Hydrogen Europe

Hydrogen Europe Position Paper

Advanced Materials for the Hydrogen Industry – Policy recommendations

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Recommendations:

1. **The European Commission should develop clear and coherent definitions for advanced materials and underpin their development through a systematic value chain approach, with the involvement of industrial stakeholders.**
2. **Member states should be encouraged to utilise a variety of financing tools to ramp up key advanced materials projects to bolster the European clean energy transition.**
3. **Policy makers should adapt the accelerated permitting framework of net-zero sectors to include the deployment of the essential underlying advanced materials supply chain.**
4. **The Commission and policy makers need to incentivise through standards-setting and regulation sustainable and circular best practices in advanced materials applications.**

In the past years, the European Union set out to achieve an ambitious set of goals, including a transition towards clean energy while reducing energy dependence. Such a complex task requires the rapid ramp up of novel sectors and technologies, including hydrogen. Electrolysers, fuel cells and other hydrogen technologies are fundamental pieces in this hydrogen ecosystem. They have a myriad of uses, decarbonising the industry, mobility and providing much needed flexibility in a system dominated by variable renewable energy sources.

This energy transition depends on the availability of an increasing amount of advanced materials. According to the European Commission's Communication on Advanced Materials for Industrial Leadership[1], advanced materials are materials rationally designed to have (i) new or enhanced properties, and/or (ii) targeted or enhanced structural features with the objective to achieve specific or improved functional performance. From fluoropolymer-based components and membranes to electrocatalysts containing platinum group metals, to (synthetic) graphite and solid carbon (e.g. for carbon-fibre tanks), the entire value chain is made up of such materials, components, and composites. To keep Europe's leading role in the accelerating global race to decarbonisation, the European industry needs to prioritise securing the development, production, and supply of these key advanced materials. For this, rigorous protection of European intellectual property and patent rights is paramount. To develop an industrial ecosystem, such as that of hydrogen technologies, it is essential to recognise the complexity of sub-sectoral value chains. These also include the upstream side, research and innovation companies, suppliers of innovative materials and components, etc. For instance, electrolysers and fuel cell systems (main building blocks of the hydrogen ecosystem) depend on fluoropolymers (considered a PFAS[2] subtype). These are present both as membranes, but also in combination with graphite or with carbon fibre elements, and in combination with critical raw materials. No alternative is foreseen of these highly specialised materials, especially on the required industrial scale. In addition, Europe's exposure resulting from insufficient reserves of certain critical raw materials (e.g. iridium) can substantially be mitigated with the increasing use of advanced materials and recyclability by design. For instance, through thrifting, the same catalyst activity and

[1] Advanced materials are understood as materials that are rationally designed to have (i) new or enhanced properties, and/or (ii) targeted or enhanced structural features with the objective to achieve specific or improved functional performance. This includes both new emerging manufactured materials (high tech materials), and materials that are manufactured from traditional materials (low tech materials). OECD working description on advanced materials https://one.oecd.org/document/ENV/CBC/MONO(2022)29/en/pdf

[2] Per- and polyfluoroalkyl substances

stability can be reached in electrolyser applications with 80% less iridium use.[3] The situation is not unique to the hydrogen sector. For instance, clean tech industries, such as the wind industry, depend on advanced composite materials for their blades, in addition to key rare earths for their permanent magnets in large offshore turbines.[4]

To achieve the EU's transition away from fossil fuels and increase decarbonisation efforts, while maintaining global competitiveness and protecting Europe from strategic dependencies, Hydrogen Europe proposes four key recommendations in advanced materials policy:

1. **Clear definitions and a value chain perspective to enable the synergic ramp up of advanced materials**

The accelerated scale up of the European hydrogen ecosystem cannot happen in a vacuum. The value chains of clean and digital technologies are so interlinked that a comprehensive evaluation of technical components, materials and substances in connected sectors and sub-sectors needs to be considered. Overlooking links between parts of the supply chain could jeopardise entire energy, mobility, construction, and electronics sectors.[5] An integrated **strategic value chain approach, underpinned by clear and coherent definitions, therefore needs to be developed.** This would give the right signals to stakeholders in the industry, establishing new, and strengthening existing links. It would also clarify which parts of the industrial ecosystem provide critical advanced materials, and where potential regulations could harm decarbonisation efforts or Europe's strategic interests. Contradictory EU policies – stressing the importance of advanced materials, while restricting their production and use (e.g. in the case of the REACH PFAS restriction proposal) – are creating significant investment uncertainty.

The setting up of the EU level public private partnership on advanced materials, as proposed by the Commission in its Advanced Materials Communication will help facilitate regular cooperation and coordination in the industry. It will also help identify investment and policy needs with a holistic perspective, making the EU more attractive for investment in advanced material production and R&I.

