PlasticsEurope
Association of Plastics Manufacturers
Fluoropolymers Product Group

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Fluoropolymers and energy storage: Charging up the European Green Deal

Batteries, indispensable to the EU Green Deal's goals

When we think of batteries, we often think of the cylindrical shaped objects that slot into the back of our remotes, or the small packs powering our smartphones. While such batteries are still widely used, the world is currently seeing the rise of much larger ones. Fluoropolymers are critical to many of these technologies, helping drive forward the dramatic advances in battery technology we have seen over the past few years which will be so crucial to achieving the EU's Green Deal objectives.

In the automotive sector, electric vehicles (EVs) are one of the most prominent examples which, while still rare a few years ago, are now more and more familiar in our lives. BloombergNEF's Electric Vehicle Outlook predicts that by 2030 EV sales will reach 26 million[1]. Less visible is the rise of stationary energy storage facilities. Renewable energy's share is increasing within the energy mix complexifying electricity grid management as windmills and photovoltaic panels provide irregular sources of energy that sometimes cannot be absorbed by the grid. Batteries are critical to absorb temporarily this energy and release it when the demand is there. In addition, batteries are used for regulation purposes, arbitrage, back-up and reserve… There's no smart grid without batteries!

Fluoropolymers, a critical component of batteries

Fluoropolymers are used in a wide variety of battery components. A commonly used one is polyvinylidene fluoride (PVDF), serving as electrode binders and separator coatings in lithium-ion batteries, providing interconnectivity within each electrode, facilitating electronic and ionic conductivity[2], increasing the cell manufacturing productivity and the cell safety. **Fluoropolymers have unparalleled cohesive and adhesive properties under high voltage, allowing for closely packed cathode active materials for high density electrodes. Thanks to PVDF, different battery components can be packed closer and closer together, improving the energy efficiency of a single unit and helping reduce overall size.**

Fluoropolymers such as PVDF also offer high durability, flexibility and other exceptional mechanical properties when used in separators and gaskets, helping resist the harsh conditions faced within a lithium-ion battery[3]. This dramatically improves performance, as well as the lifespan of batteries, which are increasingly used in applications that require a guaranteed and dependable level of output.

The alternatives to lithium-ion batteries are lead acid batteries, which do not contain fluoropolymers. These offer reduced performance notably in terms of energy efficiency because a lower proportion of the energy stored in lead-acid batteries. In addition, lead acid batteries are heavier resulting in reduced functionality and increased energy consumption compared to lithium-ion batteries[4].

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[1] BNEF, Electric Vehicle Outlook, 2020 https://about.bnef.com/electric-vehicle-outlook/
[2] https://www.solvay.com/en/chemical-categories/specialty-polymers/batteries/li-ion-battery-cells
[3] https://www.solvay.com/en/chemical-categories/specialty-polymers/batteries/li-ion-battery-cells
[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)

Building dependable batteries for the future

As Europe and the world transitions to EVs and renewables, combined with greater electrification of our energy grids, we will all become more dependent on battery technology to maintain, and enhance our daily lifestyles. Fluoropolymers, used in extremely small amounts, are critical to the industrial ramp of batteries essential for a carbon neutral future.

The Fluoropolymers Product Group and energy storage

The Fluoropolymers Product Group (FPG) and its members maintain that the restriction on all PFAS would undermine the aim of carbon neutrality. 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 PFAS family[5]. 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[5]. 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, e.g. in the case of energy storage.

[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)