Nanotechnology Fabrication Moves Closer to Mass Production

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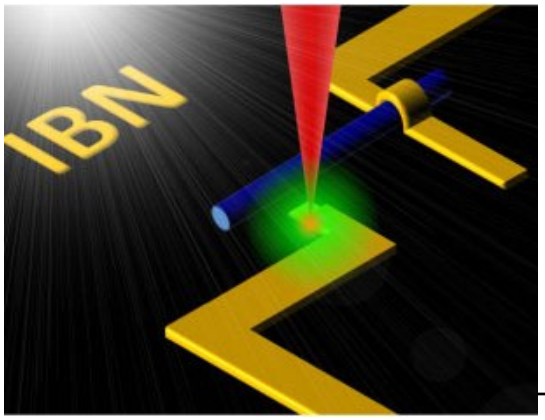

The technology for nanomaterial-based device fabrication is still at its infancy, despite the surge in research publications over the past decade. As a matter of fact, the controllable fabrication of complex, three-dimensional nanoscale structures remains a difficult challenge; it will still take some time before a commercial product can be realized. Although researchers are experimenting with a wide range of nanotechnology fabrication techniques, the lack of reproducibility in nanomaterials synthesis and the absence of a realistic high-throughput fabrication scheme pose the biggest challenges.

Researchers at the Institute of Bioengineering and Nanotechnology (IBN) in Singapore have now successfully demonstrated, for the first time, a lithography-free, direct-write technique for fabricating discrete field-effect transistors, as well as digital logic gates on a single nanowire.

In this novel direct-write fabrication process, a focused electron beam or ion-beam is scanned over the sample in the presence of a precursor gas, causing the metals or insulators to be deposited directly onto the sample and with nanometer resolution. While there is some known research on the ion-beam induced deposition of materials, the IBN researchers have made significant progress by translating this technique into a viable way for fabricating nanoscale logic circuits.

Current fabrication technologies for nanoscale devices include deep-UV or electron-beam (e-beam) lithography. Both of these techniques involve successive deposition of metal or insulating layer and a resist layer, which is patterned using a UV source or a scanning electron beam. The process needs to be repeated for each layer of the architecture while the sample is taken out of the high vacuum chamber. Thus, multilayer lithography processes seriously compromise throughput and cost. In addition, the resolution is limited in the sub-10 nm regime.

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[1] http://www.nanowerk.com/spotlight/spotid=16739.php