4 - 26 Mass Independence of Ion Guiding through an Insulating Nanocapillary

Liu Shidong, Zhao Yongtao, Wang Yuyu, Zhou Xianming, Cheng Rui and Lei Yu

In this report, we present a simulated result on the ion-mass independence of the guided transmission, which is in agreement with the previous experimental results[1].

In order to search the influence of the ion mass on guided transmission, various species of ions used as projectiles in simulations. Fig. 1 shows the transmission fractions for Ne^{7+}, Ar^{7+}, Kr^{7+}, and Xe^{7+} ions. These data were acquired for tilt angle of 2 ° in energy of 7 keV. It is seen that all of ion fractions gradually rises after a time delay, and finally reach stable.

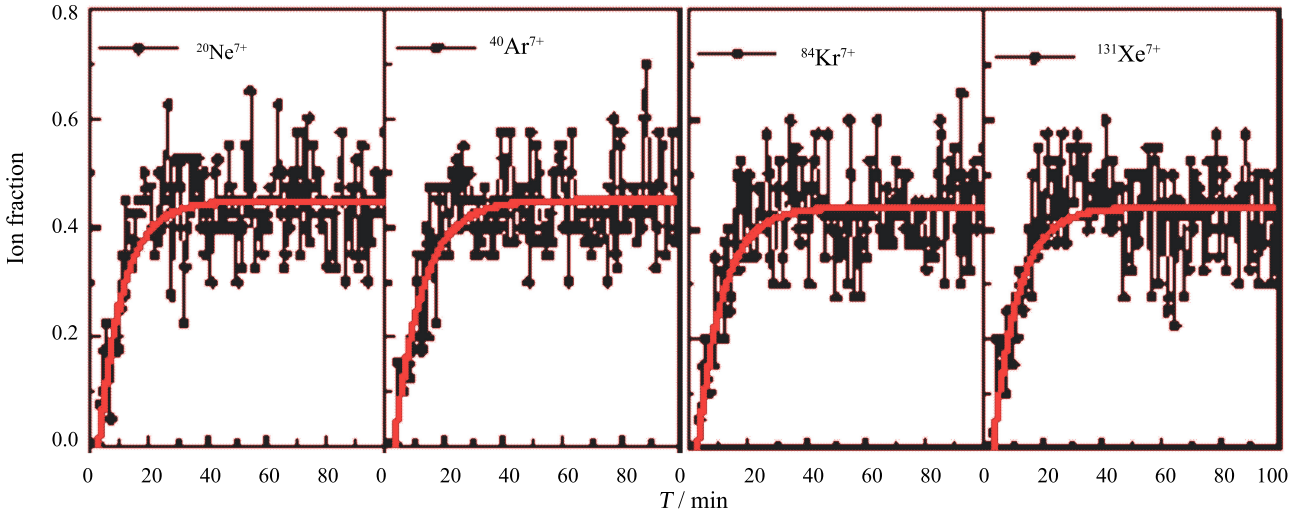

Fig. 1 (color online) Transmitted ion fraction of Ne^{7+}, Ar^{7+}, Kr^{7+}, and Xe^{7+}. The energy of these ions are fixed at 7 keV. The tilt angle is 2°.

To analyze the simulated data, we fitted the data by the expression $f(t) = f_\infty(1-\exp[(t-\tau_s)/\tau_c])$, where τ_s is a threshold denoting the time delay for the ion transmission, τ_c is characteristic for the capillary charging and f_∞ represents the fraction at equilibrium. The fitting parameters τ_s, τ_c, and f_∞ are summarized in Table 1, which are found to be nearly equal relative. This finding provides direct evidence that ion guiding though the insulating capillaries is independent of ion mass.

Table 1 Values of parameters τ_s, τ_c, and f_∞.

Ion	τ_c/min	τ_s/min	f_∞
Ne^{7+}	8.16±0.85	3.33±0.67	0.45±0.01
Ar^{7+}	9.38±0.93	3.33±0.67	0.45±0.01
Kr^{7+}	8.42±0.90	3.33±0.67	0.44±0.01
Xe^{7+}	8.24±0.90	3.33±0.67	0.44±0.01

Reference

[1] N. Stolterfoht. Phys. Rev. A, 77(2008)032905.