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**Very Low Threshold ASE and Lasing Using Auger-Suppressed Nanocrystal Quantum Dots** YOUNG-SHIN PARK, CHTM, University of New Mexico, Albuquerque, NM, and Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM, WAN KI BAE, Photoelectronic Hybrid Research Center, Korea Institute of Science and Technology, Seoul, Korea, ANDREW FIDLER, TOMAS BAKER, JAEHOON LIM, JEFFREY PIETRYGA, VICTOR KLIMOV, Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM — We report amplified spontaneous emission (ASE) and lasing with very low thresholds obtained using thin films made of engineered thick-shell CdSe/CdS QDs that have a CdSeS alloyed layer between the CdSe core and the CdS shell. These "alloyed" QDs exhibit considerable reduction of Auger decay rates, which results in high biexciton emission quantum yields ($Q_{BX}$ of $\sim$ 12%) and extended biexciton lifetimes ($\tau_{BX}$ of $\sim$ 4ns). By using a fs laser (400 nm at 1 kHz repetition rate) as a pump source, we measured the threshold intensity of biexciton ASE as low as 5 $\mu J/cm^2$, which is about 5 times lower than the lowest ASE thresholds reported for thick-shell QDs without interfacial alloying. Interestingly, we also observed biexciton random lasing from the same QD film. Lasing spectrum comprises several sharp peaks (linewidth $\sim$0.2 nm), and the heights and the spectral positions of these peaks show strong dependence on the exact position of the excitation spot on the QD film. Our study suggests that further suppression of nonradiative Auger decay rates via even finer grading of the core/shell interface could lead to a further reduction in the lasing threshold and potentially realization of lasing under continuous-wave excitation.

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