Characterization of a gas stopper for heavy element chemistry studies

M. C. Alfonso, D. A. Mayorov, T. A. Werke, and C. M. Folden III

A new gas stopper optimized for online heavy element chemistry experiments has been designed, fabricated, and characterized at the Cyclotron Institute at Texas A&M University. The design of the gas stopper is described in detail in [1]. Offline tests using ^{216}Po ($t_{½}$ = 145 ms [2]) emanating from a ^{228}Th source suggest that the extraction efficiency is approximately 70%, and that the extraction time is comparable to or less than the ^{216}Po half-life. In November 2012, the device was characterized using the products of the ^{118}Sn(^{40}Ar, 6n)^{152}Er reaction, which were delivered from the MARS spectrometer. The gas stopper was mounted at the MARS focal plane, and two detectors just downstream of the window and just downstream of the extraction nozzle were used to measure the efficiency as a function of incident ion energy, gas flow rate, and electric field settings. The setup and preliminary results are shown in Fig. 1. The peak extraction efficiency of the gas stopper in online tests was approximately 40%. This is comparable to other gas stoppers in use at laboratories worldwide [3-6], and suggests that a planned online chemistry research program is feasible.

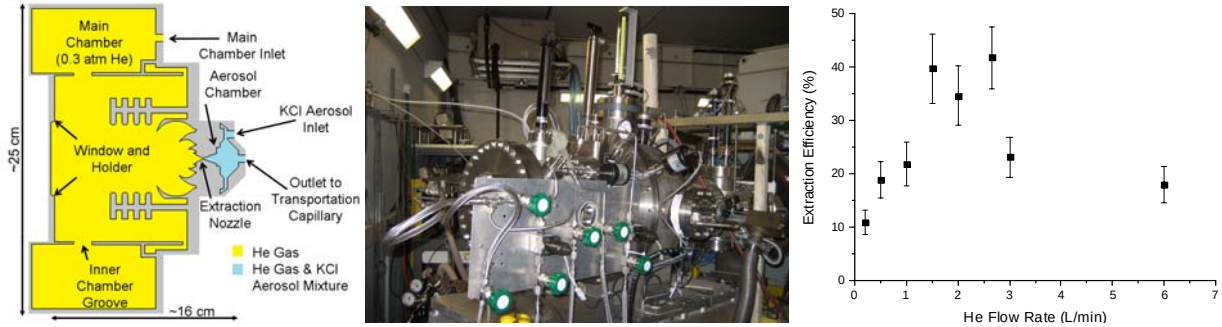

FIG. 1. Left: Schematic of the Texas A&M gas stopper. Ions pass through the window and enter the He-filled chamber (shown in yellow). A series of electrodes (shown in gray) creates an electric field that draws the ions through the extraction nozzle into the aerosol chamber (shown in blue) for transportation to a chemistry experiment. Center: The gas stopper mounted at the MARS focal plane position. Right: Preliminary results of the extraction efficiency of the gas stopper as a function of the He flow rate in the device.

[1] M.C. Alfonso and C.M. Folden III, *Progress in Research*, Cyclotron Institute, Texas A&M University (2011-2012), p.II-46; http://cyclotron.tamu.edu/2012%20Progress%20Report/2%20Heavy%20Ion%20Reactions/II_46-51_development%20of%20a%20gas%20stopper.pdf.

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