Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

Date de la proposition : 4/11/2014

Responsable du stage */ internship supervisor*:

Nom / *name*: ROUSSEAU Prénom/ *first name* : Antoine

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Nom du Laboratoire / *laboratory name*: Laboratoire de Physique des Plasmas

Code d'identification :UMR7648 Organisme : Ecole Polytechnique/CNRS

Site Internet / *web site*: www.lpp.fr

Adresse / *address:* Ecole Polytechnique

Lieu du stage / *internship place*: Palaiseau

Titre du stage / *internship title*: **Air treatment by Plasma-Catalyst coupling. In situ diagnostic of catalytic surfaces under plasma exposure**

Résumé / *summary*

Context

Air treatment devices using Non Thermal Plasmas (NTP) are now on the market or about to be for domestic applications. However, numerous scientific challenges should be solved in order to improve their efficiencies. These technological barriers can be overcome by coupling analysis of the gas phase and analysis of adsorbates to identify reaction mechanisms. The original method we have implemented allows monitoring "in situ" and in real time the species produced in the gas phase, but also pollutants or reaction intermediates adsorbed on the sorbent surface.

Research project

Identification of reaction intermediates: Intermediate species play a key role, because they block adsorptions sites (poisoning) or conversely desorbed into gas phase (possibly as highly toxic by-products). We have build-up a new diagnostic, Sorbent-TRACK, for the in situ analysis of the sorbent surface and adsorbed intermediates under direct plasma exposure. The principle is based on infrared spectroscopy (FTIR). This prototype will be used soon to quantify real-time adsorption, co-adsorption and oxidation of VOCs and chemical intermediates. We plan to be able to adjust the exposure time to the plasma a few milliseconds to a few seconds using diode laser absorption spectroscopy. Gas phase composition will be analyzed by FTIR with a sensitivity of 10-50 ppb.

A combination of catalysts and sorbents: we have shown in preliminary studies that it is necessary to combine different materials to optimize the catalytic process. Several materials have already been tested. TiO2 has been widely studied by many groups, including ours, as a photocatalyst coupled with NTP. Its adsorption properties are very well known. MnO2, is a very effective catalyst for the destruction of ozone and is therefore a prime candidate for use with plasma. We recently studied CeO2 and were able to show excellent adsorption capacity in the presence of high humidity.

LPP expertise in air purification

Since 2003, the laboratory is working on the air pollution control by plasma and plasma-adsorbent-catalyst coupling. The LPP is expert in the generation, control and metrology of NTP in reactive gases. Its expertise covers electrical engineering and electrical metrology, chemical gas analysis, plasma spectroscopy, the understanding of the interaction plasma- adsorbent and plasma-catalyst.

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : oui**

Si oui, financement de thèse envisagé/ *financial support for the PhD***: en discussion**

Lasers, Optique, Matière		Lumière, Matière, Interactions	
Plasmas : de l'espace au laboratoire	**X**		