in mobility and also for lowering carbon reliance in several industrial fields. This new joint laboratory with the CNRS, Université Grenoble Alpes, Grenoble INP - UGA and Université Savoie Mont Blanc, the third devoted specifically to hydrogen research, will improve our knowledge of the processes and materials that will enable its large-scale production to be less carbon reliant in the future", points out Christophe Moriceau, VP Advanced Research for the Michelin Group.

“This partnership illustrates the strength of our scientific and economic ecosystem, mobilizing researchers and industrialists to accelerate innovation and technologies transfers. Together, we are asserting our commitment to a more sustainable society and low-carbon industry. With more than 80 joint laboratories currently operating, including Université Grenoble Alpes and industrial partners, and as the European leader in terms of patent registrations, UGA is a pioneering university in terms of innovation, committed to digital and ecological transformation, as well as European sovereignty”, explains Yassine Lakhnech, President of Université Grenoble Alpes.

“A historic player founded by and for companies, Grenoble INP - UGA is delighted with the creation of this joint laboratory – a strong symbol of the public-private collaboration and a strategic lever for innovation. Committed to broad transitions, in particular as an operator of the Carnot Energies du Futur Institute, the establishment plays a central role in this hydrogen project, with 40% of the public employees drawn from its ranks. This initiative consolidates the long-standing collaboration between Grenoble INP - UGA and Michelin, combining training, research and innovation to offer advanced and impactful programs, both locally and internationally”, emphasizes Vivien Quéma, President of Grenoble INP - UGA.

“Addressing the challenges of the energy transition is one of the three fundamental pillars defining research at Université Savoie Mont Blanc (USMB). We are therefore eager to get involved with this multi-stakeholder collaboration, which led to the creation of Alcal’HyLab. This initiative perfectly illustrates the synergy between academic research and industry to serve our regions. Alongside our partners, we support the activities of the Laboratory of Electrochemistry and Physical-Chemistry of Materials and Interfaces (LEPMI) for developing next generation materials to be used in AEM water electrolyzers. This strategic project reinforces our commitment to innovation for a more sustainable and competitive hydrogen production”, adds Philippe Briand, President of Université Savoie Mont Blanc.

Philippe Briand, President of Université Savoie Mont Blanc ; Yassine Lakhnech, President of Université Grenoble Alpes ; Christophe Moriceau, VP Advanced Research for the Michelin Group ; Jacques Maddaluno, Director of CNRS Chimie et Vivien Quéma, President of Grenoble INP - UGA. © Vincent MARTIN/LEPMI

A multi-faceted research-company collaboration for innovation in hydrogen production

Alcal'Hylab is the third laboratory to pool the expertise of the CNRS and Michelin devoted to developing green hydrogen production technologies:

- LabCom HydrogenLab to develop next generation core of the fuel cell and alkaline water electrolyzer materials, in partnership with the French National School for Chemistry in Montpellier and University of Montpellier (Institut Charles Gerhardt de Montpellier).
  Further information: HydrogenLab, un laboratoire commun avec Michelin pour dessiner le futur (French only)
- LabCom SpinLab to optimize nanofibrous materials using the electrospinning process, in partnership with University of Strasbourg (Institut de chimie et procédés pour l'énergie, l'environnement et la santé).
  Further information: Michelin, the CNRS, and the University of Strasbourg are joining forces to develop innovative nanofibrous materials

Notes :

1- Whose real chemical name is dihydrogen, or H_2.
2- According to the International Energy Agency (IEA).
3- Alkaline Water Electrolyzer.
4- Metals that are not resistant to corrosion. In particular, they dissolve when immersed in an acidic solution.
5- Proton-Exchange Membrane Water Electrolyzer.

