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MICROFLUID DROPLET GENERATORS FOR THE SYNTHESIS OF MONODISPERSE POLYMERIC MICROPARTICLES

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We present novel microfluidic droplet generators and their applications to the synthesis of various monodisperse polymer particles. Microchannels such as T-junctions and co-flow geometries (e.g., 100-200 μm in width and 100 μm in depth) were fabricated on planar glass substrates by dry-etching technique. By infusing polymerizable monomers as to-be-dispersed phase and aqueous solutions of surfactants as continuous phase into the microchannels, we could produce monodisperse oil-in-water (O/W) emulsion droplets, typically with coefficient of variations (CVs) of diameters below 3%. Also, we could vary the sizes of the droplets formed (e.g., 50-200% of the cross-sectional size of the channels) and the breakup frequency (10^0-10^4 Hz) by changing flow rates under the condition of low Reynolds and Capillary numbers. Subsequent photo/thermal polymerization *off* the microdevices produced various polymer particles. Examples include homogeneous microspheres,[1] biphasic *Janus* particles with electrical anisotropy,[2] and nonspherical particles with tunable shapes.[3] We also report the mass production of monodisperse emulsions and particles for industrial application using large-scale parallelization of the microchannels on a chip.[4]

References

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