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### **Study of Planar Surface Wave Excited Plasma**

CAIZHONG TIAN, Tokyo Electron Ltd.

The need for plasma processing has increased as miniaturization in semiconductor manufacturing goes ahead. In these processes, a large-diameter plasma source is required with respect to 300mm wafer size. A Radial Line Slot Antenna (RLSA) driven surface-wave-sustained plasma is a potential best candidate to various applications with respect to damage free process. Many researches focus on the control of plasma density and electron temperature in RLSA technique. However, the plasma stability and uniformity control are less implemented in the practice. In recent years, we study sheath formation and plasma behavior at the interface, where the surface wave propagate, by using electromagnetic particle-in-cell simulation techniques. The simulations include the effects of ionization, and allow us to study the buildup of plasma density associated with ionization in the presence of the large fields of the RF-enhanced sheath. Our results show both the mechanism of plasma generation and heating at the plasma dielectric interface and the strong effect on geometric design of dielectric. Various scenarios are of interest, and help us to design an optimal RLSA driven plasma source, where the plasma stability and uniformity are firmly sustained under the various process conditions. Plasma diagnosis is carried out to reveal the more essential difference in plasma behavior between our RLSA and a custom inductively coupled plasma (ICP) source.