Nanostructured polymer-based composites: a combination of nanochemistry and irradiation processes

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Strong of our previous experience in the synthesis of nanocomposites made from the association of polymer materials and inorganic nanoparticles [1], we propose here to present our recent work in the development of functional composite nanoporous membranes.
Through the combination of Swift Heavy Ions (SHI) irradiation with chemical etching and radiografting processes, we are able to synthesize membranes, whose nanoporosity is perfectly controlled, with specific functional polymer grafted onto the pores walls [2]. The addition of nanochemistry processes to *in situ* synthesize metallic nanoparticles has shown to be an efficient strategy for the formation of composite membrane materials. Optical properties depend on both the polymer matrix and the metallic nano-objets that are composing them. In this study, both chemical and radio-induced synthetic pathways were followed for the synthesis of the metallic nanostructures, lifting the veil on the various parameters (reducing agent, temperature for chemical processes; atmosphere, dose and dose rate for the radio-induced processes) influencing the reduction of the metal precursors, as well as the growth of the resulting nano-objects. Especially, the effect on the shape, size and distribution of theses nano-objects within the nanopores was investigated using spectroscopy (UV-visible absorption) and microscopy (SEM, TEM) techniques.
Such anisotropic functional composite materials should theoretically exhibit new and promising optical and photonic properties due to the inclusion an alignment of functional metallic nanostructures within transparent polymers.

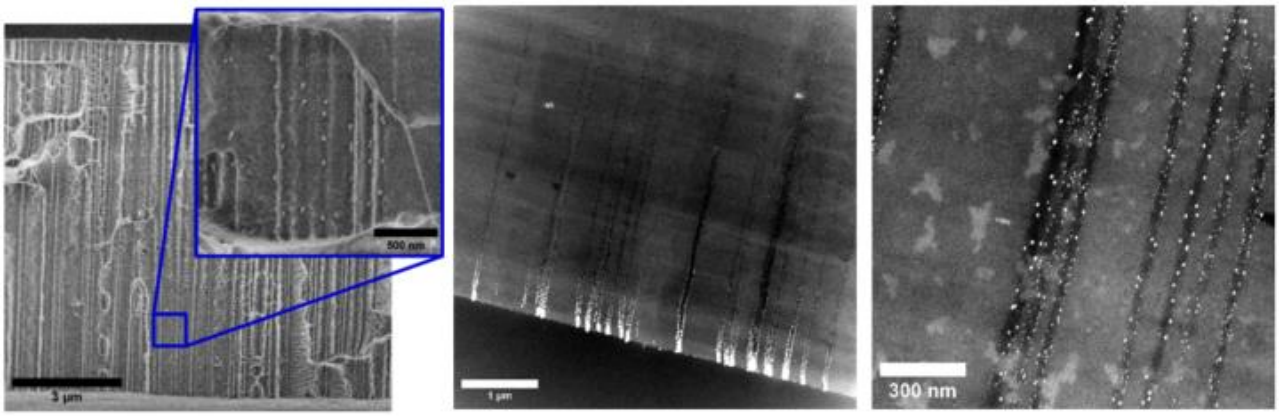

Figure: SEM (left) and STEM (center, right) pictures of nanocomposite polymer/gold nanoparticles membranes

References:
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