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Increasing electron density with increasing oxygen admixture? Competing reaction and recombination processes in an atmospheric N_2/O_2 dielectric barrier discharge[1] KATHARINA STAPELMANN, North Carolina State University, FRIEDERIKE KOGELHEIDE, BJOERN OFFERHAUS, PHILIP KRAJINSKI, NIKITA BIBINOV, PETER AWAKOWICZ, Ruhr University Bochum, JULIAN SCHULZE, Ruhr University Bochum, West Virginia University — A DBD is investigated for various N_2/O_2 mixtures in controlled atmosphere by OES in combination with numerical simulations and I/V-measurements. Surprisingly, an increasing electron density was found for increasing O_2 content. Due to the higher electron affinity of O_2, the opposite would be expected. Furthermore, the spatial electron distribution in the discharge volume differs comparing synthetic air with pure N_2 as process gases. While the synthetic air discharge shows a homogeneous electron distribution in the center of the discharge, the pure N_2 discharge appears to be more confined to the electrode. The rate constants, reaction rates, and life times of the positive ions of O_2^+ and N_2^+ are calculated and compared. The recombination rate of N_2^+ is more than an order of magnitude lower than the recombination rate of O_2^+. Calculating the N_4^+ production and recombination rates, we found that they are several orders of magnitude larger than both, O_2^+ and N_2^+ recombination rates. Since N_4^+ occurs in significant densities with higher N_2 fraction in the gas mixture, electrons are consumed in recombination with N_4^+ efficiently. Thus, the electron density decreases with higher N_2 content.

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