Soft Micro- to Nanolithography Using Highly Periodic Smectic Liquid Crystal Defects HEE-TAE JUNG, YUN HO KIM, Korea Advanced Institute of Science and Technology, DONG KI YOON, Samsung Electronics, HYEON SU JEONG, Korea Advanced Institute of Science and Technology, ORGANIC OPTO-ELECTRONIC MATERIALS LAB. TEAM — Achieving perfect long-range order with soft building blocks at high speed and high resolution is one of the most exciting interdisciplinary research areas in current materials science and nano-biotechnology. Here, we have developed highly periodic patterns with sub-micrometer features over large-areas using toric focal conic domains (TFCDs) originated from smectic liquid crystal (LC). TFCDs are accomplished by precisely controlling the surface and interfacial properties of smectic LC. In order to apply the smectic liquid crystal defect arrays in lithography, the hexagonal arrays of domain patterns are used as molds for ultraviolet (UV) curable polymers, thereby providing LC defect stamps with high spatial resolution over large areas. Our method was further utilized to transfer patterns with sub-micrometer features from the polymer stamp surface to a secondary surface by microcontact printing (μ-CP). The patterning method based on LC defects has significant advantages over existing lithographic approaches: 1) the masters and stamps are easy to fabricate, 2) the masters and stamps provide long-range surface ordering over large-areas, 3) the periodic arrays are formed quickly in several seconds, and 4) the stamps can generate feature sizes on the micrometer and submicrometer length scales, and 5) the methodology offers the possibility of controlling the array geometry by altering the geometry of the confining channels.

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