



## Dense Polymer Brush Growth with New Copolymer

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**WARF: P130169US02**

Inventors: Padma Gopalan, Daniel Sweat, Myungwoong Kim

**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to grow polymer brushes with high grafting density using a crosslinkable random copolymer.**

### Overview

Polymer brushes are a broad class of materials consisting of a polymer chain tethered at one end to a surface. These brushes have a variety of uses given their ability to tune or modify surface properties like adhesion or wettability.

Two main methods for preparing polymer brushes have emerged. The 'grafting to' approach reacts an end-functionalized polymer chain with a surface to anchor it. This does not work for all substrates and grafting efficiency drops as molecular weight increases.

Alternatively, the 'grafting from' approach overcomes some of these limitations. By anchoring a suitable initiator to a substrate, polymer chains can be grown directly by various polymerization techniques. One technique, called surface-initiated atom transfer radical polymerization (SI-ATRP), is popular because polymers can be synthesized with ease and control. These capabilities should be exploited by new polymer brush material.

### The Invention

UW-Madison researchers have developed a novel crosslinkable random copolymer and film. The film can be used as a grafting substrate to grow polymer brushes via SI-ATRP.

The copolymers are synthesized by standard techniques. They consist of a styrene or acrylate-based inimer for initiating ATRP and a monomer for crosslinking. Once the copolymers have been formed, they can be crosslinked into films by applying heat and/or light. This step can be carried out on different surfaces using spin-coating methods.

After the crosslinked films have been prepared, they can be used as grafting substrates for SI-ATRP growth of polymer and copolymer brushes. During SI-ATRP, a reaction generates a polymer brush composed of multiple polymer chains attached to the film.

### Applications

- Block copolymer (BCP) lithography and directed self-assembly
- Electronics
- Potential for use in implantable devices

### Key Benefits

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- Highly versatile approach
- Stability and ease of synthesis

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| [info@warf.org](mailto:info@warf.org) | 608.960.9850

- Film is made of highly homogenous, single-component polymer.
- Separate synthesis and crosslinking steps avoid blending problems.

## Additional Information

### For More Information About the Inventors

- [Padma Gopalan](#)

### Related Technologies

- [WARF reference number P09005US describes a method for using thin polymer films to control the orientation of BCP microdomains on different types of substrates.](#)

### Related Intellectual Property

- [View Continuation Patent in PDF format.](#)

### Publications

- Sweat D. P., Kim M., Xiang Y. and Gopalan P. 2013. A Single Component Inimer Containing Cross-linkable Ultra-thin Polymer Coating for Dense Polymer Brush Growth. Langmuir. 29, 3805-3812.

### Tech Fields

- [Materials & Chemicals : Polymers](#)

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