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Tuning of AC Sheath Thickness by Varying Plasma Excitation Frequency[1] ABBAS SEMNANI, SERGEY MACHERET, DIMITRIOS PEROULIS, Purdue University — It is known that increasing the magnitude of discharge current, either DC or RF, in abnormal glow discharge regime results in shrinking of sheath layer. Since plasma sheath behaves mainly as a capacitor due to its low electron density, this property was successfully employed to make a current-controlled tunable RF capacitor[2]. On the other hand, RF sheath thickness also depends on the frequency of plasma excitation field. In this work and to prove this concept, an LC resonator with resonant frequency in the range of 100s of MHz was fabricated and measured. In this resonator, a gas discharge tube (GDT) ignited by a kHz-range electric field performs as a variable capacitor. By changing the frequency of the plasma excitation signal in the range of 1-1200 kHz, the measured resonant frequency of the LC resonator tuned in the range of 410 MHz to 300 MHz. This measurement clearly shows the possibility of achieving frequency-controlled sheath thickness in AC abnormal glow discharge regime.

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[2]A. Semnani et al. IEEE Trans. Plasma Sci., 44, 1396-1404 (2016).

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