EVOLUTION OF ELECTRIC FIELD IN DIELECTRIC BARRIER DISCHARGE IN HELIUM

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Abstract. In this paper the diffuse dielectric barrier discharge (DBD) in helium was investigated using electrical measurements and time-space resolved optical emission spectroscopy. The electric field strength, in the cathode sheath of the DBD is determined using Stark splitting of He I 447.15 nm and He I 492.19 nm lines polarized in the electric field direction. The electric field is calculated using spectral distance between forbidden and allowed components and results are compared with those obtained using forbidden/allowed intensity ratio (Obradović et al. 2008). For comparison of lengths of the cathode fall regions we DBD was operated at 200 and 800 mbar pressures. Distributions of the electric field, obtained for both pressures, are typical for the Townsend-like or subnormal-like discharge (Mangolini et al. 2004). These discharge types have a low electric field in the positive column dissimilar to glow-like DBDs (Massines et al. 1998).

For measurements of the electric field evolution, we have increased time resolution ten times, and in 0.1 µs steps obtained the electric field distributions using, a more intensive He I 492.19 nm line (Ivković et al. 2009). During the development of the discharge, the length of the cathode fall region reduces at all times and even in the falling phase of the discharge current. In the period of current decrease, the electric field at the cathode decreases, whereas the maximum of the electric field distribution moves from the cathode showing the accumulation of negative charge near the cathode surface.

References