Abstract Submitted
for the OSF16 Meeting of
The American Physical Society

Colloidal Synthesis of Monodisperse Semiconductor Nanocrystals through the Saturated Ionic Layer Adsorption. NATALIA RAZGONIAEVA, Bowling Green State University — We demonstrate a general strategy for the synthesis of colloidal semiconductor nanocrystals (NCs) exhibiting the size dispersion below 5%. The present approach relies on the sequential deposition of fully saturated cationic and anionic monolayers onto small-diameter clusters, which leads to focusing of nanocrystal sizes with the increasing particle diameter. Each ionic layer is grown through a room-temperature colloidal atomic layer deposition (ALD) process that employs a two-solvent mixture to separate the precursor and nanocrystal phases. As a result, unreacted precursors can be removed after each deposition cycle, preventing the secondary nucleation. By using CdS NCs as a model system, we demonstrate that a narrow size dispersion can be achieved through a sequential growth of Cd^{2+} and S^{2-} layers onto starting CdS cluster "seeds". Besides shape uniformity, the demonstrated methodology offers an excellent batch-to-batch reproducibility and an improved control over the nanocrystal surface stoichiometry. The present synthesis is amenable to other types of semiconductor nanocrystals and can potentially offer a viable alternative to traditional hot-injection strategies of the nanoparticle growth.

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Date submitted: 12 Sep 2016 Electronic form version 1.4