Mechanistic model of atomic recombination[1] J.D. GUHA, V.M. DONNELLY, University of Houston — Recently we have started a new approach of studying atomic recombination at the reactor walls, by rapidly rotating a spinning substrate between the plasma and differentially pumped diagnostic chamber, thereby exposing the surface to the plasma, and then analyzing the reaction products few ms thereafter. We have investigated atom recombination in Cl_2 and O_2 plasmas with this technique. In a Cl_2 plasma, Cl_2 physisorbs and then desorbs over the time scale comparable to that for Cl recombination, thereby competing with Cl adsorption for active sites. With the plasma off, Cl_2 desorption flux increases nearly linearly with pressure. Cl recombination probabilities, γ_{Cl}, ranged from 0.01 to 0.1 and were found to increase with increasing n_{Cl}/n_{Cl2} number density ratio (from 0.1 to 0.8) in Cl_2 plasmas. A multi-site adsorption model has been developed to explain the desorption kinetics of physisorbed Cl_2. The total surface site density of $\sim 10^{15}$ cm^{-2} was distributed with a Gaussian profile over binding energies (B.E) ranging from 7.8 to 19.8 Kcal/mol. For Cl_2 physisorption, the sites with B.E < 14Kcal/mol are mostly unsaturated, and give rise to the pressure scaling of Cl_2 desorption flux. For sites with B.E >14Kcal/mol, the fractional surface coverage (θ_i) rises sharply with increasing B.E and pressure. The competitive adsorption of Cl_2 vs Cl at these high B.E sites is likely responsible for the observed dependence of γ_{Cl} on n_{Cl}/n_{Cl2}.

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