

## On the characteristics of streamers interacting with ionized plasma patches or dielectrics

Anbang Sun, Xuchu Yuan, Xiaoran Li, Guanjun Zhang

State Key Laboratory of Electrical Insulation and Power Equipment, School of Electrical Engineering, Xi'an Jiaotong University

e-mail (speaker): anbang.sun@xjtu.edu.cn

Residual charged particles from previous discharges or external sources can produce some localized plasma patches. Such plasma patches can affect the propagation morphology of passing streamers. We developed a 3D particle model to investigate 1) how a positive streamer propagates through an electron-ion or a purely positive ion plasma patch, in air with two planar electrodes 2) How streamer branches react with laser-induced plasma patches, in air with a needle-plate electrode. Furthermore, electric discharges along dielectric are common phenomena in electronics and high-voltage equipment. We here also study the dynamics of both positive and negative surface streamers, with a 2D plasma fluid model that is based on the Afivo-streamer code. Selected results of streamers interacting with dielectrics will be presented, including inception besides the dielectric, attaching to and propagation over the dielectric surface.

### References

- [1] Xu-Chu Yuan, Han-Wei Li, M. F. Abbas, Xiao-Ran Li, Zhen Wang, Guan-Jun Zhang, An-bang Sun. A 3D numerical study of positive streamers interacting with localized plasma regions, *J. Phys. D: Appl. Phys.* 53 (2020) 425204
- [2] Xiao-ran Li, An-bang Sun, Guan-jun Zhang, Jannis Teunissen. A computational study of positive streamers interacting with dielectrics, *Plasma Sources Sci. Technol.*, 29, 065004, 2020
- [3] Xiao-ran Li, An-bang Sun, Jannis Teunissen. A Computational Study of Negative Surface Discharges: Characteristics of Surface Streamers and Surface Charges, *IEEE Transactions on Dielectrics and Electrical Insulation*, 27(4): 1178-1186, 2020
- [4] J. Teunissen and U. Ebert, "Simulating streamer discharges in 3D with the parallel adaptive Afivo framework," *Journal of Physics D: Applied Physics*, 2017, 50, 474001

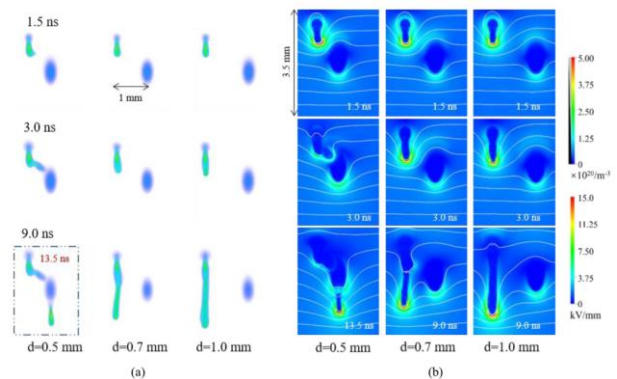


Figure 1 Time evolution of electron density (a) and electric field (b) between the streamer and an electron-ion plasma patch.

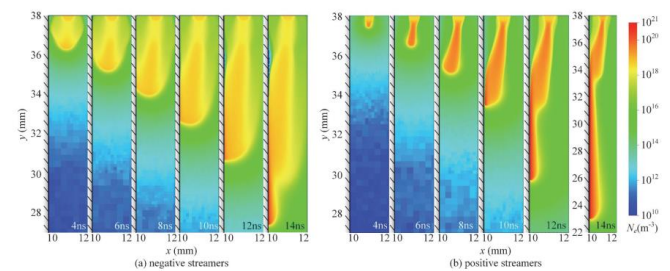


Figure 2 Evolution of negative (a) and positive (b) streamers along a dielectric surface on the left.