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4 - 13 900 keV O^{6+} Guiding through a Single Macro-capillary: Dependence on Incident Current

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Since 2002[1], guiding effect was reported by N. Stolterfoht, more and more groups have got into this research. In 2007[2], N. Stolterfoht, et al. found the incident current slightly affect the nanocapillaries guiding, by means of studying the fraction of transmitted ions. In this work, we studied the relation between the tilt angle and the deflection angle, and found that the incident current almost had no influence on the guiding effect for the single capillary.

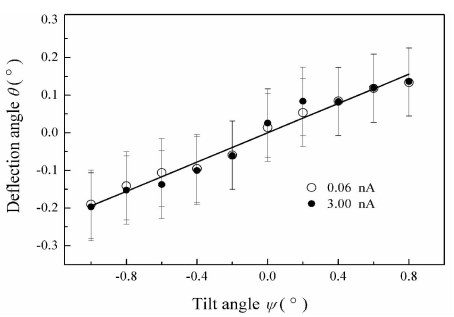

Fig. 1 Dependence of tilt angle on deflection angle. ○: experimental data of the lower incident current 0.06 nA; ●: experimental data of the higher incident current 3.00 nA.

The experiments were carried out at the 320 kV high voltage platform for multi-discipline research with highly charged ions (HCIs) at the Institute of Modern Physics (IMP) in Lanzhou, China. In the experiments, the ion beams 900 keV O^{6+} with the incident currents of about 0.06 and 3.00 nA, were used to bombard a single glass cylindrical capillary (inner diameter 0.6 mm, 31 mm long). We found the transmitted ions kept their initial energy and charge, which is similar with the nanocapillaries guiding.

Fig. 1 shows the tilt angle dependence of the deflection angle in the single capillary guiding, with a linear relationship, which is though different from the tilt angle equal to the deflection angle in Refs. [1, 3].

The experimental results suggest that the behavior of transmitted ions in the capillary is the same with different incident currents and the transmitted ions were not guided along the glass capillary's axis, i. e. the guiding power is the same in the two conditions for the capillary. According to the model of charge patches, this phenomenon can be explained that the charge patches along the capillary, produced by 900 keV O^{6+}, do not change with the incident currents, which reveals that the single capillary guiding is nearly independent on the incident current.

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