Abstract Submitted
for the SES14 Meeting of
The American Physical Society

Photoexcitation energy transfer enhancement through atomic ligand exchange in a novel graphene-colloidal quantum dot interface ALEXANDER LI, North Carolina School of Science and Mathematics — The photonic applications of graphene are limited by its optical transparency and short exciton lifetime. To address this, colloidal quantum dots (CQDs) have been employed as light sensitizers from which photoexcited electrons can be transferred to graphene. Thus, recent research has been conducted on graphene-CQD interfaces (GCIs), which consist of CQD layers deposited on monolayer or few-layer graphene. However, the efficiency of photoinduced energy transfer at GCIs requires improvement. Using a theoretical model, we predicted that decreased CQD-graphene separation distance and lower CQD emission energies would result in unprecedented energy transfer rates. We therefore fabricated a novel PbS-based GCI employing atomic ligand passivation. PbS was chosen as the CQD material because we expected it to allow for faster energy transfer and more solar light absorption than current CdSe-based GCIs. The ligand exchange was performed to facilitate energy transfer by reducing CQD-graphene separation distance and improving CQD-graphene adhesion. Following the exchange, we observed an up to fivefold increase in energy transfer rate, thus verifying our theoretical predictions. Our findings are an important step in the development of GCIs for applications in optoelectronics.

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Date submitted: 03 Oct 2014 Electronic form version 1.4