Abstract Submitted
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The Role of Ligand in the Mechanical Properties of Self-Assembled Nanoparticle Films SEAN GRIESEMER, James Franck Institute, The University of Chicago, SEAN YOU, Department of Chemistry Chemical Biology, Harvard University, PONGSAKORN KANJANABOOS, Materials Science and Engineering, Mahidol University, EDWARD BARRY, Center for Nanoscale Materials, Argonne National Laboratory, WEI BU, Center for Advanced Radiation Sources, The University of Chicago, STUART RICE, James Franck Institute, The University of Chicago and Department of Chemistry, The University of Chicago, BINHUA LIN, James Franck Institute, The University of Chicago and Center for Advanced Radiation Sources, The University of Chicago — Self-assembled films of nanoparticles (NP) capped with ligands at the air/water interface exhibit rich mechanical responses to compression including hashing, wrinkling, and folding, which are the combined result of particle- and ligand-based interactions. Previous studies have shown that a high concentration of ligands inhibits wrinkling and folding, but the mechanism remains elusive. By using inductively coupled plasma optical emission spectrometry (ICP-OES) to measure the ligand concentration of our NP solutions and then back-adding excess ligands at controlled amounts, we precisely control ligand-based interactions, enabling an investigation of how these interactions guide self-assembly and correspondingly on mechanical properties. Our experiments reveal that increasing the ligand concentration of the films causes the formation of free-ligand islands in addition to an increase in the interparticle separation. These effects are correlated with the previously observed inhibition of wrinkling and folding, as well a decrease in the dilatational and shear moduli. This work was supported by the University of Chicago Materials Research Science and Engineering Center, NSF-DMR-1420709.

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