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# NON-CONFIDENTIAL TECHNOLOGY DISCLOSURE

## New Methods to Generate 10-Terabit-per-Square-Inch Arrays of Nanoscopic Elements with Long-Range Lateral Order

**Lead Inventors: Thomas P. Russell, Ph.D. and Ting Xu, Ph.D.**

### TECHNOLOGY DESCRIPTION

Researchers at the University of Massachusetts Amherst and the University of California at Berkeley have recently developed novel methods to produce block copolymer thin films containing near perfectly ordered arrays of nanoscopic elements on macroscopic non-flexible or flexible substrates. The long-range lateral order of the block copolymer nanoscopic elements is achieved by using substrates with saw-tooth patterns to guide the copolymer self-assembly. The block copolymer thin films produced using saw-tooth patterned substrates have areal densities of nanocylinders in excess of 10 terabits per square inch, and can be easily processed to generate templates with long-range lateral order of nanopores for a wide variety of commercial applications.

### ADVANTAGES

- **Ultradense arrays:** The self-assembly of block copolymers on the patterned substrates generates arrays of nanoscopic elements having areal densities in excess of 10 trillion bits per square inch, at least an order of magnitude over current capabilities.
- **Long-range lateral order:** The saw-tooth substrate topography provides directional guidance to the self-assembly of block copolymers, resulting in perfectly oriented and laterally ordered arrays of nanocylinders over arbitrarily large substrate surfaces.
- **High substrate versatility:** Perfectly ordered ultradense arrays from block copolymers can be formed on both hard/non-flexible substrates and soft/flexible substrates for various end-use applications.
- **Simple and environmentally friendly processes:** The “bottom-up” fabrication processes eliminate the use of environmentally unfriendly harsh chemicals required by lithographic techniques. All of the processing steps are non-disruptive and can be easily incorporated into the current production lines.
- **Flexible surfaces:** Addressable media is no longer restricted to perfectly rigid substrates, opening unique opportunities for the design of flexible, solid-state storage media.

### APPLICATIONS

- Ultrahigh-density addressable media, electronic devices, opto-electronic devices, photovoltaic devices

### ABOUT THE LEAD INVENTORS

Dr. Russell is a Distinguished Professor in the Department of Polymer Science and Engineering at UMass Amherst and a member of the National Academy of Engineering. His research interests span the areas of polymer-based nanoscopic structures and nano-particle assemblies, electrohydrodynamic instabilities in thin polymer films, surface and interfacial properties of polymers, and polymer morphology.

Dr. Xu is an Assistant Professor with joint appointments in the Department of Materials Science and Engineering and the Department of Chemistry at UC Berkeley. Her research efforts focus on obtaining a fundamental understanding of the hierarchical self-assembly of complex materials systems and applying the knowledge gained toward generating functional materials with novel properties.

**BUSINESS OPPORTUNITIES**: Available for Licensing or Sponsored Research
**DOCKETS**: UMA 08-47 and UMA 09-47
**PATENT STATUS**: Patent Pending

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