Chemotactic catalytic colloids

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Phoretic motion uses stresses generated e.g. by electric fields to generate force-free propulsion [1]. Artificial phoretic swimmers create this field themselves [24] to propel themselves in a direction determined by the orientation of their surface patterns of reactivity and mobility, if the ambient reactant concentration is uniform. Can a polar active particle of this type discover and reorient itself with respect to an imposed gradient of reactant concentration? We show that it can, thus offering a theoretical construction of chemotaxis in reactive colloids. We calculate the dependence of the taxis on particle shape and patterning. We also examine the case when reaction product distribution evolves on timescales comparable to the particle reorientation time. Finally, we consider the effect of interparticle interaction between two such chemotactic particles.

References

[1] J.L. Anderson, Annu Rev Fluid Mech **21**, 61 (1989).

[2] W. Paxton et al. JACS **126**, 13424 (2004).

[3] R. Golestanian et al. Phys Rev Lett **94**, 220801 (2005).

[4] G. Ruckner and R. Kapral Phys Rev Lett **98**, 150603 (2007).

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