Electrospinning of TiO_2 based semiconductor nanofibers with enhanced photocatalytic properties

P. Pascariu[1], L. Georgescu[2], E. Koudoumas[2] and M.P. Suchea[2,3*]

[1]"Petru Poni" Institute of Macromolecular Chemistry, 700487, Iasi, Romania
[2]Center of Materials Technology and Photonics, School of Engineering, Hellenic Mediterranean University, Heraklion, Crete, 71410, Greece
[3]National Institute for Research and Development in Microtechnologies (IMT-Bucharest), Bucharest, 023573, Romania

The photocatalytic materials are important for various applications, such as antifouling, self-cleaning, antifogging and antibacterial actions as well as deodorization or decomposition or removal of pollutant, applications requiring the development of a broader range of smart functional materials. The most widely used semiconductor photocatalysts are TiO_2 and ZnO, because of their high photosensitivity, photochemical stability, large band gap, strong oxidizing power and non-toxic nature. In particular, anatase TiO_2 has been reported as the most extensively used semiconductor photocatalyst for industrial applications and pollution clean-up since 1970s. The successful exploitation of such photocatalysts requires the development of appropriate techniques for controlling their size, morphology, structural and surface characteristics, in an effort to enhance their photochemical response to visible/solar illumination.
This presentation concerns the development and optimization of inorganic nanocomposite fibrous materials, fabricated by electrospinning followed by electrospinning-calcination and suitable for nano-environmental applications, having high photocatalytic activity against various water pollutants in the presence of ultraviolet and visible light. These fabrication methods are of low cost and easy to scale up and can lead to materials having the photocatalyst immobilized in a felt-like structure exhibiting remarkable photocatalytic activity for the degradation of a large number of common water pollutants. At the same time, these felt-like structures are easy to recover and rejuvenate for re-use. In this work, the fabrication of pure and doped TiO_2 membranes will be presented. Moreover, characterization of the fabricated nanocomposites will be shown, such as X-ray diffraction (XRD), scanning electron microscopy (SEM), Raman spectroscopy, ultraviolet–visible spectroscopy (UV–vis) as well as their involvement in the photocatalytic degradation of common water pollutants.

Acknowledgements: PP contribution to this work was partially supported by a grant of the Romanian Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P1-1.1-TE-2019-0594, within PNCDI III. M.P.S. contribution was partially financed by the Romanian Ministry of Research, Innovation and Digitalisation thorough „MICRO-NANO-SIS PLUS" core Programme.

*Correspondence to: mirasuchea@imt.ro; mirasuchea@hmu.gr