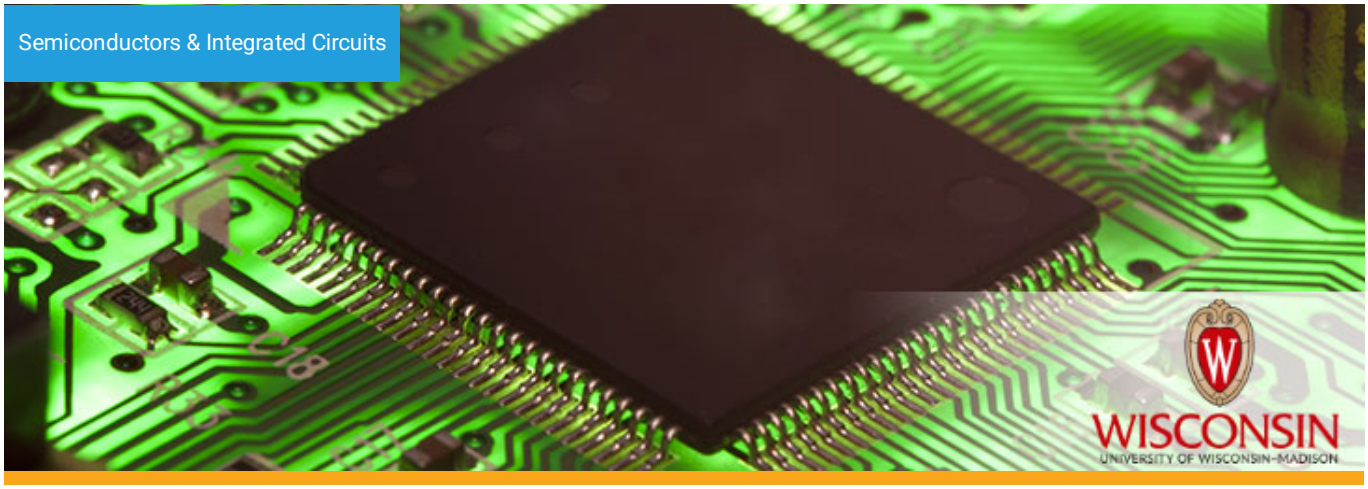

Directed Self-Assembly of Block Copolymers to Make Bit Patterned Media

View U.S. Patent No. 8,815,105 in PDF format.

WARF: P110093US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method of using directed self-assembly of block copolymers to make a master mold used to nano-imprint patterned magnetic recording disks that have chevron servo patterns with minimal defects.

Overview

In magnetic recording bit patterned media (BPM), each magnetic bit is physically isolated in the form of nanometer-scale islands. These features can be fabricated by nano-imprint lithography in which a master template containing all the features is used to imprint a resist layer on the magnetic disk. The master template can be fabricated via e-beam directed self-assembly, in which e-beam lithography is used to define a sparse chemical contrast pattern in the substrate to direct the assembly of a block copolymer film. The periodic patterns formed by the block copolymer are used to define the features for the BPM template.

In addition to the highly periodic, uniform features that define the bits, BPM architecture also requires nondata servo regions that are used for read/write head positioning. Such servo regions often involve irregular patterns such as a chevron pattern of slanted stripes that extend across the data tracks. Finding servo patterns that are compatible with self-assembly remains a technological challenge.

The Invention

UW–Madison researchers have developed a method to generate chevron structures suitable for servo regions in BPM by self-assembly of block copolymers. The method uses conventional or e-beam lithography to form a pattern of chemically modified polymer brush material on the master mold substrate that will result in the desired pattern of concentric rings for the data tracks and chevron pattern of slanted stripes for the servo sectors. The pattern includes interface strips between the sets of slanted stripes and at the transition regions between the concentric rings and the stripes. It is the patterned interface strips that significantly reduce defects and control the extent of the disruptive areas in the servo patterns of the resulting nano-imprinted disks.

A block copolymer material is deposited on the pattern, resulting in directed self-assembly of the block copolymer as lamellae perpendicular to the substrate are formed into alternating slanted stripes of the first and second components of the block copolymer. One component also forms on the interface strips, but as a lamella parallel to the substrate. One of the components then is removed, leaving the remaining component as a grid that acts as a mask for etching the substrate to form the master mold.

Applications

- Nanolithography for semiconductor devices that require irregular or aperiodic features such as those used in the fabrication of integrated circuits and hard drives

Key Benefits

- Disks imprinted by the master mold will have significantly reduced defective areas in the transition regions of the chevron servo patterns.
- Additional features patterned onto the substrate enable the use of a single block copolymer to define track lines and chevron stripes.

- Method facilitates control of the defect or transition areas without adding additional polymers that may compromise bit density and limit storage capacity.

Tech Fields

- Semiconductors & Integrated Circuits : Lithography

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842