About the CNRS

A major player in basic research worldwide, the National Centre for Scientific Research (CNRS) is the only French organisation active in all scientific fields. Its unique position as a multi-specialist enables it to bring together all of the scientific disciplines in order to shed light on and understand the challenges of today's world, in connection with public and socio-economic stakeholders. Together, the different sciences contribute to sustainable progress that benefits society as a whole. (www.cnrs.fr)

About Michelin

Michelin is building a world-leading manufacturer of life-changing composites and experiences. Pioneering engineered materials for more than 130 years, Michelin is uniquely positioned to make decisive contributions to human progress and to a more sustainable world. Drawing on its deep know-how in polymer composites, Michelin is constantly innovating to manufacture high-quality tires and components for critical applications in demanding fields as varied as mobility, construction, aeronautics, low-carbon energies, and healthcare. The care placed in its products and deep customer knowledge inspire Michelin to offer the finest experiences. This spans from providing data- and AI-based connected solutions for professional fleets to recommending outstanding restaurants and hotels curated by the MICHELIN Guide. Based in Clermont-Ferrand, France, Michelin operates in 175 countries and employs 129,800 people. (www.michelin.com)

About Université Grenoble Alpes (UGA)

As the leading European university in innovation based on the number of patents filed and ranked among the top 150 universities worldwide in the Shanghai ranking, Université Grenoble Alpes (UGA) is deeply rooted in its region, multidisciplinary, and open to the world. UGA is one of the nine French universities awarded the "Initiative of Excellence" (IDEX) label. Since 2020, UGA has integrated three component institutions—Grenoble INP, Institute of Engineering and Management-UGA; Sciences Po Grenoble-UGA; and the Grenoble National School of Architecture (ENSAG-UGA)—as well as three academic divisions: the Faculty of Science-UGA, the University School of Technology-UGA, and the Faculty of Humanities, Health, Sports, and Societies-UGA.

With 57,000 students, including 10,000 international students and 3,000 doctoral candidates, and more than 7,700 staff members, UGA operates across multiple campuses, primarily in Grenoble and Valence. The university has strengthened its collaboration with national research organizations—including CEA, CNRS, INRAE, Inria, and Inserm—to develop a shared research and innovation strategy on an international scale. It also fosters strong ties with the IRD and Grenoble Alpes University Hospital (CHU Grenoble Alpes). (www.univ-grenoble-alpes.fr)

About Grenoble INP - UGA
Grenoble INP - UGA, a component institution of Université Grenoble Alpes, is a public higher education and research institution that has been supporting the socio-economic world in its developments for over a century. With its recognized scientific excellence, a long-standing culture of innovation, and a strong policy of social openness, it plays a key role in addressing major societal and environmental challenges, thus contributing to the construction of a sustainable world. Within its 8 engineering and management schools, it trains specialized, responsible students with the skills necessary for the jobs of tomorrow. Preparing for the future, its teaching and research staff conduct cutting-edge research in some forty laboratories, in France and abroad. (www.grenoble-inp.fr)

About Université Savoie Mont Blanc (USMB)
With 15,000 students, a rich and multidisciplinary range of programs, and 18 internationally recognized research laboratories, USMB is a people oriented institution that combines strong local ties with a broad openness to Europe and the world. In the Shanghai ranking for the 7th consecutive year thanks to the excellence of its research, it is also among the top 10 French universities for student success, positioning itself as one of the best public higher education institutions in France (data from December 2023). Across its three campuses nestled between lakes and mountains —Annecy, Le Bourget-du-Lac, and Jacob-Bellecombette—USMB offers highly attractive study conditions in an exceptional setting. (www.univ-smb.fr)

Contacts :

CNRS researcher | Frédéric Maillard | + 33 4 76 82 65 92 | frederic.maillard@grenoble-inp.fr

Michelin Advanced Research I Fabien Dufour I fabien.dufour@michelin.com

CNRS Press | Manon Landurant | +33 1 44 96 51 37 | manon.landurant@cnrs.fr

Michelin Press | Hervé Erschler | +33 6 70 47 85 04 | herve.erschler@michelin.com

UGA Press | Muriel Jakobiak | +33 6 71 06 92 26 | muriel.jakobiak@univ-grenoble-alpes.fr

Grenoble INP – UGA Press (agence MCM) | Elodie Auprètre | +33 7 62 19 83 09 | e.aupretre@agence-mcm.com

USMB Press | Céline Lestievent | direction.communication@univ-smb.fr