REVEALING THE ROLE OF STRUCTURE AND BOUNDARY CONDITIONS IN FRICTION REDUCTION WITH TRIBOCOLLOID LUBRICANTS.

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ABSTRACT

Structural Superlubricity is a mechanism of ultralow friction which occurs due to atomic lattice misfit between clean, flat, rigid crystalline surfaces achievable with 2D materials. So far, it has been mostly as curiosity, observed between idealized surfaces. In this project, we explore upscaling of this phenomenon using tribocolloidal particles coated with 2D materials such as Graphene and MoS2. Using these coated granular particles, we investigate the resulting friction reduction at the macroscale. As a function of parameters such as particle size, polydispersity, solvent and boundary conditions. To optimize the friction reduction, we elucidate the tribocolloid structure under sliding by direct imaging and simulations. Experimentally, we combine testing devices with confocal microscopy to visualize the particle structure in three dimensions and real time. We find very low friction coefficient with tribocolloids suspended in glycerol compared to friction coefficient of boundaries and silica particles suspended in glycerol.

We combined investigations with simulation results from our collaboration to get more insight into the role of surface roughness, solvent and normal load in the formation of tribocolloid structures mediating the resulting macroscopic friction reduction.

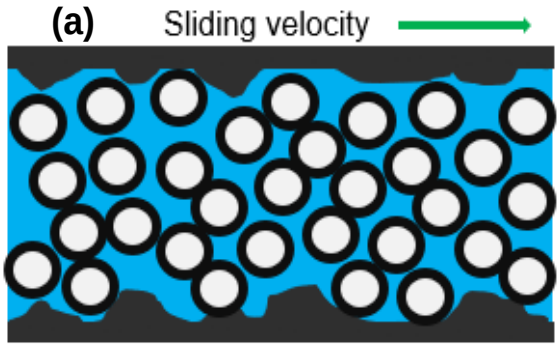

Fig.1 Shearing tribocolloids and visualizing structures.

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