

Abstract Submitted  
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**Simulations of sheath-wave interactions controlling low frequency modulation of uniformity in VHF driven plasma sources** TOSHIHIKO IWAO, Tokyo Electron Technology Solutions Limited, PETER VENTZEK, JIANPING ZHAO, Tokyo Electron America, Inc., ROCHAN UPADHYAY, Esgee Technologies Inc., LAXMINARAYAN RAJA, The University of Texas at Austin — Plasma sources capacitively driven at very high frequencies (VHF, e.g. 100MHz) have attracted much interest for semiconductor device fabrication. These sources have the advantage of high efficiency plasma generation since power couples efficiently with electrons and with lower ion energy loss through sheath acceleration. This is beneficial for processes requiring reduced ion energy, high ion and radical flux. At the same time, spatial variations in plasma density and sheath voltage can arise leading to non-uniformities at the wafer. The root cause of VHF plasma non-uniformity is related to both electromagnetic wave and sheath coupling effects. Unfortunately, most previous plasma fluid models that include electromagnetic wave effects have found it challenging to simulate this physics. Predictive models that can capture these effects are important for plasma properties and their uniformity in industrial systems. We have recently developed approaches that have succeeded in reproducing how VHF power influences plasma uniformity by hybridizing electrostatic and electromagnetic power delivery in a plasma fluid model with no loss of self-consistency. These simulations also demonstrate how low frequency added to VHF impacts uniformity through a sheath-wave interaction mechanism.

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