3 - 17 Incident Ion Charge State Dependence of the Visible Light Emission of Xe^{q+} Ions Bombarding Aluminum

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Slow highly charged ions (HCIs) interaction with the solid also provides information such as electron configuration, multi-interaction, ionization, excitation and charge transfer for the basic research[1−3]. What is more, the understanding on the heavy HCI structure and relevant collision processes has a special meaning for inertial confinement fusion (ICF) research. Up to now, many experiments or theories in ion-solid collisions focus on the investigation of secondary electrons, sputtering ion or characteristic X-rays emission by the slow projectile[4]. However, very few studies involve the visible light emission and its charge state dependence measurements; especially scare studies focus on the quantitative dependence of the visible light emission intensity on the charge state in theory field.

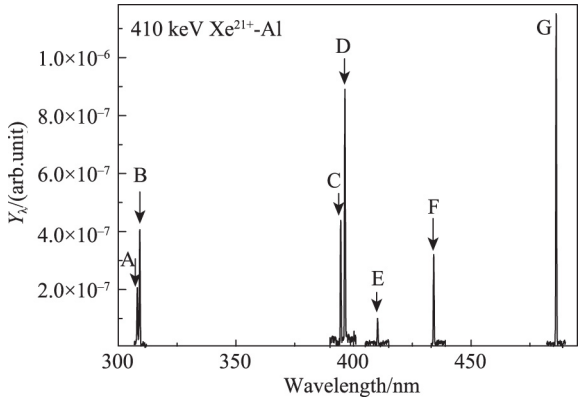

Fig. 1 Normalized optical emission spectrum during 410 keV Xe^{21+} in the visible light range.

Hence, our present work concentrates on the visible light emission during the slow highly charged Xe^{q+} ions with different charge states ($10 \leq q \leq 21$) bombardment on the Al surface. The experiment was carried out at the 320 kV high-voltage platform at the Institute of Modern Physics, Chinese Academy of Sciences, using a high-charge state all permanent Electron Cyclotron Resonance Ion Source.

In this work, the visible light emission from both neutralized Xe^+ ions and Al atom at the wavelength range 300∼500 nm are measured, as shown in Fig. 1.

Besides, the intensities of the photon emission have a strong dependence on the incident charge states, which is similar to the variation of the potential energy versus the q. Taking spectra (A) and (B) as examples, Figs. 2 and 3 give the photon emission and the potential energy vs the q.

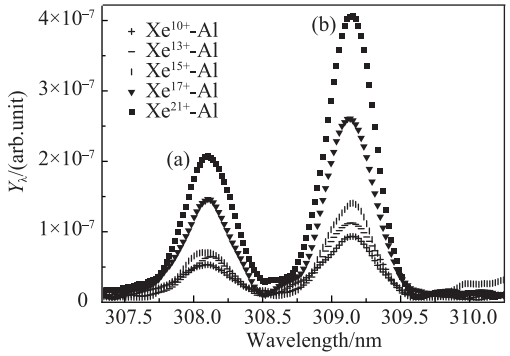

Fig. 2 Normalized spectra at 308.10 (a) and 309.19 nm (b) by different incident charge states.

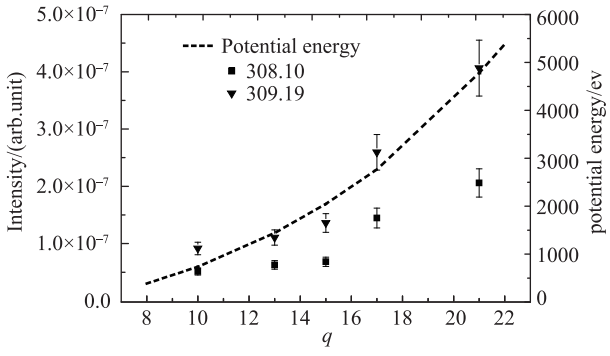

Fig. 3 Visible light intensity at 308.10 (a) and 309.19 nm (b) and potential energy versus q.

One can see that photon intensities exhibit an incident charge state dependence, the larger q, the more visible light emission and they have a same variation tendency with the potential energy. It indicates that our results agree well with the staircase COB model[5].

References

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