Abstract Submitted
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Fabrication of Converging and Diverging Polymeric Microlens Arrays By A Thermocapillary Replication Technique[1] SOON WEI DANIEL LIM, KEVIN FIEDLER, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd, MC 128-95, Pasadena, CA — Thermocapillary forces offer a powerful method for sculpting interfaces at microscale dimensions. Here we demonstrate how periodic arrays of cooled pins placed in close proximity to the surface of a molten polymer nanofilm can be used to fabricate various large area microlens arrays, which when solidified exhibit ultrasmooth surfaces and excellent focusing capability. This technique was used to fabricate both homogeneous converging and diverging microlens shapes by application of various thermal distributions. The converging arrays were incorporated into a Shack-Hartmann wavefront sensor able to image moving currents of airborne spray droplets. Feature overlap was also used to achieve hierarchical arrays comprising two superimposed patterns. By varying the width of the cooled pins, it was also possible to fabricate converging microlens structures featuring a caldera-like depression at the vertex able to focus collimated light into a sharp annulus. These demonstrations prove that with suitable microscale control over the thermal distributions projected onto molten nanofilms, a diverse set of micro-optical components can be fabricated by thermocapillary replication from a nearby mask without contact and in a single step.

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