Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Prevention of ion flux inhomogeneities in large area capacitively coupled discharges via the Electrical Asymmetry Effect[1] EDMUND SCHUENGEL, JULIAN SCHULZE, Department of Physics, West Virginia University, Morgantown, WV 26506, SEBASTIAN MOHR, UWE CZARNETZKI, Institute for Plasma and Atomic Physics, Ruhr-University Bochum, 44780 Bochum, Germany — For large area processing applications of capacitively coupled radio frequency (CCRF) discharges, the lateral uniformity of the plasma surface interaction is crucially important. The benefit of an increase in the plasma density and, therefore, in the overall deposition rate by driving the discharge at higher frequencies is accompanied with inhomogeneities caused by the presence of electromagnetic effects. Here, we propose a method based on the Electrical Asymmetry Effect (EAE) to prevent such inhomogeneities. Spatially resolved measurements of the ion flux onto the grounded electrode of a CCRF discharge operated in hydrogen show a standing wave pattern in a 81.36 MHz single-frequency discharge, strongly reducing the ion flux uniformity. However, applying a dual-frequency voltage waveform consisting of 40.68 MHz + 81.36 MHz, the lateral distribution of the ion flux can be controlled via the phase angle between the two applied harmonics. Using the EAE, a phase angle dependent DC self-bias develops in the geometrically symmetric discharge. Tuning the phase angle allows for the compensation of ion flux inhomogeneities due to the standing wave effect. Thus, a high and laterally uniform ion flux can be generated in electrically asymmetric high frequency plasmas.

[1]Funding by the German Federal Ministry for the Environment, Nature conservation, and Nuclear Safety (0325210B) is gratefully acknowledged.

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Date submitted: 12 Jun 2014 Electronic form version 1.4