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Magnetically Enhanced Multiple Frequency Capacitively Coupled Plasmas: Dynamics and Strategies[1]

MARK J. KUSHNER, Iowa State University

The desire to independently control the magnitude and energy of ion fluxes to wafers during plasma materials processing has motivated development of a variety of plasma tools, from inductively coupled with a separate bias to the increasingly popular dual frequency capacitively coupled plasmas (CCPs). The success of these strategies has in part been due to, for example, CCPs being able to produce more favorable radical fluxes to achieve selectivity compared to ICPs. At the same time, there is a resurgence in the use of magnetically enhanced CCPs which also have an ability to control the shape of ion energy and angular distributions by radically changing the structure of the sheath. For example, a static magnetic field of sufficient magnitude applied parallel to the sheath results in ions being more mobile than electrons; and a reversal of the electric field in the sheath.[1] The combination of dual (or multiple) frequency CCPs and magnetic enhancement provides additional parameters with which to control reactive fluxes to the substrate. Using results from a 2-dimensional plasma equipment model, the dynamics of magnetically enhanced, multiple frequency CCPs will be discussed. Strategies to use their unique properties will be proposed.

[1] M. J. Kushner, J. Appl. Phys. J. Appl. Phys. **94**, 1436 (2003)

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