Mechanical Behavior of Architected Nanomaterials

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Abstract:

Many nanomaterials (e.g. graphene, metallic nanowires, and ceramic nanospheres) exhibit extraordinary strength, ductility and flaw tolerance. These nanoscale size effects can be transmitted to the bulk by arranging nanostructures in 3D hierarchical architectures with optimized structural topologies, but these nano-architected structures are challenging to construct using conventional manufacturing techniques. In this talk, the speaker will present the use of two-photon lithography to fabricate 3D copper lattices made up of micron-sized beams connected at solid nodes in the octet geometry. Mechanical testing reveals that the porous Cu lattice has *higher* strength than monolithic copper with the same volume and microstructure. This counterintuitive behavior results from size-dependent strength enhancement within lattice beams coupled to the strong and lightweight structural geometry. We will next explore the use of self-assembly to form mechanically robust nanocomposites from solution-processed nanoscale building blocks. Polystyrene grafted Au nanoparticles are self-assembled at a fluid interface to form ordered, superlattice thin films with sub-10 nm features. The mechanical behavior of superlattice thin films is found to depend critically on the degree of lattice disorder, polystyrene molecular weight and grafting density

Biosketch:

Xun Wendy Gu is a postdoctoral scholar with Prof. Paul Alivisatos at UC Berkeley. She is interested in the size-dependent mechanical properties of architected nanomaterials such as metallic and polymeric nano-lattices, pillars, and semiconducting quantum dots. Wendy received her PhD at the California Institute of Technology, where she worked with Prof. Julia Greer on the strength, deformation and fracture of lithographed metallic nanostructures. Before starting graduate school, Wendy was a Fulbright Scholar with Prof. Ernesto Joselevich at the Weizmann Institute of Science in Israel. She received a B.S. in Chemical Engineering from UC Berkeley in 2009.