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Directed assembly of nanoparticles for hybrid photovoltaic
VIVIAN CHUANG, UC Berkeley, ALEXANDER MASTROIANNI, KARI THOKELSSON, WANLI MA, PAUL ALIVISATOS, TING XU — Nanoparticles have unique optical and electronic properties. Be able to control the hierarchical assembly of nanoparticles in thin films may lead to devices for energy harvest and storage. Recently it was shown that nanoparticles can be assembled with high precision using block copolymer-based supramolecules.¹ Here we present detailed studies on nanoparticle assembly in thin films. Effects of various parameters including: small molecular loading, supramolecular morphology, film thickness, nanoparticle loading, interfacial interaction and solvent annealing condition on the macroscopic alignment of nanoparticle assembly as well as inter-particle ordering within the copolymer microdomain have been systematically investigated. We show that nanoparticle assembly can be readily aligned either parallel or perpendicular to the substrate. In addition, inter-particle distances can be tailored. A Schottky barrier type solar cell has been fabricated to correlate the structure and device performance and cell efficiency. 1. Zhao, Y.; Thorkelsson, K.; Mastroianni, A. J.; Schilling, T.; Luther, J. M.; Rancatore, B. J.; Matsunaga, K.; Jinnai, H.; Wu, Y.; Poulsen, D.; Frechet, J. M. J.; Paul Alivisatos, A.; Xu, T. *Nat Mater* 2009, advance online publication.

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