Electric field measurements in N_2:CO_2 ns-APPJ by E-FISH technique

N.D. Lepikhin[1*], D. Luggenhölscher[1], U. Czarnetzki[1]

[1]*Institute for Plasma and Atomic Physics, Ruhr University Bochum, D-44780 Bochum, Germany*

The electric field in the nanosecond (near) Atmospheric Pressure Plasma Jet (ns-APPJ) is measured by the Electric Field Induced Second Harmonic generation (E-FISH) technique. The optical system used for the E-FISH measurements is similar to the one described in [1, 2], but has been optimized: the laser beam bypasses the amplifiers of the ps-laser in order to suppress an astigmatism of the beam caused by the non-uniform pumping of Nd:YAG rods in the amplifiers. With this modification the maximum possible energy of the laser pulse is much lower (~1 mJ), but nevertheless is still sufficient for generation of the second harmonic at 532 nm. At the same time, elimination of the amplifiers from the laser path leads to higher quality and better stability of the beam, which allows to achieve reliable E-FISH signals even at the relatively low pressure of 150 mbar. The electric field measured in different N_2:CO_2 mixtures is shown in Fig. 1: its value (E/N≈100 Td) is steady after the breakdown, moreover it weakly depends on the CO_2 content. It was shown already [1, 3] that electron density, pulse duration and volume of the plasma bulk can be controlled independently of E/N. Fig. 1 demonstrates that an exact gas mixture composition can be considered as an independent control parameter for applications, e.g. vibrational excitation, too. Influence of the electrical circuit characteristics on E/N value is investigated in order to optimize the vibration excitation in the jet studied by QCLAS in a similar discharge cell in the framework of SFB1316 project.

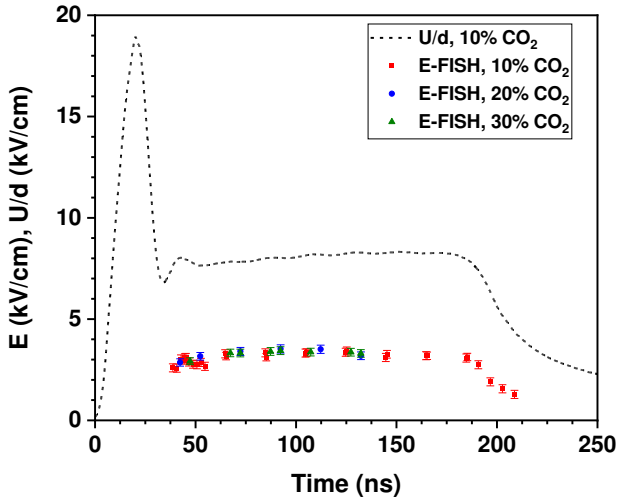

Figure 1. Electric field in ns-APPJ measured by E-FISH technique together with voltage over gap (1 mm) ratio for different N_2:CO_2 mixtures at pressure of 150 mbar and gas temperature of 340 K.

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[2] N. D. Lepikhin *et al.*, J. Phys. D: Appl. Phys. **54** (2021) 055201.

[3] N. D. Lepikhin *et al.*, PSST (2023) accepted manuscript, DOI 10.1088/1361-6595/acde09

*Presenting author: nikita.lepikhin@rub.de