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Ar^+ recombination with negative ions in a flowing afterglow: A new approach. THOMAS M. MILLER, A. A. VIGGIANO, Air Force Research Laboratory — Ion-ion recombination (mutual neutralization) has been previously studied in a flowing-afterglow Langmuir-probe apparatus, using the probe to measure the positive-ion and negative-ion densities as a function of distance (time) along the flow tube axis.[1] A different approach has been taken in the present work, applicable to Ar^+ (or Kr^+ and Xe^+) recombination reactions. A flowing electron-Ar^+ afterglow plasma is first established, and the ambipolar diffusion frequency is measured. Then, an electron attaching gas is added to the afterglow, and the electron attachment rate constant and product ion branching fractions are measured in the usual manner.[2] Finally, the reactant gas concentration is reduced enough that the attachment reaction has not gone to completion by the end of the flow tube. Modeling of the diffusion, attachment, and recombination processes allows us to determine rate constants for each negative ion type recombining with Ar^+. For example, Ar^+ neutralized by Cl^-, Cl_2^-, and CCl_2O^- produced in attachment to oxalyl chloride,[2] shows that Cl_2^- recombines at about half the rate constant of CCl_2O^-, and Cl^- + Ar^+ recombination is negligible. [1]D. Smith and N. G. Adams, in *Physics of Ion-Ion and Electron-Ion Collisions*, Ed. F. Brouillard and J. W. McGowan (Plenum, New York, 1983). [2]J. M. Van Doren, T. M. Miller, and A. A. Viggiano, J. Chem. Phys. (submitted).

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