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Plasma-Surface Interactions on a Spinning Wall Probed by Mass Spectrometry and Auger Electron Spectroscopy[1]

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We have developed a new approach for studying plasma-surface interactions. A cylindrical substrate in the reactor wall is rotated at a variable frequency of 800 to 200,000 rpm, allowing the surface to be exposed to the plasma 40% of the time and then analyzed in differentially pumped chambers at variable times after plasma exposure. Desorption of products from the surface is detected by a chopped molecular beam mass spectrometer (MS), while adsorbates are observed by Auger electron spectroscopy (AES). We have studied oxygen and chlorine-containing plasma reactions on anodized Al. We observe desorption of Cl_2 in chlorine plasmas, O_2 in oxygen plasmas, and Cl_2, O_2, ClO, and ClO_2 products in Cl_2/O_2 plasmas, due to recombination reactions on the surface. Absolute desorption yields are computed from a calibration of the pressure rise in the differentially pumped MS or AES chamber. Chemisorbed Cl and O detected by AES have little if any dependence on substrate rotation frequency. From these combined results, it appears that most adsorbates are strongly bound and do not participate in recombination and desorption. Recombination of a small percentage of weakly bound species occurs with a range of rates on the rough and porous anodized Al surface. In collaboration with Joydeep Guha, University of Houston.

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