



Masks for Growing Nanopatterned Polymer Brushes

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WARF: P130118US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing block copolymer-based masks that can be used to more easily manufacture patterned polymer brushes.

Overview

Polymer brushes are a broad class of materials made of polymer chains tethered at one end to a substrate. These brushes are able to tune and modify surface properties like bioadhesion and wettability.

Two main strategies are used to grow polymer brushes: grafting 'to' and grafting 'from.' The grafting 'from' approach is faster and can be used with a range of substrates. It works by anchoring a suitable initiator to a substrate and then directly growing polymer chains via some polymerization technique. One favored technique is SI-ATRP (surface-initiated atom transfer radical polymerization), which is versatile and lends a high degree of control.

Furthermore, it is possible to create polymer brushes with desired nanoscale features. But this has conventionally required growing them on a substrate that's been patterned by sophisticated lithography. It would be highly useful if polymer brushes could be grown and patterned using a standard process like SI-ATRP.

The Invention

UW-Madison researchers have developed a method for growing nanopatterned polymer brushes using SI-ATRP. The method relies on making and using a lithographic mask.

The mask has three layers: a surface, a neutral layer and a block copolymer (BCP) film. The neutral layer serves two purposes. First, it induces the overlying BCP film to form vertical domains. Secondly, it provides initiating sites from which to grow the polymer brush chains.

Before that can happen, parts of the BCP film are selectively removed by etching. This forms a desired pattern of exposed regions. During SI-ATRP, these regions are exposed to a growth solution. The result is a polymer brush made of multiple chains, each of which is attached to the neutral layer.

Applications

- Manufacturing nanopatterned polymer brushes for semiconductor templates
- Biological and filtration uses

Key Benefits

- High grafting density

- Relies on standard manufacturing methods
- No need to optimize conditions for each new surface

Additional Information

For More Information About the Inventors

- [Padma Gopalan](#)

Related Technologies

- [WARF reference number P100296US02 describes polymer brushes that may be used in underlying buffer or imaging layers for block copolymer lithography.](#)

Tech Fields

- [Materials & Chemicals : Polymers](#)
- [Semiconductors & Integrated Circuits : Design & fabrication](#)

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