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Electron attachment to halomethanes at high temperatures T.M. MILLER, J.F. FRIEDMAN, L.C. SCHAFFER, A.A. VIGGIANO, Air Force Research Laboratory — We have modified our high-temperature flowing-afterglow apparatus to include a movable Langmuir probe, a 4-needle reactant gas inlet, and a microwave discharge plasma source for the purpose of measuring electron attachment rate constants at high temperatures. We have focused initially on molecules which have very small attachment rate constants, k_a, at room temperature to see if their behavior at high temperatures can be described in Arrhenius fashion. We have reported k_a for CH_3Cl, but only above 600 K, because the value at 600 K was quite small: 5.8 $\times 10^{-12}$ cm^3 s^{-1}. The Arrhenius plot for these data imply k_a = 10^{-17} cm^3 s^{-1} at 300 K, a value that is so small as to be immeasurable with any current apparatus. We now have k_a for other halomethanes, CF_3Cl, CF_2Cl_2, and CH_2Cl_2. The halomethane data cover seven orders-of-magnitude in k_a. Electron attachment to CF_3Cl is endothermic by 143 meV at 300 K, but our measurements indicate that there is a barrier of about 400 meV, probably related to the energy at which the anion surface crosses that of the neutral. The reactions for CH_3Cl, CF_2Cl_2, and CH_2Cl_2 are exothermic, but our data again indicate large barriers to attachment which accounts for the extremely slow attachment at 300 K. From these data and literature measurements at 300 K, one can make educated guesses as to the behavior of k_a for other halomethanes.

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