Spectral Diagnostics of the Pulsed High Voltage Generated Plasmas with Convenient Spectral Source

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The afterglow plasma of the pulsed hollow cathode discharge working in pure Neon at 5 torr pressure has been investigated by absorption spectroscopic technique using a convenient spectral source. The peak current of the pulsed discharge was about 10-30 A with a duration of 150 ns (half-width) and repetition rate of 30 Hz. The spectral source was a pulsed discharge emitting intense atomic and ionic lines. The Doppler line profile of the emitted atomic lines of the pulsed spectral source has been determined [1] using the laser absorption technique and rigorously solving the absorption formula of Mitchell and Zemansky. It was demonstrated that the line profile of the spectral source may be controlled by varying the working peak current. The used experimental set-up is appropriate for absorption measurements in the pulsed and temporal afterglow plasma and was featured with an original system for time synchronization of pulses [2].

The measurements of the absolute population density of excited $^3P_2$ levels of Ne in the afterglow plasma of the pulsed discharge revealed a population density of excited atoms in metastable states in the 5 - 60 μs temporal afterglow range from $3 \times 10^{12} \pm 20\%$ cm^{-3} to $1.7 \times 10^{11} \pm 20\%$ cm^{-3} with an exponential decay. The use of the pulsed spectral source with controllable emission line broadening allows us to increase the sensitivity of the method making measurements of densities of metastable atoms in the long temporal afterglow plasma.

The diagnostics of the temporal afterglow plasma achieved in this work is of great interest in transient plasma processing and especially in analytical investigations with systems like Glow Discharge Optical Emission Spectroscopy (GDOES), Glow Discharge Mass Spectrometry (GDMS) and Direct Analysis in Real Time Mass Spectrometry (DARTMS), in which the energy transfers of the metastable atoms, are central for the excitation and ionization of the analyte species.

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[2] A. Surmeian, C. Diplasu, A. Groza, M. Ganciu, P. Chapon, I Iovitz Popescu, *Optoelectronics and Advanced Materials - Rapid Communication*, **11**, (2010)