Challenges for future rf driven plasma systems

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Pulsed plasma systems have led to a new generation of plasma processing systems. In particular, the deposition and etching of layers as thin as one atom at the same time controlling sidewall characteristics. With pulsing there are some characteristic times to be respected such as plasma breakdown, time to approach equilibrium, and decay time in the afterglow of the plasma potential, electron temperature and density. To be added to this family of time scales is the residence time of different species within the vacuum system. During breakdown the plasma impedance changes rapidly and can move from the bottom of the Smith chart to the top within a few tens of microseconds during changes from E to H discharges. It is also necessary to consider the isolation of the rf tank circuit from a varying load and whether it is necessary to maintain 50Ohm transmission or to move to some form of close coupled system. The advantages and problems associated with rf design requirements for different time scales whilst respecting sufficient closed loop stability will be discussed along with different rf amplifier rear end topologies. The great challenge of what parameter to choose for control: volts, current or power will be mentioned.