ACAC 2024 Athens Conference on Advances in Chemistry November 6 – November 8, 2024
HELLENIC REPUBLIC National and Kapodistrian University of Athens EST. 1837 Department of Chemistry

Modification of fluoropolymer surfaces using ultraviolet irradiation

Maria-Eleni Mylona [a], Theodore Manouras [b], Anastasia Kanioura [c], Panagiota Petrou [c], Maria Vamvakaki [b,d], and Margarita Chatzichristidi [a]

[a] *Industrial Chemistry Laboratory, Department of Chemistry, NKUA, Athens, Greece*
[b] *Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion, Crete, Greece*
[c] *Immunoassay/Immunosensors Lab, INRASTES, NCSR Demokritos, Aghia Paraskevi, Greece*
[d] *Department of Materials Science and Technology, University of Crete, Heraklion, Crete, Greece*

e-mail: marilenamylwna@gmail.com

Surface modification techniques are crucial for tailoring polymer properties to suit various applications, especially in biomedical science. The key goal is to alter the polymer's surface by introducing functional groups that improve its performance, without compromising its bulk properties. These modifications can be achieved through physical, chemical, or biological methods. Recently, physical methods, such as plasma and radiation-induced treatments, have gained prominence. Radiation, divided into ionizing and non-ionizing types, includes UV irradiation, which has become popular for non-ionizing polymer surface modification due to its simplicity and the accessibility of UV lamps in laboratories. Fluoropolymers, in particular, possess exceptional properties, including high thermal stability, low dielectric constant, chemical resistance, low friction, and surface energy, making them indispensable in industries like aerospace, automotive, electronics, and medical devices. This study focuses on modifying fluoropolymers using UV irradiation to examine its effects on protein adsorption.

The fluoropolymers investigated in this study were poly(tridecafluoroheptyl acetal ethyl methacrylate) homopolymer and its copolymer with poly(methyl methacrylate), both synthesized via ATRP. The monomer used has a fluorinated side chain that can be cleaved in acidic conditions and thus by incorporating a photoacid generator in the polymer solution and exposing to UV irradiation the polymeric film, surface chemistry modification can be achieved. The change of the biomolecule adsorption capacity of the prepared films after UV irradiation was showed and evaluated, showcasing the innovative use of optical lithography and fluorinated polymers to create well-defined areas on substrates where biomolecules are selectively attached. This study is expected to have potential applications in site-specific biomolecule immobilization for biological research.

References:

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