

Fabrication of controllable micro-patterns by droplet-based microfluidic photomasks

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Photomask is the material commonly used in a photolithography technique. Using a photomask, various micro-/nano-patterned structures for sensing, display or bio-application can be created. Although a conventional film type photomask is powerful tool for creating various patterned structures, it would not be possible to manipulate the size or shape of photomask design in real time. Herein, we report droplet-based microfluidic photomasks for on-demand control of various patterns. Monodisperse droplets were generated in microfluidic devices with high throughput. Generated droplets which contained water-soluble dye molecules absorbing the ultraviolet (UV) light were hexagonally close-packed in the reservoir. Finally, spatially selective penetration of UV light ensured the selective crosslinks of photoresist lying beneath the reservoir. Therefore, micro-patterned structures were fabricated after exposing UV light to the photoresist through the microfluidic devices. The shape, size and arrangement of droplets were easily tuned by adjusting the flow rates of the constituting fluids. We expect that the microfluidic photomasks can reduce the cost and time for fabricating various patterns.