Universal Liquid Metal Alloy Ion Sources containing light and heavy ions for FIB and nanofabrication

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Nanofabrication requirements for FIB technologies are specifically demanding in terms of patterning resolution, stability, and the support of new processing techniques. Additionally, the type of ion defines the nature of the interaction mechanism with the sample and thus has significant consequences on the resulting nanostructures [1].

We have extended the technology for a stable supply of multiple ion species selectable into a nanometer scale focused ion beam by employing a liquid metal alloy ion source (LMAIS) [2]. This LMAIS provides single and multiple charged ion species of different masses, resulting in significantly different interaction mechanisms. Nearly half of the elements of the periodic table are thus made available in the FIB technology because of continuous research in this area [3]. This range of ion species with different mass or charge can be beneficial for various nanofabrication applications. Recent developments could make these sources to an alternative technology feasible for nanopatterning challenges. In this contribution, the operation principle, first results and prospective domains for modern FIB applications will be presented. As an example we will introduce the GaBiLi LMAIS [4, 5]. It enables high resolution imaging with light Li ions and sample modification with Ga or heavy polyatomic Bi clusters, all coming from one ion source. For sub-10 nm focused ion beam nanofabrication and microscopy, the GaBiLi-FIB could benefit of providing additional ion species in a mass separated FIB without changing the ion source.

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