プラズマ Xe^{+}イオン FIB とその応用技術

Xenon Plasma FIB Technology and Applications

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A new FIB technology using a Xenon ion plasma source has been developed with some advantages compared to the traditional Gallium ion source. Two major differences compared to Ga^{+} ions are the larger Xe^{+} ionic radius and the much higher achievable ion beam current. Plasma FIB technology is thus expanding the range of FIB applications.

The Xe^{+} ion is larger than Ga^{+} which reduces the penetration depth in the sample surface and thus the damage layer thickness. With the amorphous damage layer more confined to the outermost surface, more of the original structure of the material is maintained during ion-beam microfabrication and TEM sample preparation.

Use of a plasma-excited ion source also increases the achievable ion current, which is around 40x higher than for a Ga field emission source. Larger areas and volumes can thus be processed, and thus the expanded use of FIB technology in new fields can be expected.

In this presentation, we will discuss the benefits and use-cases of FIB with such large ion current.

Figure 1 shows the thickness of amorphous damage when a Si substrate surface is etched with Xe^{+} ions of varying voltage. At each ion energy (30 kV, 5 kV, and 2 kV) there is less amorphous damage with Xe^{+} than Ga^{+}.

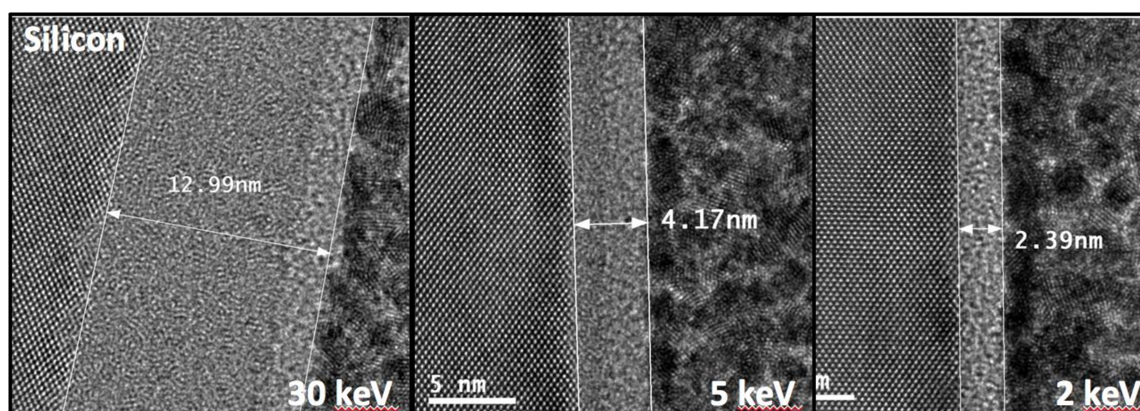

Figure 1: Xe^{+} FIB damage in Si as a function of accelerating energy. 30 kV ~ 13 nm, 5 kV ~ 4 nm and 2 kV ~ 2 nm.