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Simultaneous determination of rotational and vibrational temperatures in microwave plasma torch operating in Ar or Air/Ar mixtures using optical emission spectroscopy. SEBASTIEN RASSOU, ALAIN PIQUEMAL, CEA DIF, Arpajon, France , NOFEL MERBAHI, FREDERIC MARCHAL, MOHAMMED YOUSFI, LAPLACE, Universite Paul Sabatier, Toulouse, France
— A microwave (MW) plasma torch is considered to produce plasma at Non local thermodynamic equilibrium (Non-LTE). When the electronic density is not too high the plasma can be considered optically thin. In these assumptions, optical emission spectroscopy can be performed to determine plasma parameters as the temperatures or the species density. A specific method to determine the rotational (Tr) and vibrational temperatures (Tv) using molecular nitrogen second positive system (SPS) emission spectroscopy is presented. It was tested on experimental emission spectra collected from a MW plasma torch operating in gas conditioning cell at 950 mbar with Argon/Air mixtures under different input MW powers and gas flows. From synthetic spectra generated by the line by line radiation code SPARTAN, two coefficients calculated from emission peaks intensities ratio are tabulated as a function of Tr and Tv. The two coefficients are calculated from experimental spectra to determine simultaneously Tr and Tv from the tabulation. The results are validated with comparisons between experimental spectra and synthetic spectra. The present method can be easily generalized to other molecular emission systems for the temperature measurements of non-thermal plasmas generated in different gas mixtures.

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