Exploring the charge/energy transfer process at the graphene/giant nanocrystal quantum dots interfaces

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Center for Integrated Nanotechnologies, Materials Physics and Applications Division, Los Alamos National Laboratory — Due to its transparency in wide spectral range and high charge mobilities, graphene has been considered to utilize as transparent electrode for nanocrystal based photo-voltaic and light emitting diodes. A detail understanding on charge/energy transfer (CT/ET) processes between zero dimensional quantum dots and 2D graphene layer hold the key in optimizing the performance of these devices. To attain this understanding, we conduct a systematic study on CT and ET processes between a graphene layer and CdSe/CdS giant nanocrystal quantum dots (g-NQD) as the function of CdS shell thickness. In addition to analyzing PL quenching and change of PL decay dynamic, we also perform 2\textsuperscript{nd} order photon correlation spectroscopy studies to investigate the effect of graphene layer on dynamic and emission efficiency of g-NQDs’ multi-exciton states. In case of g-NQDs over coated with a thick 16 ML CdS shell, we observed a surprising increase of multi-exciton emission efficiency.

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