2 - 11 Ionization of Highly Charged Iodine Ions near Bohr Velocity

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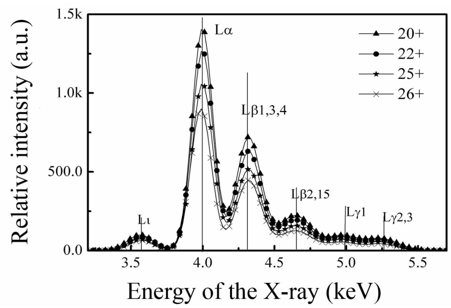

Fig. 1 Normalized iodine L X-ray spectra by 3 MeV I^{q+} ions impacting on Fe target.

X-ray emission investigation provides a useful method to study the ionization process of ion-atom collisions. Near the Bohr velocity, the projectile penetrates into the bulk and interacts with the target atom in a close distance. Except for electron capture, the projectile may be ionized. Accompanied by the inner-shell ionization, the outer-shell electrons may be multiple ionized. That leads to the shift of the X-ray and the change of the sub-shell X-ray relative intensity ratio[1,2]. Here, we would like to present the investigation of the iodine ions ionization near the Bohr velocity energy range.

Fig. 1 shows the L X-ray spectra of iodine by 3 MeV I^{q+} ions impacting on Fe target. Six distinct L sub-shell X-rays were observed and identified. The result indicates that additional L-shell vacancies were produced during the I^{q+}-Fe collisions. It is found that the experimental energy of the L sub-shell X-ray is large than that of single ionized atom. That indicates that the outer-shell states are multiply vacancies under the balance of the ionization and the neutralization when the L-shell X-ray emission occurs.

In the case of outer-shell multiple ionization, the relative intensity ratio of the L sub-shell X-ray may be changed, because some of the Auger transition and Coster-Kronig (CK) transition are forbidden[3]. As shown in Table 1, the relative intensity ration of L_α/L_β is larger than the theoretical data of single ionized atom. That also provides a possible evidence for the multiple-ionization of iodine ions.

Table 1 Relative intensity ratios of iodine L_α to L_β X-ray

	I^{20+}	I^{22+}	I^{25+}	I^{26+}	Theory
$I_{L\beta1}/I_{L\alpha}$	0.65±0.03	0.63±0.03	0.64±0.03	0.62±0.03	0.55
$I_{L\beta2}\ I_{L\alpha}$	0.24±0.03	0.23±0.03	0.23±0.03	0.22±0.03	0.17

References

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[2] X. Wang, et al., Phy. Let., A376(2012)1197.
[3] M. Polasik, et al., J. Phys., B32(1999)3711.