2. **Develop a coherent and substantial financing framework on Member State and EU levels for scaling up advanced materials projects**

The ambitious targets of the European Green Deal rest on the development and use of novel technologies, such as electrolysis-based hydrogen production, fuel cell and hydrogen mobility, energy transport and storage solutions. As such, the promotion of innovation in clean tech manufacturing and production processes, including final product improvements need to be supported to scale up proven technologies. This would increase business competitiveness and find solutions to raise their efficiency, durability, and sustainability (including recyclability and mitigation of potential environmental externalities). Public funding should make sure the latest and best technologies are indeed in use and not merely available. Funding criteria could contain levers to incentivise material efficiency for critical raw materials, and could set up top runner programs, mitigating bottlenecks in

[3] Advanced materials that involve application of scarce raw materials realise substantial savings of material for the same or even higher efficiency of fuel cells and electrolysers. Both the electrode catalyst design, and the material design with specialised fluoropolymer ionomers and membrane thickness increase the efficiency. The same applies to further components in the stack and in the optimisation of their interplay. While today, in average of about 400kg Iridium per Gigawatt is in use, in the medium term about 100kg is possible, while in the long term less than 30kg is possible.

[4] See e.g. Raw materials demand for wind and solar PV technologies in the transition towards a decarbonised energy system, Joint Research Centre, EUR 300095 EN.

[5] This can be seen for instance in the interplay amongst renewables, electrolyser technology and mobility. Electrolyser technologies, like PEM (proton exchange membrane) technologies depend on iridium, which is a by-product of platinum mining. Platinum is used in spark plugs in internal combustion engines. Hence, its demand is expected to decrease along with a decrease of conventional engines. Fuel cell-based vehicles also use platinum and thus their demand could make up for the decrease demand from ICE vehicles, which in turn would secure the supply of iridium for electrolysers.

the hydrogen sector. A clear and robust funding framework to back advanced materials projects with lower technology readiness levels (TRL) is also essential to incentivise and enable key solutions**. This could take the form of dedicated grants and mixed financing options by EU financing instruments. It can also be unlocked by private financial stakeholders through increased legislative and regulatory certainty.** At Member State level, the crises and market shocks of the past years triggered a relaxation of State aid rules in certain sectors, including in the hydrogen sector. Although the rules are provided for a level playing field for all stakeholders within the same country, the utilisation of this opportunity varies per Member State, ultimately causing an uneven playing field for stakeholders in the advanced materials industry. **To achieve consistency, Member States need to be encouraged to make use of State Aid mechanisms, such as the Temporary Crisis and Transition Framework or the General Block Exemption Regulation,** both of which accommodate clean technology support.

3. Streamlined permitting for advanced materials projects is needed to support key accelerated net-zero projects

It has been recognised by the European Commission and co-legislators that one of the most significant and avoidable hurdles in clean tech deployment is the red tape brought by lengthy permitting processes. This includes multiple layers of authorisation for land exploitation, complex environmental impacts assessments, and a lack of harmonisation across countries and regions within countries. There have been considerable steps taken under the revision of the Renewable Energy Directive, and under the Net Zero Industry and the Critical Raw Materials Acts. These are all welcome by the industry. However, more focus should be given to ensuring long-term coherence between climate and industrial policies to avoid wrong investment or a hesitancy to invest in the development and commercialisation of new technologies in the EU. It is clear that for renewables and hydrogen projects to successfully scale up and take advantage of accelerated permitting time, projects in **the value chain of advanced materials should be granted the same preferential approach in permitting rules as those in manufacturing the final applications. This includes regulatory sandboxes ensuring the ease and speed up of research and innovation**. In addition, **appropriate staffing and tools in permitting administration are needed to enable the ramp up of these clean tech sectors**.

4. Need to boost sustainable and circular practices in advanced material production and use

The sustainable scale up of the hydrogen industry rests on the sustainable development and manufacturing of necessary components and materials. The EU's approach to growing this essential sector needs to rest on incentivising and supporting solutions, which themselves comply with ambitious circularity rules. **Developing a homogenous and consistent regulatory framework by strong standard-setting in systematic recycling and considering the entire life cycle of products** (including the end-of-life at the outset by promoting take-back systems) **could establish a closed-loop market, where possible, and a cascading cross-application and cross-sectoral supply chain elsewhere**[6]. The ramping up of the hydrogen industry provides a unique opportunity for policymakers to take on a full industrial value chain, including its end-of-life phase. Thus, they can create an enabling and supporting regulatory environment for essential advanced material production and management. Nevertheless, such a **regulatory framework needs to streamline sustainability reporting obligations to limit overall administrative burden on stakeholders.** The EU is in a situation to drive the transition of industry in tandem with enhanced environmental protection, but this can only work if managed through a science-based approach.

[6] For instance, recovered ionomers with decreased robustness over time can go from being used in PEM fuel cell or electrolyser technologies, to being used in chlor-alkali processes, then in flow batteries, then as membranes in humidification, then in water purification organocatalyst applications.

HYDROGEN EUROPE
Avenue Marnix 23
1000, Brussels / Belgium

secretatariat@hydrogeneurope.eu
www.hydrogeneurope.eu

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