Fédération Sciences Plasmas Fusion

Année universitaire / Academic year 2020-2021

PROPOSITION DE STAGE / INTERNSHIP PROPOSAL

Organisme / Institution : CNRS-AMU

Laboratoire / Laboratory : PIIM

Adresse du lieu de stage / Lab address : Avenue Escadrille Normandie Niemen

Responsable de stage / Supervisor : Minissale Marco

Téléphone / Phone : 0491282896

e-mail : marco.minissale@univ-amu.fr

Conditions de stage (rémunération, voyage, logement, cantine, …) / internship conditions (salary, travel, lodging, food,…) : rémunération/salary

Titre / Title : Experimental study of the optical properties evolution of tungsten induced by deuterium ion interaction.

Résumé / Abstract: The interactions of particles (i.e. ions) with matter can induce temporary or permanent changes in the optical properties of matter [1-2]. The study of optical properties evolution is essential for a wide range of research fields and applications, such as photonics optoelectronics and infrared thermography. It represents a critical issue for environments where materials are submitted to high ion fluxes, like nuclear fusion reactors [3-4]. Actually, a poor knowledge of the evolution of optical properties of reactor wall materials (the so-called plasma facing components) during plasma operation can lead to underestimate their light absorption and thus to errors in temperature measurement [4]. The proper functioning of these machines therefore seems to depend heavily on a detailed study of the optical properties of metals during interactions with plasma and ions.

The aim of the internship is to study experimentally the modifications of optical properties of tungsten induced by deuterium ion interaction. The tungsten samples placed in a UHV (Ultra-High Vacuum) chamber will be exposed to a deuterium ion beam. The optical properties will be measured during ion implantation in the visible and near-infrared domain. The spectroscopic measurements will be coupled with ex-situ analysis of the surface by the means of AFM (Atomic Force Microscopy), Confocal Microscopy, and XPS (X-Ray Photoelectron Spectroscopy) to study the morphological/chemical changes induced by ion implantation. Eventually a statistical model will be used to model the BRDF (Bidirectional Reflectance Distribution Function) of implanted materials and to quantify the role of the roughness on the optical response of the samples.

[1] Minissale, M., Pardanaud, C., Bisson, R., Gallais, L., 2017, *J. Phys. D: Applied Phys.* **50**, 45560

[2] Luo, G. -N. Shu, W. M., and Nishi, M., 2005, *J. Nucl. Mater.* **347**, 111L

3] 't Hoen M.H.J., Balden M., Manhard A., Mayer M., Elgeti S., Kleyn A.W. and van Emmichoven P.Z. 2014, *Nucl. Fusion* **54**, 083014

[4] Guilhem, D., Gaspar, J., Pocheau, C., Corre, Y. *IEEE Transactions on Plasma Science*, **48**, 2495-25