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Positive to Negative Helium Ion Production Ratios when Using Nano-Foils as a Charge Exchange Medium

Negative helium ions are typically created from positive helium ions which undergo double charge exchange with a neutral, atomic vapour, in a metallic vapour charge exchange apparatus. For high production rates of He^- (1 to 5%) alkali metals are used as the charge exchange material. However, alkali vapours are deleterious in vacuum systems, particularly ones with nearby electrodes for beam optics or acceleration. Additionally, He^- is used in power semiconductor wafer manufacture, where alkali metals are contaminants.

Here we describe ongoing efforts to measure the creation of negative helium using nanometer-range foils of carbon as the charge exchange medium, thus avoiding problematic metallic vapours. A helium ion microscope (HIM) is used as a source of He^+ (15 keV to 30 keV, 50 fA to 10 pA), modified to include a radiation camera (Advacam MiniPIX) for ion detection. The use of carbon foils up to 50 nm thick are investigated, with conversion rates of He^+ to He^- reported and observations made on effects to the foil due to He^+ bombardment. Future work will investigate the use of other foil materials.

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Yes

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