Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Thermo-mechanical behavior of nanoparticle membranes. HENRY CHAN, BADRI NARAYANAN, Argonne National Laboratory, YIFAN WANG, University of Chicago, XIAO-MIN LIN, Argonne National Laboratory, HEINRICH JAEGER, University of Chicago, SANKARANARAYANAN SUBRAMANIAN, Argonne National Laboratory — Ultra-thin nanoparticle (NP) membranes are self-assembled hybrid materials that have attracted considerable interests. Monolayer membranes formed of simple dodecanethiol ligated gold NPs have mechanical strength that comes mostly from weak non-covalent van der Waals interactions between ligands, yet they can free-stand over micron-size holes and have a Young's modulus on the order of several GPa. We will present our recent experimental-theoretical study on the thermo-mechanical behavior of these membranes and reveal microscopic details relating to ligand rearrangement and dynamics that lead to their hysteretic mechanical response. The results provide insight that can be useful in the development of new non-covalent self-assembled materials with tunable properties.

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Date submitted: 11 Nov 2016 Electronic form version 1.4