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Robust Three Dimensional Liquid Films through Nanoparticle Assembly TZU-CHIA TSENG, ERIN MCGARRITY, PHILLIP DUXBURY, Michigan State University, AMALIE FRISCHKNECHT, Sandia National Laboratories, MICHAEL MACKAY, University of Delaware — We create three-dimensional thin liquid films that cover rough surfaces, typically thought to be un-wettable, by employing a nanoparticle self-assembly technique. In this technique, the nanoparticles assemble at the liquid-substrate interface during annealing and they stabilize the liquid-air interface by screening its interactions with the substrate. This results in robust liquid films capable of wetting surface protrusions that are greater than their thicknesses. In this work, blends of polystyrene and CdSe nanoparticles were spincoated onto silicon substrates containing sparsely distributed SiO2 particles (circa 110 nm) and thermally annealed. Film profiles of different thicknesses (40-180 nm) were characterized using atomic force microscopy (AFM). Calculations based on a continuum theory were performed and found to be in agreement with the AFM profile data. Cross-sectional transmission electron microscopy (TEM) was performed to provide validation of the film profile contours and the 3D-assembly of the nanoparticles. This method could be used, for example, to enlarge the interfacial area for exciton dissociation in organic photovoltaic cells.

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