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Uniformity Control in Capacitively Coupled Plasmas SANG-HEON SONG, TEL Technology Center, America, LLC., PETER VENTZEK, Tokyo Electron America, ALOK RANJAN, TEL Technology Center, America, LLC. — In the fabrication of microelectronics devices, the volume production at mature yield is ultimately determined by the uniformity of the plasma. Plasma uniformity associated with patterning and hard mask open (HMO) steps are especially critical as the feature scale becomes smaller (<20 nm) than the limitation of ArF lithography. Capacitively coupled plasmas (CCP) are attractive for these processes as the uniformity of radical and ion fluxes onto the wafer can be made quite uniform. In the case of dual frequency CCP (DF-CCP) sources, the high frequency (HF) power may be applied to an upper electrode and low frequency (LF) power is applied to a lower electrode where a substrate is located. The upper electrode can be divided into inner and outer electrode segments in order to provide plasma uniformity control. In this presentation we describe the ion flux and energy distributions and radical flux to the substrate for a DF-CCP source generated using a 2-dimensional plasma hydrodynamics model. We compare simulated results with the experimental measurements. The ability to control the plasma uniformity is demonstrated showing how changing electrode gap distance and splitting power on the upper electrodes impacts species and energy flux to the substrate. Gap variations introduce trade-offs. We find that a more uniform ion flux can be obtained for smaller gaps. As we split the HF power more towards the outer electrode, the fluxes to the wafer becomes more uniform.

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