Title/TitolO

Mapping existing models and development of optimisation frameworks for hybrid coatings based on relevant manufacturing process parameters, experimental data and available databases for safe-and-sustainable-by design approaches

a. Scheduled activities/Piano delle attività

The research objectives are included in two sections. The first one includes the study of mathematical models for the implementation of production processes for (hybrid) coatings applied to fabrics and packaging materials - in particular, those developed in HORIZON EU ZEROF (Development of verified safe and sustainable PFAS-free coatings for food packaging and upholstery textile applications) without the use of per-fluorinated and polyfluorinated alkyl substances (PFASs) -. It will be relevant to study the coating materials industrially relevant in the two areas under consideration by (1) identifying the parameters of the manufacturing processes significant for the application of coatings on fabrics and packaging materials, (2) developing predictive models for estimating the main performance (water repellency and oil repellency) of investigated coatings to be included in the Safe-and-Sustainable-by-Design approaches, and (3) develop calculation techniques to assess impacts related to the production, application and use of (hybrid) coatings.

In the second section of the research grant, the focus will be (4) identifying optimisation models, possibly including Artificial Intelligence tools, related to the investigated production processes to seek and, possibly (5) implementing optimisation models for the reduction of environmental impacts related to the production, application, use and end-of-life of hybrid coatings in textiles and packaging industry starting from previous activities and results achieved in (1), (2) and (3).

b. Research project/Progetto di Ricerca

Research activities will be developed within the framework of the HORIZON EU project ZEROF (Development of verified safe and sustainable PFAS-free coatings for food packaging and upholstery textile applications) in collaboration with consortium partners that are focused on the development of databases and Safe-and-Sustainable-by-Design approaches (WP5 and WP6).

Scheduled activities will be divided into three main phases:

(a) Surveys of models concerning organic and hybrid coatings. Maps of computational tools and their input/output. Identification of relevant manufacturing process parameters to be considered for increased product sustainability and circularity. Particular attention will be paid to those manufacturing processes implemented as case studies.

(b) Predictive models will be developed with the aim of ensuring that the treated textiles and packaging can perform as expected. Several properties are experimentally investigated within the ZEROF Consortium partners: functional properties (water and oil repellency), mechanical and durability properties. Developed models will be helpful to include process parameters in predictive tools.

(c) Optimisation models and tools to optimise the process impact on the final product by taking into account identified relevant manufacturing process parameters will be developed based on developed models. The implementation of effective and reliable manufacturing processes can contribute to product sustainability and the safety of industrial products.

Bologna, 4 April 2024