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Experimental observation of multi-layer excitation structure in capacitively coupled SF6 plasmas[1] YONG-XIN LIU, FEI GAO, YUAN-HONG SONG, XUE-CHUN LI, YOU-NIAN WANG, Dalian University of Technology —
Electron excitation dynamics in capacitively coupled SF6 plasmas driven at 9 MHz $\sim$ 16 MHz are studied by using phase resolved optical emission spectroscopy (PROES) of trace rare gas. Multi-layer excitation structure inside the bulk plasma of capacitive discharges operating in SF6 is experimentally observed for the first time. Experimental results show that with the decrease of the rf power and/or the increase of the pressure, the multi-layer excitation structure becomes noticeable while the gap between two adjacent layers is almost kept constant. By increasing the driving frequency with a constant electrode gap, however, the number of layers increases while the layer gap decreases. The layer structure disappears at the driving frequency larger than 16 MHz. The electrode gap is found to have a negligible effect on the gap between two adjacent excitation layers, nevertheless only the number of excitation layers is increased when enlarging the electrode gap. The multi-layer formation may be due to a large modulation of the F- negative-ion density throughout the bulk plasma, and is more pronounced at intermediate and low frequencies, since F- negative ions do not respond to the time-varying electric field at high frequencies (>16 MHz).

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