Modular phoretic micro-swimmers

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There currently is a strong interest in understanding and applying self-propulsion on the microscale. Typical biological and artificial micro-swimmers use non-reciprocal motion (e.g. flagellae) or phoretic propulsion (e.g. driven by chemical reactions) [1]. We here present a complementary approach to micro-swimming by combining several non-active parts to self-organize into a self-propelling complex. Our modular phoretic micro-swimmer consists of an ion exchange resin (IEX) particle (being the fuel reservoir) and a charged colloidal particle (CP, acting as gearing), both settled to a charged substrate and hydro-dynamically coupled by an electro-osmotic solvent flow along the substrate (acting as a motor), which is caused by the gradient generated by the IEX [2,3]. Using different optical techniques, we carefully characterize the swimming performance of this complex as a function of gradient strength, substrate charge, size and electro-kinetic mobility of the CP, size of the IEX and number of CP coupled to the IEX. We further report interesting structures and shapes of the swimming complex formed under specific conditions

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