

<Supplementary Material>

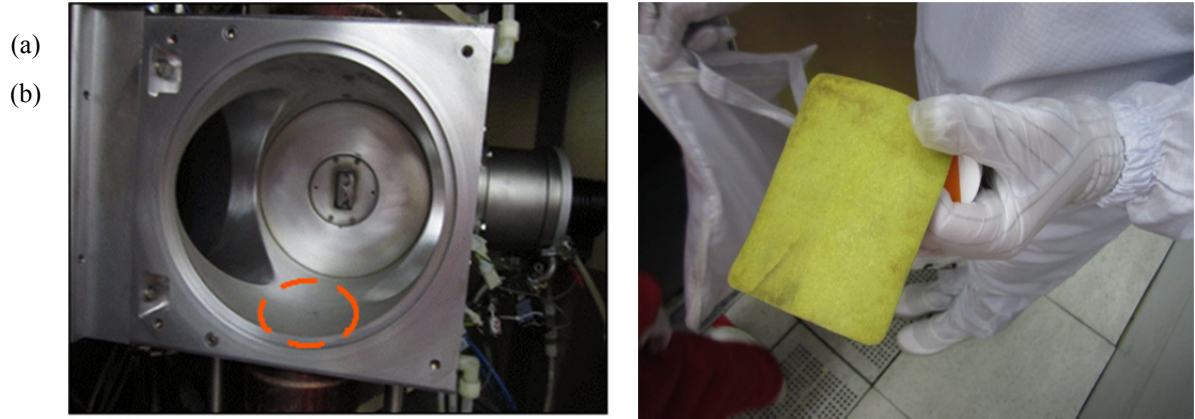


(a)

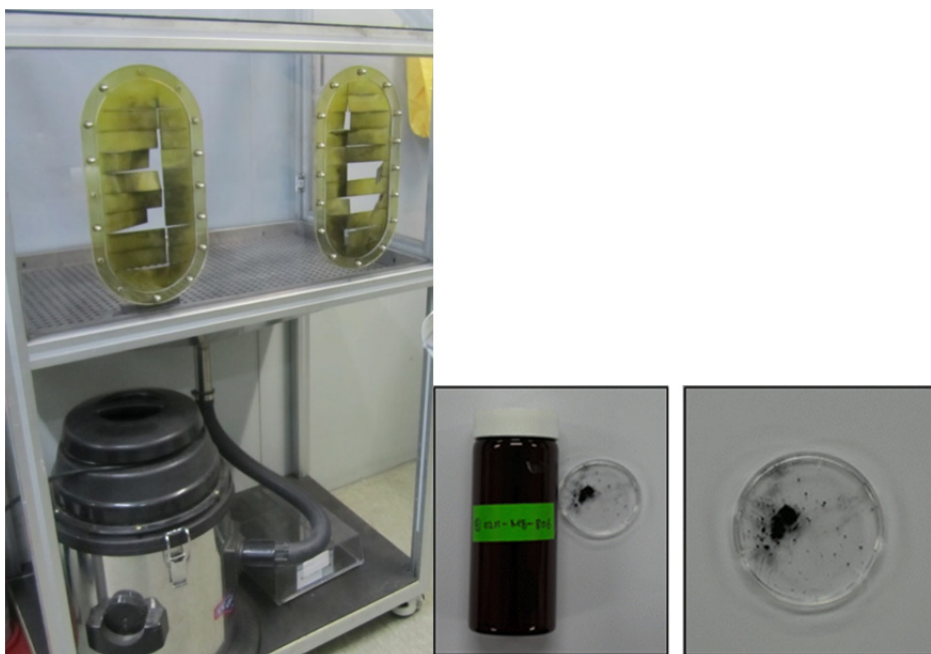


(b)

**Fig. S1.** (a) Worker with an air-line respirator cleaning a high current implanter, with personal sampling conducted throughout the task (Task 5). Portable local exhaust ventilation was operated throughout the task. (b) Sampling of debris from the high current implanter throughout the task (Bulk 5-1).



**Fig. S2.** (a) Beam source chamber and debris remaining on the surface of the chamber in a high energy implanter (Bulk 6-1) (b) Cleaning pad collected from the high energy implanter during the beam source cleaning task.



(a)

(b)

**Fig. S3.** (a) Cleaning booth with a vacuum cleaner used for collecting graphite particles generated by grinding. (b) Sample collected from the vacuum cleaner during Task 8 (Bulk 8-1).