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Simulation of the self-assembly of colloidal droplets in a microchannel[1] ZHOUYANG GE, LUCA BRANDT, KTH Mechanics, Sweden — In colloidal sciences, much progress has been made on the synthesis of complex building blocks mimicking molecular structures to elaborate innovative materials. The basic elements of such colloidal molecules are particles or droplets less than one millimeter in size. Their self-assembly relies on either lengthy brownian motion or careful microfludic designs, on top of typical colloidal interactions, e.g. depletion attraction. Regardless of the approach, however, questions remain why the colloids undergo certain path to organize themselves and how such process can be optimized. Here, we perform direct numerical simulations using a Navier-Stokes solver at low Reynolds number, combined with either the immersed boundary method (IBM) or a newly-proposed level set (LS) method for interface description. In the IBM simulations, the colloids are treated as rigid, spherical particles under a Lennard-Jones-like potential, reproducing attractive depletion force. Results show that, for four particles, a planar diamond is formed under a weak potential while a 3D tetrahedron is formed under a strong potential, which agree qualitatively with experiments. In the next step, LS simulation of colloidal droplets will be performed to investigate the roles of surface tension in the self-assembly.

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