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A Study of Impedance Relationships in Dual Frequency PECVD Process Plasma DOUGLAS KEIL, EDWARD AUGUSTYNIAK, YUKINORI SAKIYAMA, Lam Research Corporation, PECVD/ALD TEAM — Commercial plasma process reactors are commonly operated with a very limited suite of on-board plasma diagnostics. However, as process demands advance so has the need for detailed plasma monitoring and diagnosis. The VI probe is one of the few instruments commonly available for this task. We present a study of voltage, current, impedance and phase trends acquired by off-the-shelf VI probes in Dual Frequency (DF) 400 kHz/13.56MHz capacitively-coupled plasma (CCP) as typically used for Plasma Enhanced Chemical Vapor Deposition (PECVD). These plasmas typically operate at pressures from 1 to 5 Torr and at RF power levels of ˜3 W/cm^2. Interpretation of DF VI probe impedance trends is challenging. Non-linear interactions are known to exist in plasma impedance scaling with low and high frequency RF power. Simple capacitive sheath models typically do not simultaneously reproduce the impedance observed at each drive frequency. This work will compare VI probe observed DF CCP impedance tends with plasma fluid simulation. Also explored is the agreement seen with sheath models presently available in the literature. Prospects for the creation of useful equivalent circuit models is also discussed.

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