Approaching Programmable Reconfigurable Electric Nanocontact Lithography

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Existing Technologies such as projection photolithography and electron-beam lithography are still very active areas of research. Despite new developments towards deep UV photolithography and projection electron lithography the increasing cost ($1-10 billion is projected for a high-throughput microprocessor fabrication facility) is likely to limit their use [1]. Direct write scanning probe lithography [2, 3] and parallel nanoreplication techniques (e.g.: soft-lithography, nanoimprint lithography, and others) are more affordable techniques to enable the fabrication and study of prototypes of future devices with features < 100 nm in size. Scanning probe lithography, however, remains very slow and an increase in speed can only be expected from arrays of probes, which will increase both complexity and costs. Nanoreplication techniques have the disadvantage that they require the fabrication of a master. To reconfigure a design requires the fabrication of a new master.

In this study, we report on a programmable, reconfigurable, printing approach for parallel nanofabrication of two different types of structures: patterns of charge for nanoxerographic printing, and patterns of e-beam resist for nanofabrication [4, 5]. Programmable Reconfigurable Electric Nanocontact Lithography (PRENL) is based on previous knowledge in the area of conducting scanning probe lithography, which uses a conducting probe to electrically expose and modify a surface. Our tool makes use of the same physical principles; however, instead of using a single electrical point contact, we use programmable electrical nanocontacts of different size and shape to expose a surface. Our electrodes are based on a flexible membrane that forms multiple electric contacts of different size and shape to the surface. For example the electrodes are used to expose e-beam sensitive resists to generate patterns of charge and patterns of

topography with 100 nm resolution as shown in figure 1. The location of the patterns can be programmed, without making a new mask or mold. The produced pattern is erasable for reconfiguration. Electric nanocontact lithography provides a route to enable programmable, reconfigurable nanofabrication.

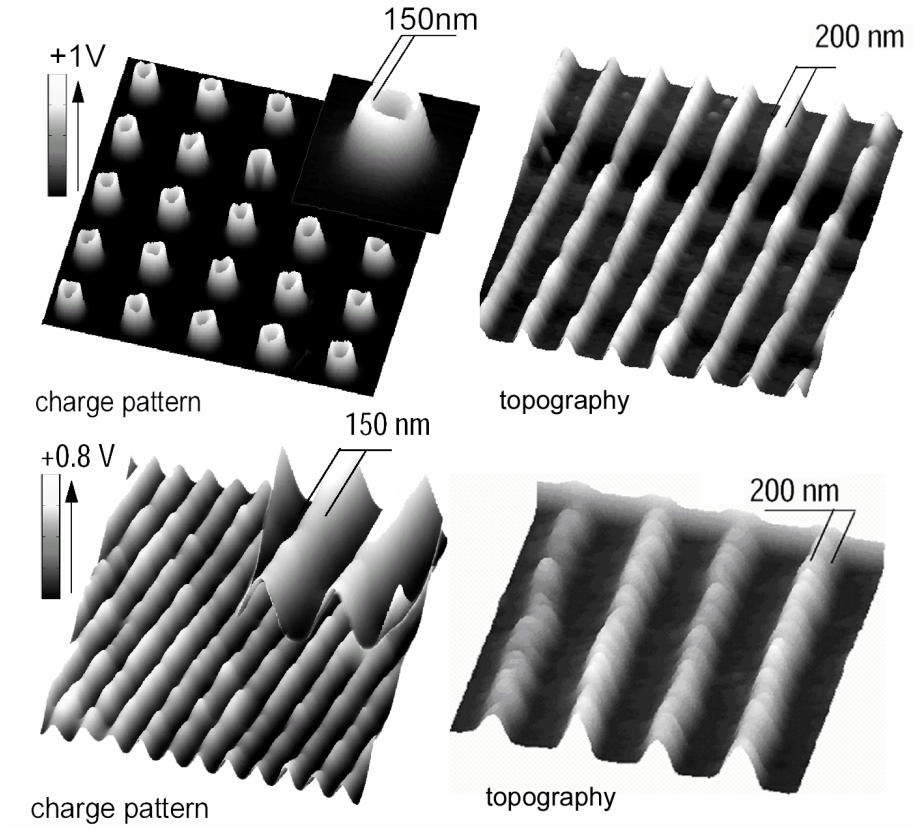

***Figure 1**: Patterns of charge (left) and topography in e-beam resist.*

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