Abstract Submitted
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Ionization Costs in Air and Argon Plasmas Sustained by High Voltage Repetitive Nanosecond Pulses[1] VLADLEN PODOLSKY, ANDREI KHOMENKO, SAMUEL ROWE, SERGEY MACHERET, Purdue University — Previous research [Phys. Plasmas, vol. 13, no. 2, pp. 1–10, 2006] has shown that a key benefit of utilizing repetitive nanosecond pulses for the generation of plasma is low power budget, with the ionization cost per electron close to the Stoletov's minimum. This work expands on previous experiments in air and introduces new results in argon over a pressure range of 1-10 Torr, pulse repetition frequencies of 0.1 – 30 kHz, and applied voltages of 1.5-7 kV. The electron density was measured with a 58.1 GHz microwave interferometer while the voltage and current profiles to determine the deposited energy were measured using both a back current shunt and V-I probes. The results indicate that, as expected, the ionization cost in argon is lower than that in air, and the ionization costs in both gases approach the Stoletov's minima. In argon, the measured ionization cost increases with voltage at all pressures tested, while in air, a decrease in cost occurs at higher pressures as voltage is increased. This suggests that most of the "excess" voltage applied falls on the cathode sheath, and the electric field in the quasineutral plasma is within a factor of 2 of the Stoletov's field. These experimental results are found to agree well with 1-D drift-diffusion modeling.

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