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4 - 15 Guiding of Electrons through a Paired Parallel Glass Plates

Liu Junliang, Yu Deyang, Xue Yingli and Cai Xiaohong

Interaction between charged particles and insulating capillary has become more and moreimportant in the fundamental study of ion-surface collision processes. What's more, it alsoprovides a possible new method to produce micro/nano meter sized beams, which may bewidely used in nanotechnology. Particular attention has been paid to the transmission of HCIs though insulating capillaries[1-5]. However, in contrast to the case of HCIs, study of transmission of electrons through insulating capillaries is still deficient.

In the present work, the transmission of 800 eV electrons through a paired parallel glass plates was investigated. The glass plate used in this study was 21 mm in length, 30 mm in width and 4 mm inthickness, which was made of soda lime glass. The gap in thepaired plates was set to 0.6 mm. To avoid macroscopic charge-up of the entrance surfaces of the glass, they were covered by the sample holder. The measurements were focused on the angular distributions of electrons transmitted through capillary.

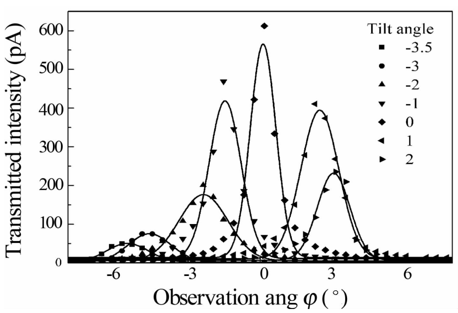

Fig. 1 Angular distributions of 800 eV electrons transmitted through a paired parallel glass plates for different tilt angles ψ.

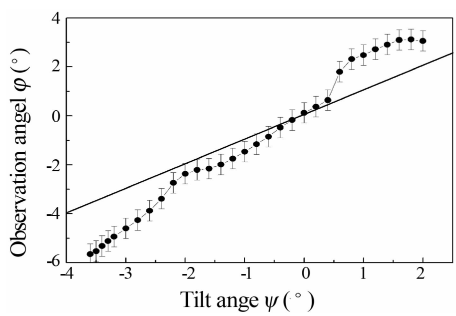

Fig. 2 Observation angle φ of the transmitted beamas a function of capillary tilt angle ψ. — represents a direction of $\varphi=\psi$.

The intensity and angular distribution of the transmitted electrons for various tilt angles were measured using a one-dimensional position sensitive detector. Fig. 1 shows the angular distributions of 800 eV electronstransmitted through a paired parallel glass platesfor different tilt angles ψ. From the figure it is evident that electrons are guided through the paired plates. Transmission of 800 eV electrons was observed for tilt angles of up to roughly 3° as well.

Fig. 2 shows the observation angle of the transmitted beam as a function of capillary tilt angle ψ with respect to the beam direction. In the figure, the observation angle φ is the center of the transmitted electrons profile and the solid line represents the observation angle being equal to the tilt angle. According to Fig. 2, the observation angle φ is larger than the tilted angle ψ when increasing the tilt angle of the capillary. This behavior has not been observed in the previous studies.

The present results indicate the existence of guiding effect and the guiding effect is observed to be enhanced at lower incident energies. Moreover, when the capillary was tilted with respect to the direction of the incident beam, a unique phenomenon that the observation angle φ related to the center of the transmitted electrons profile was larger than the tilted angle ψ is observed.

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4 - 16 Dissociative Recombination of Imidogen Radical Ions[1]

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Dissociative recombination (DR) of molecular ions with electrons is one of the key processes in low density and low temperature plasma environments. DR removes ionized species and produces neutral fragments, thus affecting chemical composition of the plasma. Rate coefficient, fragmentation branching ratios and excitation of final fragments resulted from DR gives helpful information for modeling these plasmas.

The imidogen radical NH has been detected in some comets and in the sun, which is very important in nitrogen-bearing chemical reaction in atmospheric media. Simply nitrogen hydrides, such as NH^+, are intermediates for forming ammonia in cold interstellar clouds[1]. Here DR is an important destruction channel for NH^+, thus reducing also the abundance of ammonia. Up to now, theoretical investigation on DR of NH^+ does not exist. Experimentally this reaction was previously investigated only for vibrationally excited NH^+ and low collision energies[2].

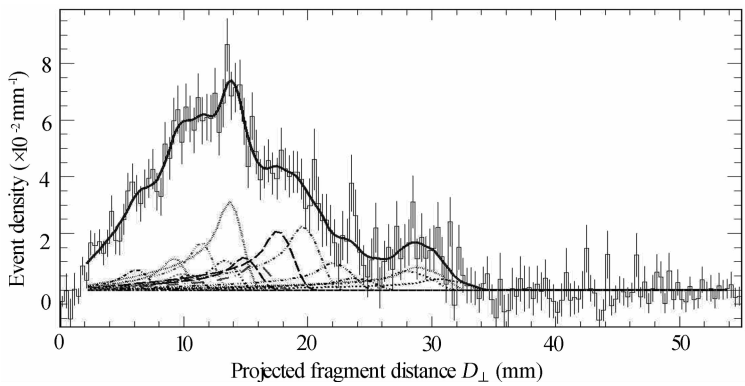

Fig. 1 Normalized projected fragment distance distribution $P(D_\perp)$ measured in the DR of NH^+ at relative collision energy $E=4.6$ eV and the detector distance from the reaction zone of 9.41 m. The thin solid line displays the measured imaging data together with statistical uncertainty. The thick solid line is the result of a fit with simulated distributions (dashed lines) corresponding to various product excitation channels.

We have experimentally investigated the DR of NH^+ at the TSR storage ring of the Max Planck Institute for Nuclear Physics in Heidelberg, Germany. A narrow, 6.2 MeV beam of vibrationally code NH^+

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