Poster paper

DETERMINATION OF THE GAS TEMPERATURE OF AN ARGON MICROWAVE PLASMA AT ATMOSPHERIC PRESSURE USING VAN DER WAALS BROADENING

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The ro-vibrational emission spectra of the molecular species are usually used to measure the gas temperature of a discharge at atmospheric pressure. But, under some experimental conditions, it is difficult to detect them. In order to overcome this difficulty, and obtain the temperature, a new method based on the relation between the gas temperature and the van der Waals broadening of argon atomic spectral lines is proposed in this work.

In order to analyze the possibility to use the van der Waals broadening of the neutral-argon lines to determine the gas temperature in an argon surface-wave sustained discharge (SWD) at atmospheric pressure, the values of the gas temperature inferred from the atomic lines with that ones obtained from the analysis of the OH molecular specie spectrum, were compared. The plasma column was created in a quartz tube with one of its ends opened to the air.

Under our experimental conditions, the Lorentzian broadening is due to the Stark and the van der Waals broadenings. Considering that the Satrk broadening can be approximated to a Lorentzian function, the total Lorentzian width of a spectral line is the sum of Stark and van der Waals widths. Moreover, in an argon surface-wave plasma at atmospheric pressure the axial profile of T_g can be considered constant and so, the van der Waals broadening too. If the Lorentzian broadening of a spectral line depends on axial position, this line is sensitive to the electron density variation. This is in particular the case for the 522.1, 549.6 and 603.2 nm lines. For this reason, these lines could be used to measure the electron density in discharges at atmospheric pressure. For these spectral lines a linear fit is obtained, which intersects the ordinate at a point corresponding to the Lorentzian width for zero electron density. This value is called here an origin ordinate and is determined for each analyzed line. It can be considered approximately equal to the van der Waals width and is used here to calculate the plasma gas temperature.

From our results and the comparison with other authors we can conclude that the method, proposed in this work, gives a possibility to estimate the gas temperature from the van der Waals of atomic lines.