

Abstract Submitted  
for the GEC20 Meeting of  
The American Physical Society

**Effects of Focus Ring in Capacitively Coupled Plasma Based on 1D Circuit Modeling and Experiments**<sup>1</sup> YUHUA XIAO, YAO DU, North Carolina State University, SANG-KI NAM, Samsung Mechatronics Research Group, STEVEN SHANNON, North Carolina State University — In plasma etching equipment, focus rings are widely used to achieve acceptable uniform fluxes near the wafer edge. The ion incident angle, particle, and energy fluxes to the wafer are controlled by adjusting the wafer-focus ring gap, focus ring height, and relative electrical impedance return of the focus ring. The sheath structure and voltage drop across the sheath are also affected by these focus ring properties. Usually, the focus ring is viewed as a capacitor which divides total sheath voltage drop and thereby normalizes voltage to the main electrode values. In this work, the plasma is simplified to an equivalent circuit model and adapted to simulate the effect of focus ring on sheath properties. The simulations are further compared to experimental results measured using hairpin probe, Langmuir probe, VI probe, and a retarding field energy analyzer (Impedans Vertex RFEA). Results show that the focus ring acts as a capacitor only in high voltage cases, and it will increase sheath voltage drops in low voltage cases and does not rigorously follow the capacitive voltage divider model typically used.

<sup>1</sup>State of North Carolina and the Samsung Mechatronics Research Center

Yuhua Xiao  
North Carolina State University

Date submitted: 07 Jun 2020

Electronic form version 1.4