PlasticsEurope
Association of Plastics Manufacturers
Fluoropolymers Product Group

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Fluoropolymers and Fuel Cells: Enabling the Transformation of Hydrogen into Electricity

With hydrogen set to become one of the many drivers of Europe's decarbonisation, it is perhaps no surprise that, according to the Hydrogen Council, there are 200 hydrogen fuel cell projects currently announced in Europe, with investments focussed across multiple industries, from transport to heavy industry. In fact, according to a recent industry report[1], the **majority of global hydrogen-related investments this decade will be made in Europe**.

Hydrogen is on everyone's minds when it comes to the future of energy production and will be critical in helping Europe achieve its Green Deal objectives as well as the objectives set out at COP21. By 2030, 110 000 fuel cell trucks and busses could be on the road[2], and fuel cell electric vehicles could account for 1 in 22 passenger vehicles; in the construction sector, hydrogen could replace an estimated 7% of natural gas (by volume).[3]

Fluoropolymers play a key role in helping to enable this shift to hydrogen as they are indispensable to the electrochemical reaction which turns hydrogen and oxygen into the necessary electricity[4].

To understand their importance, it is worth looking at the science behind this game-changing technology. **Hydrogen fuel cells** are composed of an anode and a cathode separated by a proton exchange membrane (PEM). The hydrogen molecules separate into protons and electrons at the anode and the PEM **relies on fluoropolymers** to allow the protons to permeate through to the cathode. The electrons cannot permeate the membrane and are forced to travel through an external circuit generating an electrical current.

As the role for hydrogen increases in the EU's Green Deal, **fluoropolymers will become even more crucial to achieving those ambitious targets**. Their unique set of properties, including durability, stability and heat resistance[5], make them the perfect building blocks for the membrane key to the hydrogen fuel cell. Fluoropolymers are also **indispensable to numerous other mobility, renewable energy and industrial applications** such as photovoltaic panels and lithium-ion batteries[6].

This is why the Fluoropolymers Product Group (FPG) and its members believe that a **restriction on all PFAS would be harmful to the EU's overarching environmental goals**. Based on their structure, environmental and toxicological profiles, **fluoropolymers are distinctly different from PFAS** and do not display the environmental and toxicological properties associated with certain fluorochemicals in the

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[1] Hydrogen Insights: A perspective on hydrogen investment, market development and cost competitiveness; Hydrogen Council; 2021 (https://hydrogencouncil.com/wp-content/uploads/2021/02/Hydrogen-Insights-2021.pdf)
[2] Fuel Cells Hydrogen Trucks: Heavy Duty's High Performance Green Solution; Fuel Cells and Hydrogen Joint Undertakings; 2020 (https://www.fch.europa.eu/sites/default/files/file_attach/FCH%20HDT%20-%20Study%20Report_final_vs.pdf)
[3] Hydrogen Europe Roadmap: A sustainable pathway for the European Energy Transition; Fuel Cells and Hydrogen 2 Joint Undertaking; 2019 (https://www.fch.europa.eu/sites/default/files/Hydrogen%20Roadmap%20Europe_Report.pdf)
[4] Socio-economic Analysis of the European Fluoropolymer Industry – Executive Summary; PlasticsEurope; 2017 (https://fluoropolymers.plasticseurope.org/application/files/7816/1167/4026/Final_SEA_Fluoropolymers_summary2017_3.pdf)
[5] A critical review of the application of polymer of low concern and regulatory criteria to fluoropolymers; Henry, et al.; 2018 (https://setac.onlinelibrary.wiley.com/doi/full/10.1002/ieam.4035)
[6] Socio-economic Analysis of the European Fluoropolymer Industry – Executive Summary; PlasticsEurope; 2017 (https://fluoropolymers.plasticseurope.org/application/files/7816/1167/4026/Final_SEA_Fluoropolymers_summary2017_3.pdf)

PFAS family[7]. For example, fluoropolymers have been demonstrated to **meet the OECD's criteria for "polymers of low concern,"** as they do not present significant toxicity concerns and **cannot degrade into other PFAS** under normal conditions of use[8]. Environmentally stable compounds such as fluoropolymers need to be placed into a separate category so they can **continue to contribute to a wide range of sustainable solutions across industries.**

Did you know?

Fluoropolymers are integral to the functioning of electrolysers, which in turn enable the transformation of renewable energy such as wind power into green hydrogen. Green hydrogen has the potential to decarbonise industry, transport, energy and heating and contribute to significant emission reductions!

Unfortunately, despite the EU leading in electrolyser technology, it lacks in production capacity. This makes green hydrogen more expensive which is why Hydrogen Europe have launched an initiative to boost the demand for electrolysers and in turn reduce the price of green hydrogen.

[7] A critical review of the application of polymer of low concern and regulatory criteria to fluoropolymers; Henry, et al.; 2018 (https://setac.onlinelibrary.wiley.com/doi/full/10.1002/ieam.4035)

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