

Mechanical Properties of Cobalt Nanoparticle Membranes Coated with Oleic Acid.

Advisor: Prof. Heinrich Jaeger

Proposed Study

There are many types and forms of membranes. They have many useful applications ranging from filtration to high sensitivity sensors. I propose to study Cobalt Nanoparticle membranes. This nanoparticle system consists of closed packed inorganic particles, Cobalt, and organic polymers functioning as spacers. A similar system of gold nanoparticle arrays shows remarkable strength with a Young's modulus on the order of GPa.ⁱ Cobalt nanoparticle membranes can respond to magnetic signals, making them promising candidates for a wide range of applications.

Cobalt Nanoparticle membranes can be created using a simple drop drying technique. These ultrathin membranes can be stretched across micrometer-size holes. I propose to measure Elastic properties using Atomic force microscopy. Pressure differences between the membranes can be applied to measure the strength and used to tune the mechanical resonances.ⁱⁱ I propose to determine Stiffness.

ⁱ Klara E. Mueggenburg, Xiao-Min Lin, Rodney H. Goldsmith, and Heinrich M. Jaeger, "Elastic membranes of close-packed nanoparticle arrays", *Nature Materials* 6, 656 - 660 (2007).

ⁱⁱ J. Scott Bunch, et al. "Impermeable Atomic Membranes from Graphene Sheets" , *Nano Letters* 8, 2458-2462 (2008).