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(G*) Impact of NH3 consumption in a low frequency Ar-NH3 atmospheric pressure DBD

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In atmospheric-pressure dielectric barrier discharges, it is well known that 2 regimes of non-equilibrium discharge can be reached, a filamentary one and a homogeneous one. In nominally pure Argon at "low frequency" (below some hundreds of kHz), the discharge is filamentary. For specifics processes, filaments are unwanted. Such filaments can be suppressed by reducing the breakdown voltage through the use of Penning mixtures. Homogeneous discharge is reached by adding a molecular gas with an ionization energy lower that the one of metastable of the atomic gas, metastable atoms could then ionize molecular gas, and so lower the breakdown voltage. For example, in argon, some hundreds of ppm of NH3 are sufficient to bring the discharge to a homogeneous regime.
In this context, we realize that NH3 quantity in the Penning mixture is a key parameter in the operation of the discharge. The aim of this study is therefore to characterize the impact of NH3 consumption over the flow on a low or radio frequency Ar-NH3 atmospheric pressure DBD. It is important to notice that the NH3 is dissociated into the discharge: in the direction of the flow, there is therefore less NH3 at the end of the discharge than at the beginning. Through spaced-resolved emission spectroscopy along the gas flow and 1D fluid modeling, it appears that the electronic temperature varies only slightly and the NH emissions decreases along the gas flow lines. This is a signature of the decrease of NH3 concentration and hence the statement that Penning mixtures discharges evolve depending on the distance to the discharge entrance.

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