Ion density distribution in an expanding thermal nitrogen plasma for plasma/surface interaction studies

11:40am **PS2-TuM11 Ion Density Distribution in an Expanding Thermal Nitrogen Plasma for Plasma/Surface Interaction Studies**, *G.J. Brussaard, A. de Graaf, M.C.M. van de Sanden, D.C. Schram*, Eindhoven University of Technology, The Netherlands

An expanding thermal plasma has been designed as a high intensity source for plasma/surface interaction studies, specifically the proces of nitriding by nitrogen ions. A series of experiments has been performed to determine the relative density distribution of N^+ and N_2^+ in the nitrogen plasma. First microwave interferometry measurements are performed to determine the (total) electron density as a function of input power and gas flow through the plasma. Because the microwave interferometry only provides 'line of sight' information, Langmuir probe measurements are used to determine the electron density distribution across the plasma. From the ratio of ion to electron saturation current the relative ion density distribution of N^+ and N_2^+ is determined. These results are compared to optical emission of the N_2^+ transition at 391.4 nm (First Negative System). To explain the results, a simple kinetic model is proposed taking into account charge exchange and dissociative recombination as the main processes determining the ion distribution. Both model and experiments show that at high electron densities ($> 10^{17}$ m^{-3}) the dominant ion on the axis of the expanding plasma is the N^+ ion. Further downstream and on the edges of the plasma where the electron density is lower, N_2^+ becomes the dominant ion. The location of the transition between the N^+ dominated plasma and the N_2^+ plasma can be influenced by the gas flow, the background pressure and the current through the plasma.