Simulation of Synthetic Microscale Motors

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Molecular motors are ubiquitous in biology, with examples ranging from motor proteins moving along filaments to swimming bacteria. Recently, synthetic microscale motors have attracted considerable attention due to their potential practical applications and related theoretical open questions. A relatively simple and effective strategy to design artificial micromotors is to utilize phoresis effect [1,2], which refers to the directional drift motion of suspended particles in externally applied gradient fields, such as gradients of concentration (diffusiophoresis) or temperature (thermophoresis) [3]. When a local gradient field can be produced by particle itself (self-phoresis), then self-propulsion may occur [4].

We have proposed a mesoscopic simulation scheme, by which synthetic micromotors can be simulated in a quite simple way. We focus here on the motion of single self-phoresis dimmer and Janus particle [5], and their induced flow fields [6], and on self-propelled microrotor [7]. The simulation results are well consistent with our analytical calculations. Our model can not only nicely mimic those recent experiments of the synthetic microswimmers [1,2], but also is particularly appropriate for studying the dynamics of active colloids. Moreover, our results may help to provide new insight into design of controllable microscopic devices.

References:

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