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Freely-Suspended Monolayers of Gold Nanocrystals: Fabrication and Elastic Properties[1] KLARA ELTETO, University of Chicago, XIAO-MIN LIN, Argonne National Laboratory, SANG-KEE EAH, Rensselaer Polytechnic Institute, HEINRICH M. JAEGER, University of Chicago — We present a method to produce freely-suspended monolayers of 5.5nm-diameter gold nanocrystals, ligated with dodecanethiol, over holes with widths up to 2microns (about 250 particles). The holes are etched through a 120nm thick silicon nitride membrane. A water droplet initially covers the substrate. When nanocrystals suspended in toluene are added, they spread over the water-air interface, forming an extended, compact monolayer. As the water dries, the monolayer settles over the substrate and drapes itself over the holes. The resulting freely-suspended monolayers are stable in air and vacuum, as observed with optical, atomic force and transmission electron microscopy. No additional polymer or crosslinking of the ligands is required. Possible mechanisms for the stability of the monolayer include ligand interdigitation and van der Waals interaction between the gold cores. We report on measurements of the elastic properties of such monolayers, obtained by applying point forces to the suspended areas with an atomic force microscope and measuring the vertical elastic deformation.

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