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Diblock Copolymers for Nanoscale Patterning

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As the size scale of device features becomes increasingly smaller, conventional lithographic processes become increasingly more difficult and expensive, especially at a minimum feature size of less than 50 nm. Consequently, to achieve higher density circuits, storage devices or displays, it is evident that alternative routes need to be developed to circumvent both cost and manufacturing issues. An ideal process would be compatible with existing technological processes/manufacturing techniques and these strategies, together with novel materials, could allow significant advances to be made in meeting both short-term and long-term demands for higher density and faster devices. The self-assembly of block copolymers (BCP), two polymer chains covalently linked together at one end, provides a robust solution to these challenges. As thin films, immiscible BCP self-assemble into a range of highly-ordered morphologies where with size scale of the features is limited to the size of the polymers chains and are, therefore, nanoscopic in size. While self-assembly alone is sufficient for a number of applications in fabricating advanced microelectronics, directed self-orienting self-assembly processes are also required to produce complex devices with the required density and addressability of elements to meet future demands. By combining tailored self-assembly processes, a bottom-up approach, with micro-fabrication processes, a top-down approach, the ever-present thirst of the consumer for faster, better and cheaper devices can be met in very simple, yet robust, ways.

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