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Case Study on Ion Beam Characteristics Following Application of Dual Condenser Lens in Xenon Plasma FIB

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Extended Abstract

In the electrical, electronics, and mechanical industries, the application of Focused Ion Beam (FIB) technology has significantly increased for developing new performance capabilities and enhancing efficiency through surface processing of components and materials. FIB systems utilizing liquid gallium ion sources have been widely adopted for applications such as circuit modification, TEM sampling, and 3D nanostructure formation. However, liquid gallium ion sources face challenges in meeting the diverse demands of broader application areas due to issues such as gallium-induced contamination and limitations in large-area processing.

To address these limitations, we developed a Plasma FIB system employing xenon ions with an Electron Cyclotron Resonance (ECR) plasma source. This system achieves higher current density and significantly reduces sample contamination compared to gallium ion sources, extending the controllable ion beam current range from 60~100ŋA to up to 2μA.

In this study, we enhanced the Plasma FIB system, originally developed by KEMCTI, by transitioning from a single condenser lens to a double condenser lens configuration. The ion beam characteristics and processing performance were analyzed to evaluate the impact of this modification. The results demonstrate that the resolution of the imaging system improved from 109 nm (single condenser lens) to 56 nm (double condenser lens), achieving a level comparable to commercial equipment. Additionally, the enhanced resolution contributed to significantly improved processing capabilities, confirming the superior performance of the double condenser lens configuration in Plasma FIB systems.

This advancement highlights the potential of Plasma FIB systems to meet the growing demands of next-generation applications requiring high precision and large-area processing capabilities.