MICROPLASMA DIAGNOSTICS BY EMISSION SPECTROSCOPY

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Microplasma technology was used in the last years for various applications such as NOx removal, sterilization of bacteria or surface treatment[1]. The advantages of microplasma consist in reduced size of the reactor and low discharge voltage. Phenomena of microplasma could be analyzed using emission spectroscopy method. Our microplasma is atmospheric pressure nonthermal plasma. It is a dielectric barrier discharge generated between perforated metallic electrodes covered by a dielectric layer at small discharge gaps between 0 - 100μm. Thus the discharge voltage is around 1 kV. Nitrogen, oxygen and argon were used as discharge gases. The emission spectra were measured by an ICCD camera, a spectrometer and a photomultiplier tube. Microplasma was pulsed powered by a Marx Generator and a high voltage amplifier.

Emission spectra of the microplasma discharge in N_2 gas shown intensity peaks of N_2 second positive band system (N_2 SPS) and N_2^+ first negative band system (N_2 FNS). When O_2 was added in N_2 emission intensities of N_2 SPS and N_2 FNS were decreased due to the quenching effect of oxygen. Microplasma discharge in Ar shown intensity peaks in ultraviolet, violet and red regions. When N_2 was added in Ar it was observed an increasing tendency of N_2 SPS intensity with decreasing argon emission intensity which indicates that excited nitrogen molecules resulted from the consumption of excited argon atoms[2]. The lifetime emission signal of N_2 SPS peak of 337.1 nm was around 60 ns and 3 μs for the Ar peak of 308 nm. With the addition of water droplets in N_2 gas also OH peaks were observed.

The reduced electric field strength of microplasma in N_2 gas was calculated as a function of the intensities ratio of 391.5 nm and 337.1 nm.

The measurement of microplasma temperatures was performed using the SPECAIR software. The comparison between experimental data and simulated spectra showed that temperatures values are specific for non equilibrium plasma.

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2. Q. S. Yu and H. K. Yasuda, “An Optical Emission Study on Expanding Low-Temperature Cascade Arc Plasmas”, Plasma Chemistry and Plasma Processing, Vol. 18, No. 4, 1998, pp. 461-485.