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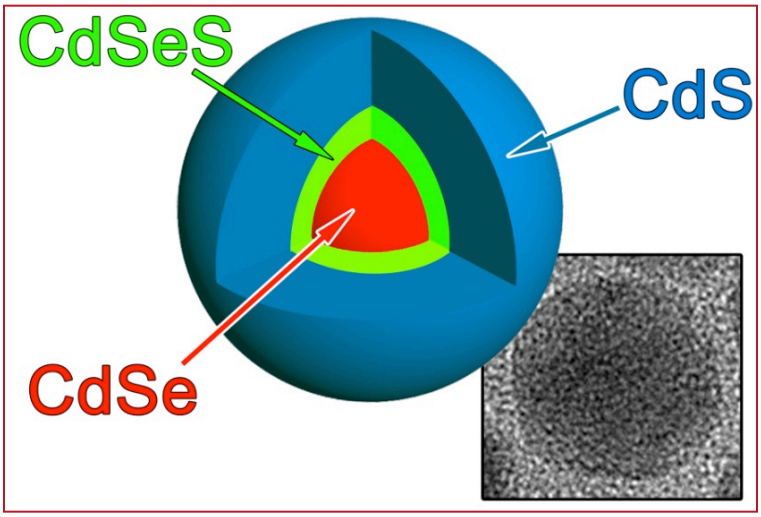
Interfacial Properties Boost Lasing by Quantum Dots

Two-monolayer-thin alloy layer in core-shell nanocrystals aids optics applications

Mitch Jacoby

Quantum dots' prospects for use in laser applications are looking bright as a result of a study showing how to limit a deleterious effect that robs the semiconductor nanocrystals of their potential lasing power (*Nano Lett.,* DOI: 10.1021/nl103801e). Ten years ago, a research team that included Victor I. Klimov of Los Alamos National Laboratory showed that quantum dots could be made to lase, a demonstration that opened the door to several applications in optics.

Despite the proof-of-principle experiment, nanocrystal lasing has remained impractical because of a fast relaxation process known as Auger recombination, which quenches the electronic excitations required for lasing and causes electron, rather than photon, emission. Now, Klimov, Florencio García-Santamaría, Sergio Brovelli, and coworkers report that capping a cadmium selenide core with just a few monolayers of cadmium sulfide suppresses the Auger process by more than two orders of magnitude. The group's spectroscopic measurements indicate that the improvement stems from the unique electronic properties of a two-monolayer-thin alloy layer at the core-shell interface, a finding consistent with recent theoretical predictions, they say.



Schematic and transmission electron micrograph of a quantum dot nanocrystal with a cadmium selenide core and a cadmium sulfide shell separated by a thin alloyed interface formed due to intermixing between selenium and sulfur atoms.