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Block Copolymer Lithography

- Fine nanopatterning by rapid directed polymer self-assembly -

NTT

Motivation

Top-down lithography—of which optical lithography is a prominent example—is reaching its critical limit, thereby raising difficulties in achieving sub-20-nm lithography. This study will focus on the development of an ultimate nanofabrication technique at the single-digit nanoscale by combining top-down and bottom-up approaches.

Originality

We have demonstrated that rapid graphoepitaxy of bottom-up self-assembled nanomaterials can be achieved by combining lithographically created alignment guides with high-temperature short-time processing. We have also achieved pattern transfer from rapidly aligned domains to the substrate. As a result, dense lines of amorphous silicon with a pitch of 42 nm can be formed.

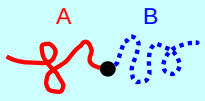
Impact

This study would enable the fabrication of nanostructures at the single-digit nanometer scale—an objective that cannot be achieved simply by top-down technologies. Our results could provide the impetus for large-scale production of novel nanodevices, especially quantum effect devices, as well as conventional nanodevices that are subject to a scaling law.

Block Copolymer Lithography

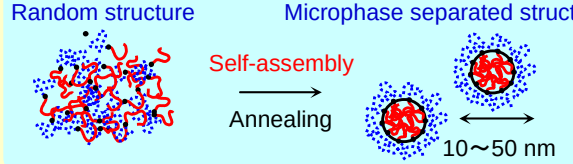
- Single layer of microphase separated domains is used as lithography template

Self-assembled nanomaterials

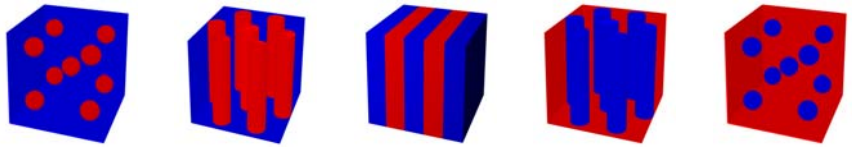


A-B diblock copolymer

Microphase separation of diblock copolymers



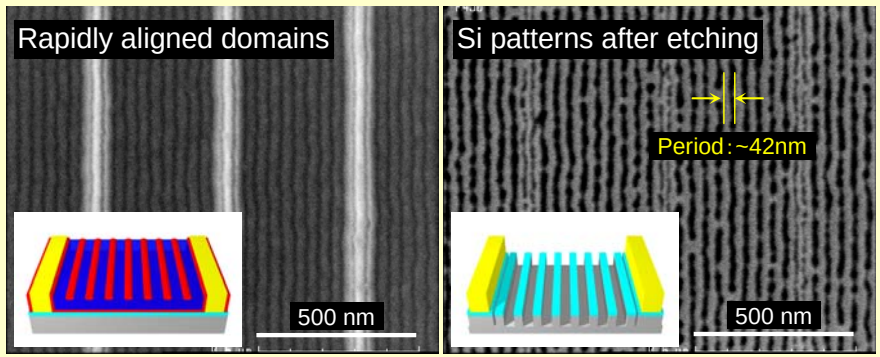
Microphase separated structures of diblock copolymers



A Sphere | A Cylinder | A,B Lamella | B Cylinder | B Sphere

Rapid Graphoepitaxy & Pattern Transfer

- Rapid graphoepitxay can be achieved by combining lithographically created guides and high-temperature short-time processing.



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