Microfluidic Synthesis of Designed Microparticles Using Structured Elastomeric Membranes

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Microparticles have a great potential in various applications such as drug delivery, tissue engineering, etc. Compared to other fabrication techniques to synthesize microparticles, the methods adopting microfluidic devices have unique advantages for the continuous fabrication of microparticles. In this work, structured elastomeric membranes were exploited for the continuous synthesis of microparticles inside microfluidic channel. The master for structured elastomeric membranes was fabricated by photolithography with transparent photomask containing various designed shapes. Then, the thin structured elastomeric membrane was prepared by spin coating the polydimethylsiloxane (PDMS) on the master. The thin membrane was incorporated between flow channel and control channel for the confinement of photocurable resin. Microparticles could be fabricated by the trapping of photocurable resin via pneumatic actuation of the elastomeric membrane and the subsequent exposure of UV light. Besides simple 2D polymeric microparticles, the approach can also be applicable to the fabrication of photonic crystals with desired shape by using colloidal particles dispersed photocurable resin.