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Assemble Nanoparticles in Diblock Copolymer-Based Supramolecular Thin Films in Fifteen Minutes JOSEPH KAO, VIVIAN CHUANG, SEONG-JUN JEONG, TING XU, UC Berkeley, TING XU GROUP TEAM — Controlling nanoparticle assemblies in thin films enables one to exploit their collective properties to generate functional devices such as hybrid photovoltaic cells, capacitors and optical waveguides. This requires precise control over nanoparticle assemblies over multiple length scales with a single particle precision. Moreover, to be compatible with large-scale processing, there is a need to reduce the processing time down to minutes. Here we present a simple yet robust approach where hierarchical assemblies of nanoparticles in thin films can be achieved in 15 minutes with control over the macroscopic alignment of nanoparticle assemblies as well as the inter-particle ordering. We use diblock copolymer-based supramolecules, in which the small molecules are attached to the polymer side chains non-covalently, to direct the assemblies of nanoparticles in thin films. Furthermore, vertical alignment of nanoparticle assemblies can be readily obtained in the films with thicknesses from 50 to 300 nm without balancing the interfacial interactions. The simplicity, robustness and the rate of nanoparticles assemblies in thin films makes it possible to apply this approach to the fabrications of nanoparticle-based nanodevices over macroscopic distances.

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