

Enabling Multi-Frequency Plasma Excitation for Photovoltaics

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Driving radiofrequency capacitively-coupled plasmas by multi-harmonic Tailored Voltage Waveforms (TVW) has been shown to allow considerable control over various plasma properties for surface processing applications. However, industrial adoption of this technology has been hampered by the difficulty of impedance matching the radiofrequency power source to the load simultaneously at multiple harmonic frequencies.

In this work, we report on the design and demonstration of a simple, practical multi-frequency matchbox (MFMB) based on a network of LC resonant circuits. The effectiveness of the MFMB was demonstrated experimentally on an Ar plasma excited by a three-frequency TVW with a fundamental frequency of 13.56 MHz. Under the plasma conditions studied, the power coupling efficiency (at the generator output) was increased from less than 40 % (without impedance matching) to between 80 ~99 % for the different exciting frequencies.

