Experimental observation of multi-layer excitation structure in capacitively coupled SF6 plasmas\textsuperscript{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 ca-
pacitive 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 in-
crease 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 in-
creases 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 for-
mation 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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