P.35 Lubrication by polymersomes under nanoconfinement

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Polymersomes, which are hollow spheres made from amphiphilic block copolymers, have been widely studied in literature for applications in biomedical sciences, *e.g.* as drug carriers and artificial cells, but no research has been reported on their lubrication properties. They show a close resemblance with liposomes including their hydration behaviour, however, polymersomes generally have a higher stability which, we hypothesise, makes them promising materials for lubrication applications.

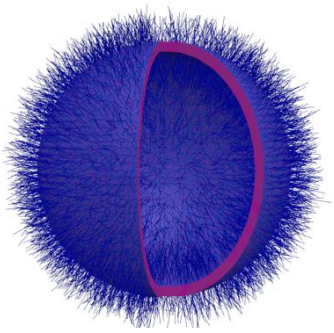

Figure 1. Schematic presentation of a polymer vesicle.

An effective friction reduction mechanism is *hydration lubrication*. Here water molecules in the primary hydration layer are bound tightly to ions and thus able to support load. Meanwhile, they are in rapid exchange with free water molecules, giving rise to a fluidity of bound water molecules similar to that in bulk, facilitating lubrication under pressure. We hypothesise that hydrated polymersomes can mediate a similar mechanism.

To this end, colloidal probe atomic force microscopy (CP-AFM) is used to study the characteristics of polymeric assemblies under confinement and shear. Initial CP-AFM experiments on PBD-PEO polymersomes in water show that the polymersomes are very “slippery” and facilitate low friction coefficients. Additionally, their morphology on a surface was studied by AFM imaging in a liquid cell.

From these observations, we hypothesise that polymersomes are promising candidates as biomimetic synthetic lubricants. We will make direct measurements of surface forces, particularly friction, mediated by different polymersomes with sizes between 50-400 nm self-assembled from a range of copolymers using the surface force apparatus.