Shape effect on motility of active systems

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An active colloid is a suspension of particles capable of converting free energy from their environment into movement. Biological (Bacteria) and artificial (synthetic self-propelled particles) microswimmers are well-known examples of active colloidal systems. Microsimmers use the surrounding energy to carry out intrinsically non-equilibrium activities such as growth, replication and self-propelled motility [1]. The motility is achieved by the creation of field gradients localized around their bodies when they consume fuel or are heated by laser light. These gradients can change in orientation and thus thereby their propulsion direction; in contrast to passive particles which move along an externally set field gradient [2]. Different factors influence the phoretic activity of these systems, like particle shape and chemical composition.

Despite several examples [3-5] the influence of shape on the features of a Biohybrid microswimmer has not been extensively analyzed and many issues remain to be understood; including the viscous forces exerted by the flow, which depend strongly on the body geometry. However, the lack of simple and reproducible preparation strategies for different shaped nano- or microparticles makes studies relatively difficult. To evaluate the influence of the shape we have prepared different particle morphologies (as shown in Figure 1), which will be used to test the different swimming behaviours. The aim is to correlate these with the flow conditions around the microswimmers. Thus, the appropriate microscopic and chemical characterization of raw and chemically functionalized particles (TEM, SEM; IR, TGA) are presented.

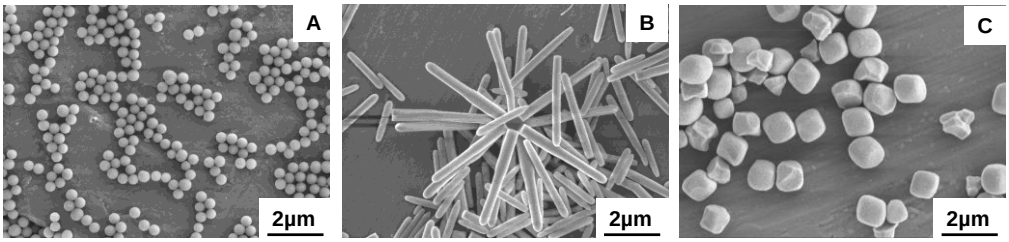

Figure 1: Scanning Electron Microscopy images of a) spherical, b) rod and c) cubic particles.

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