Electron Beam Lithography in a new nano world

Leonidas E. Ocola

IBM T. J .Watson Research Center, Yorktown Heights, NY 10598

Leonidas.E.Ocola@ibm.com

Commercial electron beam lithography has been in existence for the past 50 years. In this time research in this area has been focused on improving both resolution and throughput with amazing advances. Currently it is feasible to expose features that are just a few atoms across, and the use of multiple beams in a single tool can increase throughput several orders of magnitude over single beam systems. Along the way, this work has required advancements in understanding fundamentals of electron scattering in materials, techniques to overcome proximity effects, experiments to improve process latitude, fundamental understanding of the chemistry in electron beam resists, among many more endeavors.

Given that the field has basically reached the most fundamental of resolution limits, the question arises, is there still room for research in electron beam lithography beyond just incremental improvements to current technology. In this presentation I will describe a few areas where I believe electron beam lithography can provide novel capabilities in the world of nanofabrication today. One of these areas include, but is not limited to, patterning of non-semiconductor materials such as silk, hydrogels, and biomolecules, not as a new breed of resists, but as functional materials in themselves. In addition, it is important to realize that at 100 KV electrons can travel several tens of microns in resist type or organic-based materials. Such capability has been vastly underused to date. The typical use is for x-ray optical elements such as Fresnel zone plates, but there are many more instances where direct write of high aspect ratio structures can be useful. I will discuss how high voltage electron beam lithography can be used for high aspect ratio sensors with unique sensitivity properties.

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