

Why FIB for Nanofabrication ?

Advanced Applications and New Ion Species

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An increasing number of applications use focused ion beam (FIB) systems for nanofabrication and rapid prototyping tasks. FIB nanofabrication is a good partner to other lithography techniques providing complementary strengths like direct, resistless, and three-dimensional patterning.

Although a FIB process can in many cases be slower than a resist-accelerated process, the relative simplification of the nanofabrication approach, especially for the direct processing of novel materials, helps to achieve scientific results faster. We report on our continuous effort to advance FIB technology along with an instrumentation platform dedicated to nanofabrication requirements.

The nanofabrication requirements for FIB technology are specific and more demanding in terms of stability, resolution. We have improved gallium-based liquid metal ion source (LMIS) with a stable gun emission design enabling long-term stability, and producing low drifts in probe current and beam position.

Combining this FIB technology with an instrumentation platform optimized for nanometer scale patterning over large areas and extended periods of time applications such as X-ray zone plates, large area gratings, plasmonic arrays, and wafer-scale nanopore devices become possible.

Moreover the type of ion defines the nature of the interaction mechanism with the sample and has significant consequences on the resulting nanostructures. Therefore, we have extended the technology towards the stable delivery of multiple ion species selectable into a nanometer-scale focused ion beam by employing a liquid metal alloy ion source (LMAIS). This provides single and multiple charged species of different mass, e.g. Si, Ge or Au, resulting in significantly different interaction mechanisms. We present and discuss the capabilities of the instrument for sub-20 nm nanofabrication as well as potential applications.

Figures

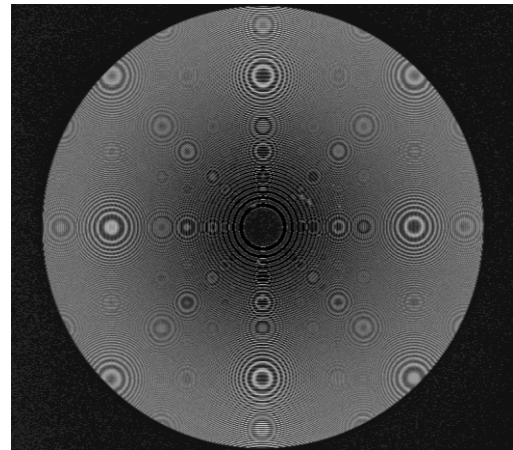


Figure 1: 100 μ m Dia zone plate on membrane

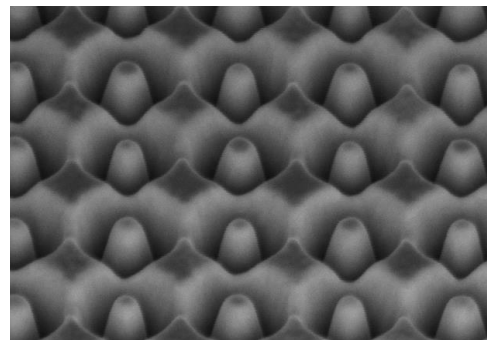


Figure 2: True Direct 3D FIB Patterning
