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Interface Modulation Lithography: Construction of Nanoscale Optical Components by Thermocapillary Forces[1] MATHIAS DIETZEL, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd., MC 128-95, Pasadena, CA 91125 — Conventional patterning of nanoscale devices relies on optical projection techniques whose resolution is set by the Rayleigh diffraction criterion. While feature sizes in the sub-100 nm are now possible, this technique is inherently 2D, requires multiple exposure cycles for generating disparate feature sizes, and is limited to flat substrates. Here we discuss development of a new, truly 3D lithographic technique based on control of thermocapillary forces, which is suitable for construction of isolated or collective arrays of optical elements such as planar waveguides or ring resonators. Finite element simulations based on actual experimental systems demonstrate how implementation of various thermal gradient maps can be used to shape and mold nanoscale polymeric films into complex 3D shapes, on demand and in a single step. These simulations provide guiding principles for achieving submicron feature size and pitch while minimizing proximity effects. The simplicity and inherent low cost of this technique, its adaptability to curved substrates, and the variety of thermal distributions possible provides an interesting new method of nanoscale fabrication based on modulation of surface shape.

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