We chose the events from the sequential dissociation to reconstruct the corresponding KER distribution. As shown in Fig. 2, two narrow peaks are observed, which means that there are two channels can cause the sequential dissociation. Our result suggests that, for the first steps of these channels, the initial $(CO_2)^{3+}$ ions are populated in different states. But for the second steps, both the intermediate states ions $(CO)^{2+}$ are populated in $^3\Sigma^+$ states.

References

[1] N. Neumann, D. Hant, L. P. H. Schmidt, et al., Physical review letters, 104(2010)103201.

[2] C. Wu, C. Wu, D. Song, et al., Physical review letters, 110(2013) 103601.

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4 - 18 Single and Double Electron Capture by Fast Xe^{54+} from Kr and Xe

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When an energetic highly charged ion (HCI) collides with an atom, the target electrons may be captured by the projectile ion, either radiatively or non-radiatively. During a radiative electron capture (REC), a target electron is transferred to the projectile accompanying with a photon emission, which carries away the excess energy and momentum. During a non-radiative electron capture (NRC), the energy and momentum conservations are ensured by the target nucleus[1]. If the captured electrons are populated in excited states, photons maybe emitted during the following stabilization processes, and therefore the X-ray spectrum can provide information about the initial population. However, if a solid target is employed, the single-collision condition cannot be ensured when considering the capture processes, as well as strong background will be produced[2]. With the development of heavy ion cooling storage rings, the experimental luminance is enhanced by the strong ion beams when a gaseous target is prerequisite[3].

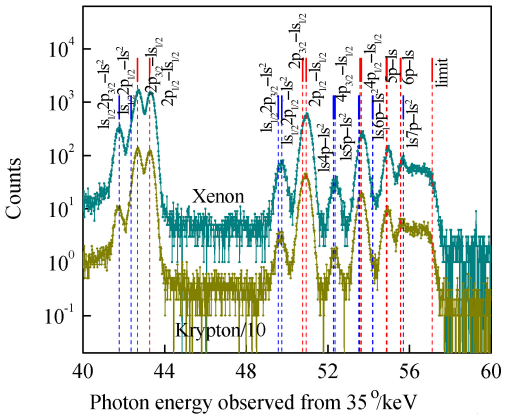

Fig. 1 (color online) Decay X-ray spectrum of the scattered Xe^{53+*} and Xe^{52+*} in 94 MeV/u Xe^{54+} collision with Kr and Xe atoms, observed from 35°. The counts of the Kr target are divided by 10 to shift the plot.

In this work, 52∼197 MeV/u Xe^{54+} ions are employed to collide with krypton and xenon atoms at the internal target of the HIRFL-CSR. The X-ray is measured from 35°, 60°, 90°, 120° and 145°, respect to the beam direction. The decay X-ray spectrum of the scattered ions in 94 MeV/u Xe^{54+} collision with Kr and Xe atoms, which observed from 35°, is shown in Fig. 1. The transitions from the single capture ion Xe^{53+*} and from the double capture ion Xe^{52+*} are observed, both in a single collision. The ratio between double and single capture channel of the Xe target is higher than the Kr target.

Although the single capture is the dominate channel at high energies, when the ion energy is lower (*e.g.*, 52 MeV/u), the double capture becomes dominate, accompany with that the NRC instead of the REC becomes the dominate mechanism[1,4]. Therefore, it is interesting that in a double capture process of Xe^{54+} with Kr and Xe, the channels of double REC, double NRC and REC plus NRC are comparable with each other at some energies between 52 ∼ 197 MeV/u.

References

[1] J. Eichler, T. Stöhlker, et al., Phys. Rep, 439(2007)1.

[2] R. Anholt, W. E. Meyerhof, Ch. Stoller, et al., Phys. Rev. A, 30(1984)2234.

[3] D. Yu et al., Nucl. Instr. Meth. B, 269(2011)692.

[4] J. Eicher, W. Meyerhof. Relativistic Atomic Collisions, Academic, New York, 1995.