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Modeling microcapsules moving through microchannels of differing geometries ALEXANDER ALEXEEV, ROLF VERBERG, ANNA BALAZS, Chemical Engineering Department, University of Pittsburgh, Pittsburgh, PA — We study the dynamic behavior of deformable microcapsules in microchannels, which are roughly comparable in size to the diameter of the capsules. The capsules model synthetic polymeric microcapsules or biological cells, such as leukocytes. The microcapsules are driven to move through the channels by an imposed pressure gradient or flow field. Each microcapsule consists of an elastic shell that is filled with a viscous fluid. To model this multi-component system, we combine the lattice Boltzmann model for fluid dynamics and the lattice spring model for the micromechanics of elastic solids. We determine the effects of the mechanical properties of the elastic capsule and the characteristics of the imposed flow on the dynamics of the capsules as they move inside microchannels with sinusoidal and undulating geometries. We also isolate conditions that lead to a trapping of the capsule inside the channel. The findings provide insight into the behavior of cells within biological vessels and provide guidelines for regulating the motion of polymeric microcapsules with microfluidic devices.

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