Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Characterization of reactive oxygen species at interfaces during photochemical reactions

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Summary :

Reactive Oxygen species (ROS) play an important role in chemical/photochemical transformation processes. To measure ROS in solution or aerosols, various tests have been developed using chemical probes such as ascorbic acid, terephthalic acid, dithiothreitol, and 2',7'-dichlorofluorescin. However, there is still no consensus on the choice of probe because the response varies according to the ROS and the experimental conditions. Moreover, these methods are often not fast and sensitive enough to capture the temporal evolution of ROS in a reactive system or for the detection of ROS produced at interfaces (liquids/gas or solids/gas).

This PhD thesis project aims to develop new analytical methodologies for the collection of ROS with much shorter sampling times and greater flexibility and simplicity to adapt the method to a monitoring of reactive systems in the laboratory but also to field measurements. The proposed methodology is to develop sampling cartridges impregnated with one or more ROS probes following the approach we have recently developed for ROS measurements in cigarette smoke or secondary organic aerosols (Sleiman et al., 2013).

The thesis will allow the development of experimental conditions for sampling and analysis of different ROS (HO•, ROO•, H_2O_2, singlet oxygen, other radicals) through the selection of the appropriate probes and the optimization of the conditions for impregnating single- and multi-probe cartridges. Tests of probe responses/sensitivities and validation through measurements at the liquid/gas or solid/gas interface on different model matrixes during irradiation will also be performed.

This thesis provides a great opportunity to carry a federating and innovative project, it will strengthen the position and visibility of the photochemistry team as a major player in reactivity studies in various natural environments (continental waters, clouds, atmosphere, plants, etc.) and depollution systems (advanced oxidation processes).