Fluoropolymer Product Group (FPG)

Fluoropolymers are Advanced Materials

The Fluoropolymers Product Group (FPG) of Plastics Europe welcomes the European's Commission's engagement with stakeholders on advanced materials. Fluoropolymers are safe and essential in a broad range of consumer and industrial applications. They drive European industrial leadership and are of strategic importance to meeting EU climate, energy and environmental goals. They contribute to key technologies that ensure EU autonomy in microchips, mobility, fuel cells, batteries, energy storage, robotics, secure connectivity, defence and innovation and help the EU to reach its ambitions under the Green Deal and Net-Zero for Industry,. In this context, the Joint Research Centre (JRC) identifies fluoropolymers as key in cutting-edge technologies (such as in fuel cells, electrolysers, batteries, and grid technologies)[1]. Given their unique properties, safe use and essential contribution to these applications, fluoropolymers are advanced materials.

Advanced Material Prioritisation: Defining effective selection criteria

The EC uses a broad definition or working description (2013) for advanced material:

"An advanced material is any material that, through the precise control of its composition and internal structure, features a series of exceptional properties (mechanical, electric, optic, magnetic, etc.) or functionalities (self-repairing, shape change, decontamination, transformation of energy, etc.) that differentiate it from the rest of the universe of materials; or one that, when transformed through advanced manufacturing techniques, features these properties or functionalities." [2]

The Commission also contributed to a 2021 OECD questionnaire about advanced materials saying 'any material [that] exhibits "novel, innovative or improved" functions…could be considered an advanced material'[3]. The OECD uses a working description for advanced materials:

"Materials that are rationally designed to have new or enhance properties and/or targeted or enhanced structural futures with the objective to achieve specific or improved functional performance. This includes both new emerging manufactured materials, and materials that are manufactured from traditional materials and also includes materials from innovative manufacturing processes that enable the creation of targeted structures from starting materials, such as bottom-up approaches[4]"

[1] The Joint Research Centre (JRC) publication showed that in order for the European Union (EU) to achieve the ambitious targets it has set for the energy and digital transitions and its defence and space agenda fluoropolymers are indispensable materials. Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study https://publications.jrc.ec.europa.eu/repository/handle/JRC132889

[2] B. Griese, M. Drapalik, L. Zajicek, D.Jepsen, A.Reihlen and T.Zimmermann, Advanced materials: Overview of the field and screening criteria for relevance assessment, Umweltbundesamt, 2020

[3,4] OECD Working Party on Manufactured Nanomaterials' Working Description on Advanced Materials https://one.oecd.org/document/ENV/CBC/MONO(2022)29/en/pdf

[4] OECD Environment, Health and Safety Publications Series on the Safety of manufactured Nanomaterials No.104, Advanced Materials : Working Description ENV/CBC/MONO (2022)29

As the EU is yet to conclude final definitions, the FPG would like to take this opportunity to contribute to a definition and propose that advanced materials should:

1. have **innovative** properties and (usually) possess unique physical, chemical, or biological properties. These can include greater strength, lighter weight, improved durability, or enhanced electrical conductivity, among others;
2. derive from a **technological advancement**: such materials are often the result of significant technological advancements in material science;
3. be used in **specialised applications**: due to their enhanced properties, advanced materials find use in a wide range of applications which could be considered specialised such as aerospace, electronics, medical devices, renewable energy technologies (Li-Ion batteries, hydrogen photovoltaic panels...), and more;
4. be **engineered** to perform specific functions or to have properties tailored for particular applications, which is a departure from more conventional materials that have a broader range of general use (e.g. wood, concrete, glass, natural fibres or metals such as iron, copper);
5. contribute to the development of **cutting-edge research and development**: the field of advanced materials is often an enabler of scientific research and development, allowing for scientific discoveries and technological innovations.
6. **meet the needs of complex emerging technologies** that move society forward.
7. are **rather complex to produce** and not broadly/easily available.

In our view, fluoropolymers meet these criteria and are advanced materials because of their:

- ✓ **Safe Use**: given their benign hazard profile, which has been demonstrated[5,6], fluoropolymers are intrinsically safe and have been used for decades without safety concerns in industrial, commercial, and consumer applications. Fluoropolymers do not pose a risk to human health or the environment as they are non-toxic, not bioavailable, non-water soluble, nonmobile and do not bio-accumulate. For example, in the medical field, they are used in catheters and graft materials.

- ✓ **Unique Physicochemical Properties:** fluoropolymers possess extraordinary physicochemical properties, being virtually inert, non-wetting, non-stick, and highly resistant to temperature, fire, and weather[7]. For example, they are highly resistant to UV radiation making them ideal for long-term outdoor applications.

- ✓ **Diverse Applications in High-Tech Industries:** playing a pivotal role in high-tech industries, including automotive, aerospace, electronics, and renewable energy, fluoropolymers demonstrate their advanced nature by supporting cutting-edge technologies and fostering innovation. Fluoropolymers' chemical resistance, thermal stability, electrical insulation, low-friction, non-stick properties, durability as well as their purity are for example, all essential criteria for the semiconductor industry.

[5] Henry B. J., Carlin P. J., Hammerschmidt J. A., Buck, R. C., Buxton W., Fiedler H., Seed J., Hernandez O. (2018). A Critical Review of the Application of Polymer of Low Concern and Regulatory Criteria to Fluoropolymers, Integr Environ Assess Manag2018:316–334 https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/ieam.4035

[6] Korzeniowski S.H., Buck, R. C., Newkold R. M., El kassmi A., Laganis E., Matsuoka Y., Dinelli B., Beauchet S., Adamsky F., Weilandt K. ,Soni V., Kapoor D., Gunasekar P., Malvasi M., Brinati G., Musio S. (2022). A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers, Integr Environ Assess Manag 2022:1–30 https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/ieam.4646

[7] https://fluoropolymers.eu/faq/#about-fp

- ✓ **Contribution to the European Green Deal:** fluoropolymers are indispensable drivers of the European Green Deal, actively contributing to renewable energy installations, low-emission transport technologies, and broader sustainability goals[8].
- ✓ **Socio-Economic Importance:** fluoropolymers bring a significant positive socio-economic impact on Europe's economy by boosting industrial efficiency and competitiveness[9].
- ✓ **Innovation and Research:** the EU fluoropolymer manufacturing sector is highly innovative marked by substantial investments in research and development which underlines their importance in cutting-edge industries such as energy storage.
- ✓ **Contribution to EU Strategic Autonomy:** fluoropolymers play a vital role in achieving EU strategic autonomy, such as in the digital and energy sectors. Recognising them as advanced materials supports the Commission's goals of ensuring self-reliance and competitiveness in key technological areas[10].
- ✓ **Support for the Circular Economy:** fluoropolymers contribute to the circular economy by extending product lifespans and reducing waste.

Based on a well-founded definition of advanced materials, the EU should build its advanced materials policy. This policy should not only reflect overall EU policy targets resulting from the Green Deal but also the realities of today's global economy. Ensuring continued access to and uninterrupted supply of advanced materials for all key technologies enabling the EU's targeted industrial transformation and sovereignty must be a priority. For fluoropolymers, the combination of long durability and high performance is increasing global demand as countries strive to be at the forefront of the digital and green transition. For advanced materials like fluoropolymers the EU is already highly dependent on production in third countries.

The FPG welcomes dialogue with the EU and looks forward to formally engaging with the Commission on this matter.

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[8] https://fluoropolymers.eu/faq/#sustainability
[9] https://fluoropolymers.eu/faq/#economics
[10] https://fluoropolymers.eu/faq/#autonomy