

# On the Overall situation of Poly- or Perfluoroalkyl substances (PFASs) including Fluoropolymers

Bruno AMEDURI  
CNRS, Institut Charles Gerhardt, UM, ENSCM  
34296 Montpellier, France  
[bruno.ameduri@enscm.fr](mailto:bruno.ameduri@enscm.fr)

Poly- or perfluoroalkyl substances (PFASs) are divided into two main families, differentiated by their molecular weights (MWs) (Figure 1).<sup>1</sup> The first one deals with non-polymers, oligomers or specific polymers bearing fluorinated side moieties. They have undergone major issues of bioaccumulation, persistency, toxicity and mobility, either intrinsically because of their low MW-structure or after some degradation (e.g., hydrolytic hydrolysis of ester functions in poly[(meth)acrylate]s releasing polyfluorinated groups). These specific PFASs are under severe restricted (several of them being banned) and drastic regulations are currently proceeding.

In contrast, *fluoropolymers* (FPs),<sup>2</sup> endowed with outstanding properties and involved in High Tech applications are not prone to face such hazardous limitations. They have high molar-masses and are non-mobile, non-bioaccumulative, non-toxic and do not cross the human cellular membrane, hence fulfilling the PLC criteria<sup>3</sup>. Indeed, though the global production of FPs is only ca. 0.1% of plastics, its growth rate is 6-8%.<sup>2</sup> Much progress has been made in the last decade where several FP manufacturers have modified their production using non-fluorinated polymerization aids (or surfactants)<sup>4</sup> and reducing their aqueous and gaseous emissions drastically. In addition, major actors working on the energetic transition are taking FPs more and more into account (fuel cell membranes, binders for Lithium-ion batteries, backsheets for PVs, and electroactive FPs as key-examples), as well as their recycling.<sup>5</sup>

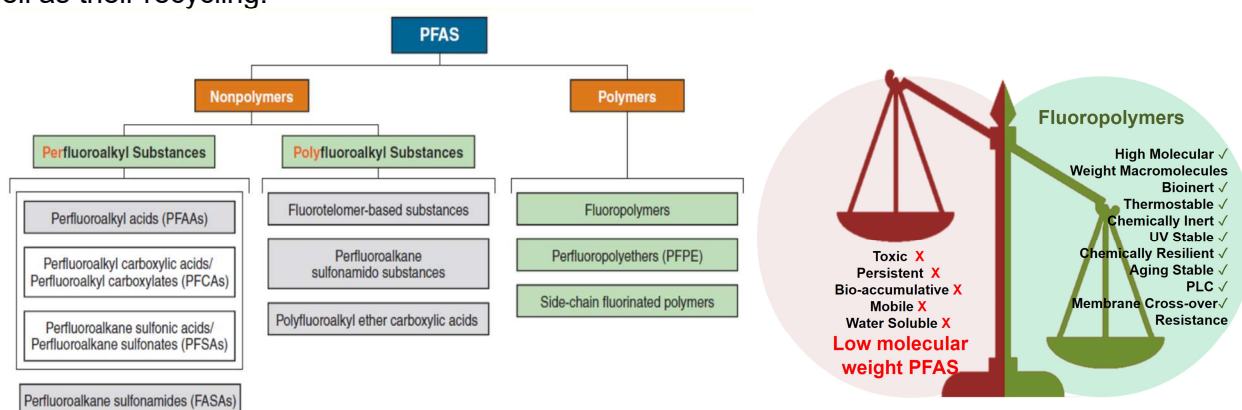


Figure 1: distinguishing PFAS families by their molar masses (MW, left); drawbacks of low MW PFAS in contrast to advantages of high MW ones (Fluoropolymers) (right)

## References

- <sup>1</sup> B. Améduri, *Perfluoroalkyl substances: Synthesis, Properties and Regulations*, 2022, RSC, Oxford.
- <sup>2</sup> B. Améduri and S. Fomin, *Fascinating Fluoropolymers*, 2020, Elsevier, Oxford.
- <sup>3</sup> S.H. Korzeniowski et al. A Critical Review of the Application of Polymer of Low Concern Regulatory Criteria to Fluoropolymers II: Fluoroplastics and Fluoroelastomers. *Integ. Environ. Assessm. Manag.* **2023**, 19, 326-354.
- <sup>4</sup> B. Améduri, Fluoropolymers: a special class of per- and poly-fluoroalkyl substances (PFASs) essential for our daily life; *J. Fluorine Chem.*, **2023**, 267, 110117.
- <sup>5</sup> B. Améduri and H. Hori; Recycling and End of life assessment of Fluoropolymers: Recent Developments, Challenges and Future Trends *Chem. Soc. Rev.* **2023**, 52, 4208-4247.