Concept of an ion implantation stage with atomic resolution

I. W. Rangelow[1], K. Ivanova[1], T. Ivanov[1], J. Meijer[2], B. Burchard[2],
S. J. Park[3], A. Persaud[3], T. Schenkel[3], L. Bischoff[3]

[1]Institute of Microstructure and Technologies and Analytics (IMA), University of Kassel,
Heinrich Plett Strasse 40, 34132, Germany
[2]Institut für Physik mit Ionenstrahlen, Ruhr-Universität Bochum,
D-44780 Bochum, Germany
[3]E. O. Lawrence Berkeley National Laboratory, Berkeley, CA, USA
[4]Institute of Ion Beam Physics and Materials Research, Forschungszentrum
Rossendorf e.V., P.O.Box 51 01 19, D-01314 Dresden, Germany

Assembly & processing tools addressing the range of dimensions from several nanometres down to atomic scale are currently approached in two distinct ways. *Top-down* nanotechnology scales down the microsystem fabrication techniques . *Bottom-up* nanotechnology is a radical new manufacturing approach. In bottom-up nanotechnology complex systems are assembled atom-by-atom driven by nanoprobe (proximal probe) manipulation. Initially developed for atomic force microscopy (AFM) and scanning tunnelling microscopy (STM), this technology provides researchers with a unique capability to analyse and synthesise (fabricate) structures and systems on atomic level. Quantum and atomic level devices and systems show great promise, but they present major challenges in manufacturing and integration with micro- and macroscale circuitry. The ability to perform high-speed single atom addressing at sub 10nm dimensions will open new horizons for semiconductor industry and specially the nanosciences.

The ability for single ion/atom placement is a unique opportunity to the formation of novel quantum devices [1,2]. We present a concept and first results from our development of a single atom placement technique based on a Scanning Proximal Probes Technology. Accurate alignment is a crucial requirement for reliable single accelerated atom or ion placement. The addressing is possible through integration of the ion beam with a piezoresistive Scanning Proximal Probe [3] with hollow tip. The piezoresistive Scanning Proximal Probe images the device region to be implanted non destructively in a high vacuum chamber. Following imaging, implantation coordinates are selected. Ions or atoms are allowed to reach the probe tip now, because the probe tip is pierced with nanometer sized hole, allowing ions to transmit. In our presentation we will discuss the fabrication technology used to fulfil the resolution requirements with respect to the capabilities of scanning probe aligned single particle implantation.

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