Title of the thesis: Characterization of the photoageing impact on the polymer permeability

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Summary:

Upon several environmental stress factors (temperature, UV light…), polymers are prone to degrade through radical chain mechanisms. The (photo)ageing of polymers results in the modification of several of their functional properties: color, gloss, permeability, thermal and mechanical resistance… Regarding the permeability properties, they are essential in various application fields such as encapsulation or packaging… The evolution of these properties, as well as the related mechanisms, have been hardly ever addressed during the photoageing of polymer materials.

This PhD subject is devoted to fill in these gaps by combining traditional polymer permeability measurement techniques (oxygen permeability, dynamic water vapor sorption) with original methods using molecular probes of various size and polarity, in order to collect information about the evolution of the transport properties of these probes during the photoageing of the polymer. A permeation setup will be especially designed and associated with analytical methods depending on the nature of the molecular probe selected: HPLC (UV-Vis or fluorescence detector), HPLC/MS/MS, ionic chromatography, GC/MS, UV-visible or fluorescence spectroscopy, XPS…

This approach will be first applied to polymers from the packaging field, and would be extended to other families of polymers in the future.

The implementation of this PhD subject will benefit from the skills of its supervisors: molecular photochemistry and analytical chemistry (Prof. Mohamed Sarakha, PRE theme), polymer photoageing and permeability (Dr. Julien Christmann, POPPI theme), as well as several instruments within the ICCF.