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Controlled Formation of Multicomponent Nanoparticle Assemblies HYUN SUK KIM, P.K. SUDEEP, CAROLINE MIESCH, TODD EMRICK, ALFRED J. CROSBY, University of Massachusetts — Nanoparticle assemblies are hierarchical material structures that have the potential to combine materials properties and well-defined geometries at multiple length scales to yield advanced properties and functions. We have developed a novel method to assemble inorganic nanoparticles that are tailored with ligands into line patterns with controlled spacing between neighboring lines. The width of the line can vary over a wide range at micron length scales, while the length can reach multi-centimeter lengths. The method of assembly is based on a flow-coating method, where a dilute nanoparticle solution is held by capillary force under a stationary knife blade as a substrate is translated beneath. Convective nanoparticle assemblies are formed spontaneously at the contact line of the meniscus. The spacing, width, and thickness of deposited lines is controlled by programming velocity profiles of the translating stage. Building upon the tailored chemistry of the nanoparticles, complex assemblies with precise arrangements of CdSe quantum dots with different sizes are achieved. This method provides an easy, robust, and lithography-free method for the formation of hierarchical assemblies, which will have advantageous effects on properties ranging from mechanics to optoelectronics.

Hyun Suk Kim
University of Massachusetts

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