PROPLANET: PFAS-free sol-gel hybrid coatings with hydrophobic and non-stick properties for low-maintenance glass and kitchenware applications

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Per- and poly-fluoroalkyl substances (PFAS) are commonly used in a multitude of applications and products. This includes coatings for textiles (water and oil repellency), for food packaging and related equipment (non-stick), for glass (anti-soiling and anti-reflection, e.g. car windows, solar panels), but also cosmetics and construction materials (among many others). Despite their valuable properties, they pose a serious risk to human health, as these chemicals do not break down under normal conditions and this leads to their accumulation in the environment and eventually in any organism depending on contaminated water and food.

PROPLANET project addresses novel coating materials solutions, tackling the problem from a sustainable-business perspective, enabling overcoming the barrier for environmental protection, safety, chemical improvements, and circular value chains. The sol-gel technique is a promising approach, offering a vast range of possibilities for coating design. Its ability to synergistically combine inorganic and organic moieties leads to the formation of hybrid materials with covalently bonded parts: the inorganic moiety confers very good adhesion to the substrate as well as chemical and mechanical resistance and hardness, while the organic part confers elasticity and density. In addition, the organic functional moiety provides the hydrophobic and non-stick properties required for these applications.

Two lines of coatings have been developed in order to fulfil the requirements of two different sectors:

o Sol-gel based hybrid coatings, with hydrophobic and anti-soiling properties for low-maintenance glass applications. The coatings are expected to remain transparent and retain their properties over time and exposure to typical usage conditions, as seen in applications like car window shields and shower doors.

o Sol-gel based hybrid coatings functionalized with PFAS-free compounds to provide non-stick and anti-wear properties for application in food-packaging machines. The coatings are expected to be robust, maintaining their properties when exposed to high temperatures during machine operation, exposure to cleaning procedures and during mechanical wear.

Different types of chemistries, as well as functional groups, have been screened during the development and the resulting coating omniphobic properties have been evaluated by means of SFE (Surface Free Energy), calculated through the measurements of the water and hexadecane contact angles, besides assessment of the other required properties.