Controlled growth of three-dimensional heterogeneous nanocrystals

THE EXISTING PROBLEM OR ISSUE
The general goal for nanomaterials engineering is to pursue the reproducible and scalable techniques for synthesis of hybrid nanostructures. Desirably, the building blocks of nanoparticles should be synthesized according to the design with controlled size, uniformity, morphology, composition, distribution, and physical/chemical properties, so that multiple functionalities will be tailored, integrated and optimized leading to a higher level of performance in any given application.

Towards solving this long-term challenge, the scale-up growth of highly uniform heterogeneous nanomaterials requires both crystallography knowledge to reveal the fundamental mechanisms and tailored engineering solutions to maintain their functionalities of controlled discrete domains of different materials.

OUR SOLUTION
We have developed a new synthesis route for programmable bottom-up growth of heterogeneous nanocrystals. This can yield a large quantity of identical single nanocrystals with 3-dimensional morphology and rare-earth doping composition synergistically controlled.

This innovation has been inspired by an interesting observation during our synthesis of Super dots nanocrystals. We discovered a new nanocrystal growth mechanism, called “migration growth”, which process involves the dissolution, “de-growth”, of a core nanocrystal, migration of ions and then formation of new crystals and epitaxial growth onto the selective surfaces of the core crystal. We have also identified several keys to control the growth of new generation Super dots with enhanced optical, magnetic and physical properties.

APPLICATIONS
- MRI biomedical imaging
- Nanophotonics sensing
- Nanomedicine drug delivery
- Photo-catalysis
- Analytical technologies

ADVANTAGES | BENEFITS
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One factor control in 3D growth | Simplifies fabrication
A vast nanocrystals library | Increases nanomaterials variety
Multifunctionality | Multimodality imaging

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INTELLECTUAL PROPERTY POSITION
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