Active matter – using photochemistry to create motion on the microscale

Linlin Wang, Sandra Heckel, Juliane Simmchen,

One of the most exciting new directions in colloidal soft matter is pushing colloids out of equilibrium, leading to self-propulsion.

A variety of different origins can be used to achieve energy dissipation in colloidal particles: catalytic reactions,[1] photocatalysis [2] or galvanic exchanges.[3] When energy is asymmetrically transferred between different forms, an active motility can be resulting. This property has been used to study different effects such as assembly,[2] apparent phototaxis,[4] but also used to tackle environmental problems.[5] Especially the photocatalytic colloids open up a large variety of control modes beyond an on-off-switch, which will be addressed in this presentation.

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[3] Feuerstein L, Biermann CG, Xiao Z, Holm C, Simmchen J, Highly Efficient Active Colloids Driven by Galvanic Exchange Reactions, JACS 2021, 143, 41, 17015–17022.

[4] Niese L, Wang LL, Das S, Simmchen J, Apparent phototaxis enabled by Brownian Motion, Soft Matter 2020, 16, 10585-10590.

[5] Wang LL, Kaeppler A, Fischer D, Simmchen J, Photocatalytic TiO_2 Micromotors for Removal of Microplastics and Suspended Matter, ACS AMI, 2019, 11, 3632937-32944.