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Self-propulsive motion and deformation of a chemically-driven drop. NATSUHIKO YOSHINAGA, Tohoku Univ — Spontaneous motion has attracted lots of attention in the last decades in fluid dynamics for its potential application to biological problems such as cell motility. Recently, several model experiments showing spontaneous motion have been proposed and revealed the underlying mechanism of the motion. The systems in these works consist of relatively simple ingredients, but nevertheless their motion and deformation give us an impression as if they are alive. Importantly, the system breaks symmetry and chooses one direction of motion. We theoretically derive a set of nonlinear equations exhibiting a transition between stationary and motile states starting from advection-reaction-diffusion equation driven away from an equilibrium state due to chemical reactions. A particular focus is on how hydrodynamic flow destabilizes an isotropic distribution of a concentration field. We also discuss a shape of the droplet. Due to self-propulsive motion and flow around the droplet, a spherical shape becomes unstable and it elongates perpendicular to the direction of motion. This fact would imply that the self-propulsion driven by chemical reaction is characterized as a pusher in terms of a flow field. We shall also show numerical results using the phase field model.

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