Continuous Fabrication of Polymer Film Using Hydrodynamically Focused Vertical Laminar Flows

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Hydrodynamic focusing using microfluidic systems has been reported for making various shaped particles and fibers. However, it is largely unexplored to fabricate film which has rectangular cross-section with considerable length. Furthermore, since present flow lithography system has been conducted in the polydimethylsiloxane (PDMS) channels which have oxygen inhibition layer at the channel walls, no further study was possible in the material point of view. Here, we demonstrate hydrodynamic focusing lithography for producing polymer film in continuous manner. Microfluidic devices were fabricated by using conventional photolithography and a soft-lithographic procedure. Then, photopolymerizable resin was used as a core stream while non photopolymerizable resin used as two sheath streams. When the fluid flows, core stream was surrounded by two sheath streams, which makes core stream focused at the center of channel. Finally, core stream was polymerized with illumination of UV light and polymer film was collected at the outlet. The thickness of film was controlled by manipulating the ratio of flow rates of the sheath and the core streams.