Enhanced active motion of Janus colloids at the air-water interface

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Abstract:

Active colloids are an emerging and promising class of colloidal particles, which are designed to perform autonomous motion as biological microswimmers by transforming chemical or other form of energies into work and propulsion. When the particle size is about a micrometer or smaller, the directional propulsion competes with the translational and rotational Brownian motion. Here we explore the possibility of enhancing the directional motion of self-propelled Janus colloids by slowing down their rotational diffusion.

We have investigated the active motion of self-propelled colloids confined at the air-water interface. The two dimensional motion of micron-sized Silica-Platinum Janus colloids has been experimentally measured by particle tracking video-microscopy under increasing concentration of the catalytic fuel, i.e. H_2O_2. Comparing to the motion in bulk, a dramatic enhancement of both the persistence length of trajectories and the speed has been observed. The interplay of colloid self-propulsion, due to an asymmetric catalytic reaction occurring on the colloid, and interfacial frictions controls the enhancement of the directional movement. The slowing down of the rotational diffusion at the interface, also measured experimentally, plays a pivotal role in the control and enhancement of active motion.[1]

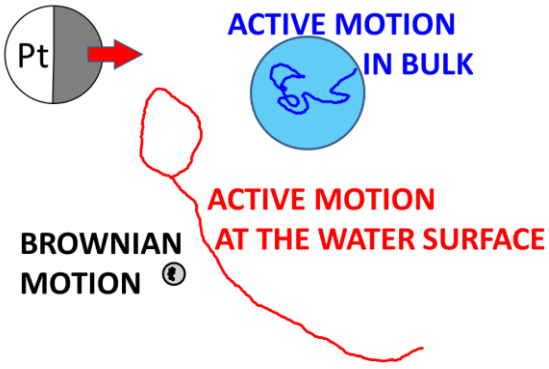

Figure : Trajectories of Janus colloids showing Brownian motion (in absence of H_2O_2), and the active motion in bulk and at the air-water interface ($[H_2O_2]$=5%).

[1] X. Wang et al., *Enhanced active motion of Janus Colloids at the water surface*, submitted to Soft Matter