# ⑭ Ultimate lithography toward molecular-scale 3D nanofabrication

## Motivation

We are developing a three-dimensional nanofabrication (3D-NANO) technique with ultra-high precision and ultra-fineness, combining the top-down and bottom-up nanofabrication techniques. 3D electron beam lithography (EBL) and the alignment technique for self-assembled nanostructures are used as the top-down and bottom-up techniques, respectively.

## Originality

We have devised a novel approach to flexibly aligning self-assembled nanostructures using an alignment guide fabricated by EBL. A successful demonstration of 30-nm-pitch nanostructures that can be aligned two-dimensionally has been obtained. We have also succeeded in fabricating 50-nm-wide patterns on a 3D Si substrate by using the 3D-NANO with EBL.

## Impact

3D-NANO will enable the fabrication of novel 3D nanostructures with a high degree of freedom and a molecular-level resolution. This will open the way to new developments in nanotechnology, such as highly functional nanorobots in nanoelectromechanical systems (NEMS).


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