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Michigan Institute for
Plasma Science and Engineering

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3:30 pm
Room 1200
EECS building

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University of Maryland

Low-Temperature Plasma Surface Interactions: Nanoscale Graphitic Film Formation, Atomic Layer Etching & Atm. Pressure Plasma Jet Modification of Biomolecules

Control of plasma-surface interactions is essential for successful application of low temperature plasmas to materials processing. We briefly review three examples of recent from our laboratory: First, formation of an ultrathin (~1nm) delaminated graphitic layer by two-step plasma processing of methacrylate-based polymer that utilizes the interaction of VUV photons and ion bombardment in low pressure plasmas with the polymer. Second, use of low pressure plasma surface interaction mechanisms aimed at achieving atomic precision in etching materials in the semiconductor industry. We show that by employing steady-state Ar plasma in conjunction with periodic injection of a defined number of C_4F_8 molecules and synchronized plasma-based Ar^+ ion bombardment 1/10 of a nanometer precision in etching of SiO_2 is possible. This is due to the temporal variation of the chemically enhanced etch rate of SiO_2 for Ar^+ ion energies below 30 eV as a function of fluorocarbon surface coverage. Third, studies of plasma-surface interactions related to application of a non-equilibrium atmospheric pressure plasma jet (APPJ) for modification of model polymers and biomolecules will also be discussed. Measurements of the changes in surface chemistry and biological activity of biomolecules exposed to the APPJ plume/effluent in a controlled environment clarify how jet chemistry and interaction of plasma with the environment impact the consequences of APPJ-biomaterial-surface interactions.

About the Speaker: Gottlieb S. Oehrlein joined the Department of Materials Science and Engineering and the Institute for Research in Electronics and Applied Physics at the University of Maryland, College Park in 2000. He received his Vordiplom in Physics from Würzburg University, Germany, and his Ph.D. in Physics from the State University of New York, Albany in 1981. He then joined IBM's Research Division in Yorktown Heights, N.Y. as a Research Staff Member where he worked on Plasma Science and Technology for Nanofabrication. From 1993 to 2000 he served as a Professor of Physics at the State University of New York, Albany. His research has been focused on the use of non-equilibrium plasma for advanced materials processing and development of the science required for the control of the interaction of plasma with surfaces.