

Laser-cooled ion source

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LASER-COOLED ION SOURCE

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Focused Ion Beams (FIB) are widely used in the semiconductor industry for milling, sputtering and imaging applications. In particular it is used for quality control of wafers, by using a combination of a FIB and an electron microscope to make cross-sectional inspections of wafers. In addition, FIBs are used for mask repair through gas-assisted etching.

The speed of these processes, as well as the minimum feature size are determined in essence by the quality of the ion source. The current industry standard ion-source is the liquid-metal ion (LMI) source, which allows a smallest focal spot size of several tens of nanometres. The fast developments in the semiconductor industry will require in a few years time ion beam milling capabilities at the 1nm level. A new source is proposed based on creating very cold ion beams by near-threshold photo-ionization of a laser-cooled and trapped atomic gas[1]. Fundamental limits for the reduced brightness and energy spread in terms of neutral particle flux and temperature are investigated, which show that 1 nm focus can be achieved. Experiments are underway.

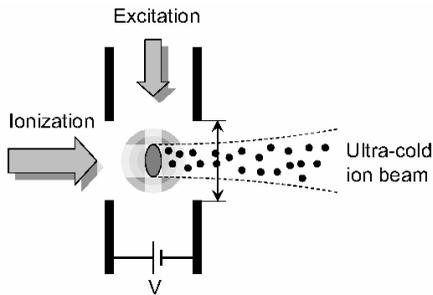


Figure 1: Schematic overview of the proposed setup for the generation of ultra-cold ion beams.

References

- [1] B.J. Claessens et al, PRL, 95, 164801 (2005)