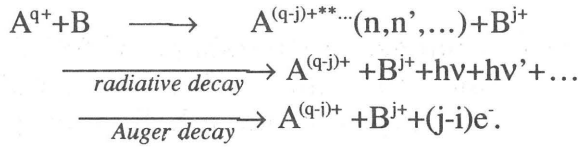


§20. Cross Sections for Multi-Electron Processes in 1.5q keV I^{q+} + Rare Gas Collisions (6 ≤ q ≤ 29)

Sakaue, H.A., Tawara, H., Yamada, I., Currell, F.J., Nakamura, N., Ohtani, S., Watanabe, H. (Univ. of Electro-Communications)
 Danjo, A. (Niigata Univ.)
 Kimura, M. (Osaka Univ.)
 Matsumoto, A. (Hiroshima Inst. of Tech.)
 Sakurai, M. (Kobe Univ.)
 Yoshino, M. (Shibaura Inst. of Tech.)

The charge exchange collision of highly charged ions with atoms are very important atomic processes for understanding the edge plasma behavior in thermonuclear plasmas.

In slow collisions of highly charged ions with multi-electron targets, multi-electron capture process is often an important channel, where electrons are transferred into multiply excited levels of the highly charged ions. The product ions are stabilized by emission of either photon(s) (radiative decay) or electron(s) (Auger decay):



In the present paper, we report the experimental results of the absolute partial cross sections ($\sigma_{q, q-i}^j$) in 1.5q keV I^{q+} (6 ≤ q ≤ 29) + rare gas collisions. Two different types of measurement were made to determine the absolute partial cross sections ($\sigma_{q, q-i}^j$). Charge state distributions of the scattered ions were measured in coincidence with the recoil ions 1). The absolute electron capture cross sections were measured by the initial growth-rate method 2). The cross sections for total electron capture (σ_q), recoil production (σ_q^j) i-electron capture ($\sigma_{q, q-i}$) and branching ratios of the multiply excited product ions have been also determined.

In figure 1, the partial cross sections ($\sigma_{q, q-i}^j$) in I¹⁵⁺ + Ne, Ar, Kr and Xe collisions are shown. Figures 1(a) to (c) represent the cross sections related to two- to four-electron transfer processes, respectively. As seen in figure 1(a), it is noticed that single-autoionization processes are dominant in the decay of the doubly-excited ions produced. As for figure 1(b) and (c), it is noticed that the higher the target atomic number Z, the more electrons are emitted through autoionization of the multiply excited ions produced. Similar features have been observed for other charge state projectiles.

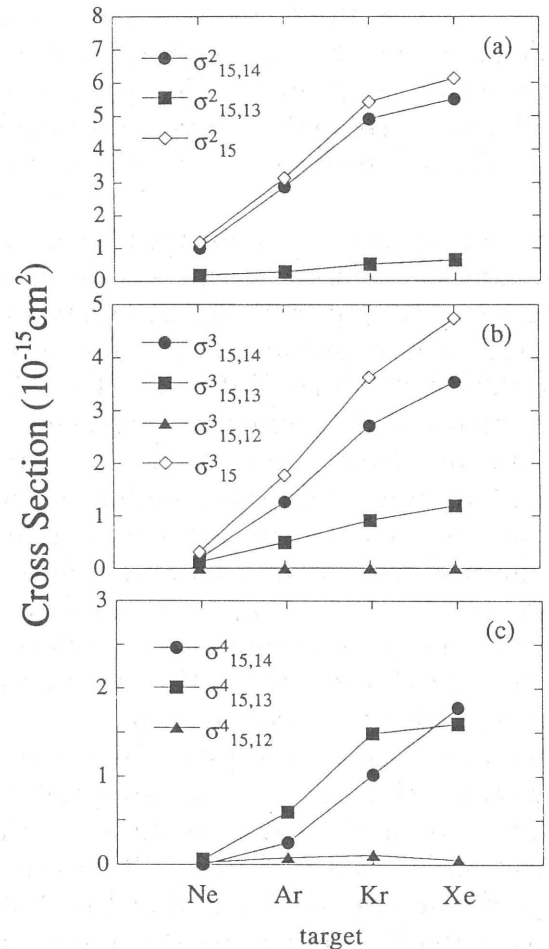


Figure 1. The absolute partial cross sections ($\sigma_{q, q-i}^j$) in I¹⁵⁺ + Ne, Ar, Kr and Xe collisions. Figures (a) to (c) represent the cross sections related to two- to four-electron transfer processes, respectively.

References

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