STORAGE RING DETERMINATION OF ABSOLUTE CROSS SECTIONS AND FINAL STATES FOR DISSOCIATIVE RECOMBINATION AND EXCTTATION OF CO^+

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The CO^+ ion is detected so far in only a few astrophysical environments, for instance toward the interfaces between the molecular cloud and the H_{II} regions around massive O stars. Its fast conversion into HCO^+ by reaction with H_2 explains its rather poor abundance in such environments. CO^+ is also an important constituent of the comets Kohoutec and West where its dissociative recombination (DR) produces $C(^1D)$ which in turn decays to give the 1931 Å emission line[1]. Prior to this storage ring measurement, the DR data from the literature were confusing, since there is a factor of twenty between the lowest and largest values[2]. We have found for CO^+ ground state a DR thermal rate of $3\ 10^{-7}$ cm^3s^{-1} at room temperature ; this is characteristic of diatomic ions (N_2^+, NO^+ or O_2^+). The energy dependence of the cross sections, as well as the appropriate dissociative states indicate that the dissociative recombination mechanism is mostly driven by the so-called "direct" process. However we hypothesise that the resonant structure at 0.165 eV is due to the "indirect" process. Although the magnitude of the dissociative excitation data was found in general agreement with that of previous single-pass data[2] (a few 10^{-16} cm^2), the location of the threshold was not. It is concluded that this is due to internal excitation of the CO^+ target ions in the single-pass set-up, whereas in our experiment the ions were internally cold.

References

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