The broadening of carbon spectral lines emitted from a pulsed atmospheric pressure gas discharge source with graphite cathode

Jovica Jovović[1] and Gordana Lj. Majstorović[2]

[1]Faculty of Physics, University of Belgrade, P.O. Box 44, Belgrade, Serbia
E-mail: jjovica@ff.bg.ac.rs
[2]Military Academy, University of Defence, Veljka Lukića Kurjaka 33, Belgrade, Serbia
E-mail: gordana.majstorovic@va.mod.gov.rs

The atmospheric pressure needle-to-cylinder (NTC) gas discharge source operating in pulsed power regime was recently developed and employed for the study of broadened neutral and ionic lines (Ar I, Fe I, Cu I, Cu II) and investigation of ro-vibrational distribution of molecular bands (AlO, CN) (Jovović and Majstorović 2023, Jovović 2023). The numerous (narrow) metallic lines originating from the cathode material (aluminum, brass, stainless steel) are identified which is of importance for metals and alloys spectral lines catalogue (Jovović 2023). The recorded narrow lines are used for electron temperature T_e measurement as well (Jovović 2023). In order to measure Stark halfwidths and shifts of broadened lines, the complex line shape is fitted by a modal function representing the summation of Voigt profiles. For those spectral lines with known Stark broadening parameters, the electron number density N_e in gas discharge regions is obtained while for those lines with unknown parameters, such as Cu II 565.1 nm line, the electron impact halfwidth can be estimated from the fitting function.

Using the same methodology, the spectra of C I and C II lines, recorded with spectrometer-CCD camera setup from the NTC gas discharge source with graphite cathode in argon, are analyzed. The experimental Stark halfwidths and shifts can be found in various references (see e.g., Konjević and Wiese 1976, Konjević et al. 1984, Mijatović et al. 1995). Since the gas temperature T_g is an important parameter for the calculation of Doppler and pressure broadening halfwidths, several well resolved C_2 molecular bands with Δv=0, 1, -1, -2 are recorded and, in conjunction with molecular data, T_g measured. The N_e and T_g results will be presented and the comparison with brass and stainless steel cathode NTC gas discharge parameters will be shown.

References

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