

Microfluidics: A tool to produce new materials

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Microfluidics offers a unique control over the fluid flow and enables the formation of highly monodisperse drops. These drops can be used as templates to produce monodisperse particles with sizes spanning more than four orders of magnitude. I will present a microfluidic spray drier, a nebulizer, which produces very small, air-born drops that rapidly evaporate. These minuscule drops enable the production of amorphous nanoparticles made from almost any material including those with a very high propensity to crystallize. By contrast, much larger drops, typically contained in a second, immiscible liquid, are often used as templates to produce polymeric microparticles and microcapsules. However, the limited throughput achieved with typical microfluidic drop makers restricts the application of microfluidics in material science; this is especially the case if particles are used as building blocks of macroscopic materials. In a second part of my talk, I will present a highly parallelized microfluidic drop maker, a millipede device, that produces monodisperse emulsion drops with sizes ranging from 20 μm to 200 μm at a throughput more than 100 times higher than that of a conventional microfluidic drop maker. This device thus has the potential to make microfluidic technologies useful for a much broader range of material science applications.