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In Situ Surface Diagnostics during Plasma-Material Interactions[1]

VINCENT M DONNELLY, University of Houston — *In-situ* diagnostics methods for plasma-surface interactions will be reviewed, with a focus on recombination of Cl on alumina, silica and ytttria coated surfaces during exposure to chlorine-containing inductively-coupled plasmas. Both gas-phase (optical emission and rare gas actinometry, optical absorption, and mass spectrometry) and surface diagnostics (Auger electron spectroscopy, sputter depth profiling) methods will be covered. The influence of Cl, F O and Si-containing adsorbates will be discussed. Cl loss coefficients, γ_{Cl}, have been measured for a variety of plasma and surface conditions. Cl_2 (i.e. recombination) and other products such as ClO and $SiCl_2$ can be produced. Cl recombination is enhanced 1) by the presence of F, due to its electron-withdrawing effect on metal atoms, and 2) by excess oxygen that cannot coordinate to a second metal atom. Recombination appears to occur mainly by a Langmuir Hinshelwood mechanism, with perhaps added contribution by an Eley-Rideal process. γ_{Cl} is as high as 0.30 after exposure to F, and as low as 0.03 to <0.001 on a $SiCl_xF_y$ surface during Si etching in a Cl_2/O_2 plasma.

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