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Experimental investigation of capacitively coupled discharge in air at 1 Torr at frequencies near the series resonance ANDREI KHOMENKO, SERGEY MACHERET, Purdue University — Capacitively coupled radio-frequency (CCRF) discharges are typically operated at frequencies much lower than that at which a series resonance occurs. In this work, we studied CCRF with 5 cm diameter parallel-plate electrodes and 2 cm interelectrode gap operating in air at 1 Torr. An ultrawideband amplifier was used to reach the series resonance and study the CCRF discharge behavior at near-resonant frequencies. Using voltage and current probes, the current-voltage characteristics were captured, and the plasma electron density was measured with a 58.1 GHz microwave interferometer. The resonant frequency, at which the phase shift between the current and voltage is zero, was found to be about 160 MHz. Below and above that frequency, the discharge exhibits capacitive and inductive behavior, respectively. At near-resonant frequencies, the current-voltage characteristics were found to be parabolic, and the effective momentum-transfer collision frequencies were inferred from these parabolic characteristics using Godyak's theory. The collision frequencies were found to be several times lower than those at electron temperatures on the order of 1 eV. This could imply an unusual electron heating regime at this relatively high pressure, which requires further studies.

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