Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

On the ignition of a pulsed CCRF discharge in argon: effect of different afterglow durations.[1] XIANGYU WANG, XIAOKUN WANG, YONGXIN LIU, YOUNIAN WANG, Key Laboratory of Materials Modification by Laser, Ion, and Electron Beams (Ministry of Education), School of Physics, Dalian University of Technology, PLASMA SIMULATION AND EXPERIMENT GROUP TEAM — It is well known that the light emission intensity generally exhibits a sharp peak at the ignition phase of a pulsed CCP, however, its physical process has not been precisely understood. In this work, the light emission intensity, electron density, amplitudes of applied rf voltage and current, etc. as a function of time during the igniting phase of a pulsed Ar CCRF discharge were studied by phase-resolved OES, time-resolved hairpin probe, and voltage/current probe. Particular attention is put on the effect of changing the afterglow duration on these time-dependent parameters. It is found that the electron power absorption mode during the igniting phase strongly depends on the duration of the afterglow, because the number of electrons remaining from the last afterglow play a key role in the re-ignition of the plasma. When the afterglow duration is long enough (e.g., Toff $\geq 200\mu$s), there are very few seed electrons left, and the re-igniting of a pulsed plasma behaves like a plasma breakdown process. With time, plasma experiences multiple mode transitions, which are successively dominated by uniform electric field across the entire electrode spacing, drift electric field in the central region, and sheath electric field adjacent to electrode.

[1]National Natural Science Foundation of China (NSFC) (Grand No. 11722541,11875100).

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Date submitted: 02 Jun 2019 Electronic form version 1.4