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Atomic Image Projection Electron Beam Lithography[1]

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While we are approaching to the nanotechnology era, as was proposed by Richard Feynman in 1959, our main concern still lies in how one can controllably manufacture and utilize nanometer scale features. The top-down approaches, most notably, lithography based techniques still have the problem of throughput although it has been successfully demonstrate to make features with the size less than 10 nm. The bottom-up approaches, either utilizing chemical vapor deposition process to make carbon nanotube or wet-chemical process to make size controllable quantum dots and rods, still have the limitation of extending it to many different types of materials and also delivering them on a wafer size substrate to make nanodevices. In this talk, we will propose a novel electron beam lithography technique to make nanometer scale features. The novelty of this process lies in the fact that one can utilize the crystalline lattice image commonly observed by the high resolution transmission electron microscopy as an ultimate mask to generate nanometer scale patterns. Using this technique, we demonstrate that down to 45 nm pitch size can be resolved on hydrogen silsesquioxine (HSQ) e-beam resist material. The patterns are formed on Si substarte with the dot size of about 30 nm and the line size of about 25 nm. This technique can be extend to define less than 10 nm size features only if the suitable resist is developed.

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