Supramolecular Lithography: From Nanoscale Patterning to Device Fabrication

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The smectic and cylindrical phases of supramolecular molecules have recently attracted considerable attention because of their potential applications as optoelectronic materials, selective membranes, and in the creation of novel nanopatterning templates. It is commonly accepted that most flat, tapered dendrimers self-assemble into cylindrical mesophases with nanometer-scale building blocks. However, the lack of long-range order and the orientation of the cylinders represents a critical limitation to realizing an ordered nanomaterial, although cylinders from supramolecular self-assemblies have many advantages including the ability to achieve very small feature sizes (sub-10 nm), flexibility in chemical functionality, and fast stabilization of the molecular ordering and nanostructure due to the reversible and noncovalent interactions of supramolecular molecules. Here we report on a dramatic improvement in the degree of control and selectivity in the orientation of fan-shaped supramolecular cylinders over large areas, which has been achieved by applied magnetic fields. We show that these cylindrical domains become aligned perpendicular to the magnetic field direction, which the aromatic parts of the cylinders orienting themselves parallel to the magnetic field vector.