P04

Correlation of Hydrogen Emission and Electron Properties in Low Temperature Plasma Conditions Close to Divertor-like Materials

E. Fox-Widdows[1], M.D Bowden[1]

[1]*Dept of Electrical Engineering and Electronics, University of Liverpool, Liverpool L69 3GJ, United Kingdom*

Understanding the behaviour of atoms and molecules in tokamak divertor plasmas is vital in order to gain information about the key processes that result in divertor detachment, crucial for the successful operation of future fusion devices [Krasheninnikov 2016].

The aim of this research is to understand atomic and molecular emission of hydrogen in a controlled low-temperature plasma environment close to divertor-like materials. The study combines electron property measurements, made using Langmuir probes, with plasma emission measurements, in an ICP discharge source. A sample heater was used to insert carbon and tungsten surfaces into the plasma. This allows the material temperature and surface conditions to be varied, while the discharge ICP environment allows the plasma conditions to be varied in a controlled way. Analysis of the set of measurements provides insight into how plasma and material conditions influence atomic and molecular emission.

For these experiments, the pressure and power were varied from 0 to 10 Pa and 10 to 300 W respectively, which provided a variety of electron properties, with densities of 10^{16} - 10^{18} m^{-3}, electron temperatures of 1 - 6 eV, and a range of electron energy distributions. Emission intensities were measured over a range of wavelengths, focusing on atomic emission of the H-alpha and H-beta lines and molecular emission in the Fulcher Band. The temperature of the carbon or tungsten surfaces was varied in the range of 100-1200C.

The experimental data was used to correlate hydrogen emission with plasma and surface conditions. These results will be compared with results from a 0-D collisional radiative model, and also used to inform emission measurements planned for the current MAST-U campaign in the Super-X divertor [J Harrison, 2019].

[1] Krasheninnikov, S.I., Kukushkin, A.S. & Pshenov, A.A. 2016, "**Divertor plasma detachment**", Physics of Plasmas, vol. 23, no. 5.

[2] Harrison, J., et al, 2019, **"Overview of new MAST physics in anticipation of first results from MAST Upgrade"** Nuclear Fusion, vol. 59, 112011