Abstract Submitted
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Measurement of resonance level densities in rare gas plasmas and modeling of their resulting VUV emissions[1] J.B. BOFFARD, C.L. CULVER, S. WANG, C.C. LIN, A.E. WENDT, University of Wisconsin-Madison, S.B. RADOVANOV, H.M. PERSING, Applied Materials, Silicon Systems Group, Varian Semiconductor Equipment — In the rare gases, the vacuum ultraviolet (VUV) emissions are dominated by the decays from the $1s_2$ and $1s_4$ (Paschen's notation) principal resonance levels. In isolation, atoms excited to these resonance levels have a short radiative lifetime ($<$ 10ns), but resonance blockade of the VUV transitions to the ground state significantly extend the effective lifetimes of these levels under typical plasma conditions with pressures greater than a mTorr. Despite this re-absorption, rare gas plasmas do produce copious VUV emissions that may play an important role in critical surface reactions under certain process conditions. We have measured the resonance level densities as a function of pressure in rare-gas discharges (Ne,Ar,Kr,Xe) in an inductively coupled plasma using both white-light absorption spectroscopy and optical emission spectroscopy by monitoring changes in the $2p_x \rightarrow 1s_y$ branching fractions [1]. The measured resonance level concentrations are subsequently used as inputs to a simple VUV transport model to determine the VUV flux to surfaces. These model VUV flux calculations are compared to measurements made with an absolutely calibrated VUV photodiode.

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