XI SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
August 21-25, 2017, Šabac, Serbia
Book of Abstracts, Eds. L. Č. Popović, A. Kovačević and S. Simić
Astronomical Observatory Belgrade, 2017

Progress Report

DETERMINATION OF GAS TEMPERATURE IN MICROWAVE DISCHARGES SUSTAINED IN ARGON-NEON MIXTURES BY USING PRESSURE BROADENED SPECTRAL LINES

J. Muñoz[1], R. Rincón[1], C. Melero[1], M. S. Dimitrijević[2] and M. D. Calzada[1]

[1] *Laboratorio de Innovación en Plasmas (LIPs), Edificio Einstein (C-2), Campus de Rabanales, Universidad de Córdoba, E-14071 Córdoba, Spain*
[2] *Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*

E-mail: jmespadero@uco.es,rocio.rincon@emt.inrs.ca, mdimitrijevic@aob.rs, fa1cazal@uco.es

Mixed gas discharges containing rare gases have different applications not only in scientific but also in technological fields like e.g. medical instrument sterilization or metal surface nitriding. Typically used gas is argon, but if a higher excitation/ionization efficiency is needed, in order to improve the excitation of atoms and ions in the samples introduced into the plasma, Ar can be replaced or mixed with He, since its metastable and excited states have higher energies than those of Ar. Since the energy of Ne metastable atoms lies between those of Ar and He, the Ar-Ne mixtures could be considered as an alternative to Ar, He or Ar-He plasmas.

A key parameter to understand the processes that take place in a plasma is gas temperature, related to the energy of the heavy plasma particles participating in the formation of radicals from the substances introduced into discharges. In atmospheric pressure plasmas, a common method is to measure gas temperature from the rovibrational spectra of OH or $N2^+$, usually present in the discharge due to the existence of water and nitrogen impurities at trace level. If their concentration is so low that it is difficult to detect them, the gas temperature can be determined from the van der Waals broadening.

Yubero et al. (2007) proposed a method to determine the gas temperature of an Ar discharge at atmospheric pressure from the van der Waals broadening of the spectral lines which have also a comparable Stark broadening contribution, and they found that the Ar I 603.2, 549.6 and 522.1 nm spectral lines are suitable for the gas temperature measurements. In Muñoz et al. (2009) this method has been extended for atmospheric pressure Ar-He plasmas. Different Ar lines were examined in that study and it has been found that Ar I 603.2 nm line could be considered appropriate to measure the plasma gas temperature from the van der Waals broadening.

In the present work, the applicability of the method for the measurement of gas temperature in argon-helium plasma at atmospheric pressure, using the van der Waals broadening of spectral lines, proposed by Muñoz et al. (2009), for the determination of gas temperature in argon-neon mixtures, has been studied. It has been established

that the Ar I 425.9 nm and 603.2 nm spectral lines are recommendable for such measurements, especially when the use of OH radicals is difficult or its the contribution to the plasma pollution should be avoided.

References

Muñoz, J., Dimitrijević, M. S., Yubero, C., and Calzada, M. D.: 2009, *Spectrochim. Acta B*, **64**, 167.

Yubero, C., Dimitrijević, M. S., García, M. C., and Calzada, M. D.: 2007, *Spectrochim. Acta B*, **62**, 169.