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MEASUREMENTS OF THE ABSOLUTE DENSITY OF GROUND STATE RO-VIBRATIONALLY EXCITED D_2 MOLECULES IN AN ECR-DRIVEN PLASMA BY MEANS OF SYNCHROTRON RADIATION

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The investigation of the production mechanisms of electronic $X^1\Sigma^+$ ground state ro-vibrationally excited molecules D_2*(v”>0,J”) on surface materials is relevant for fusion plasmas either for the plasma heating or for the divertor targets’ shielding [1]. In cold plasma physics, and particularly with regard to negative ion source development for neutral beam injection (NBI) systems, these excited molecules are of particular interest since they are one of the main reactants of the Dissociative Electron Attachment (DEA) reaction which is commonly accepted as the dominant path towards the production of negative ions in sources based on the volume production concept [1,2]. Electron cyclotron resonance (ECR) ones driven by dipolar plasma modules [3] are a representative example of this type of source. The production of the aforementioned excited molecules takes place in the plasma bulk but may also result from surface reactions. Among the most probable is the Recombinative Desorption reaction. Therefore it is worth exploring the influence of various plasma facing materials on their production, with the goal of determining a more efficient material. It is evident that an enhancing trend is accordingly reflected in the negative ion yield, which is highly desirable.

In this context, a deuterium plasma is studied in the ECR-driven source SCHEME II+ which is coupled to the VUV Fourier Transform Spectrometer at the DESIRS (Dichroïsme et Spectroscopie par Interaction avec le Rayonnement Synchrotron) beamline of the SOLEIL synchrotron (Saint-Aubin, France). Absorption spectra are recorded in different operational conditions, i.e. for pressures ranging from 1 – 36 mTorr, under constant microwave power (150 W). Both bare Quartz and material covered surfaces are considered. For the latter case, fresh in-situ magnetron sputtered thin films of tantalum (Ta) and tungsten (W) upon the Quartz surface are investigated. Preliminary observations do not indicate any difference as the material is changed. However, in a previous study [1] where commercially available foils of the same materials were placed in the interior surfaces of the same source, a drastic modification of the excited molecule population was clearly demonstrated. This may suggest that the structural properties of the sputtered surface influence the Recombinative Desorption mechanism and thus the production of the ro-vibrationally excited molecules. This subject is currently under scrutiny.

[1] S. Béchu, J. L. Lemaire, L. Gavilan, S. Aleiferis, V. Shakhatov, Yu. A. Lebedev, D. Fombaron, L. Bonny, J. Menu, A. Bès, P. Svarnas, N. De Oliveira, J. Quant. Spectrosc. And Radiat. Transf. **257**, 107325 (2020).

[2] M. Bacal, M. Wada, Plasma Sources Sci. Technol. **29**, 033001 (2020).

[3] A. Lacoste, T. Lagarde, S. Béchu, Y. Arnal, J. Pelletier, Plasma Sources Sci. Technol. **11**, 407-412 (2002).