MEASUREMENT OF H_3^+ DESTRUCTION RATES DUE TO AMBIPOLAR DIFFUSION IN AC POSITIVE COLUMN DISCHARGES

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One of the major destruction paths of ions in laboratory plasmas is the electron recombination of ions at the walls of the discharge tube. In positive column discharges, ions drift toward the wall by ambipolar diffusion. In order to analyze the chemistry in plasmas quantitatively, direct measurements of destruction rates due to this process are needed. In this work, we studied variations in H_3^+ concentration in plasmas when small amounts of CH_4, N_2 and CO are added under various discharge conditions. The concentration was measured from intensities of the H_3^+ spectra observed in a liquid nitrogen cooled positive column discharge using a color center laser and the velocity modulation method. The destruction rate due to ambipolar diffusion was obtained using a steady state model and previously reported ion-neutral reaction rate constants.