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Directed Energy Transfer through Size-Gradient Nanocrystal Layers into Si Substrates MICHAEL NIMMO, LOUIS CAILLARD, WILL DEBENEDETTI, HUE NGUYEN, YVES CHABAL, YURI GARTSTEIN, ANTON MALKO, University of Texas at Dallas — Nanostructured materials attract great interest as candidates for next generation of photoelectronic devices. Presently, the majority of hybrid devices are based on charge transfer in which exciton break-up occurs at the interface between dissimilar materials. Poor interface quality and carrier transport are issues that result in a conversion efficiencies lower than in the inorganic crystalline devices. An alternative approach is based on hybrid structures, which combine strongly absorbing components such as nanocrystal quantum dots (NQDs) and adjacent high-mobility semiconductor layers coupled via proximal energy transfer. Building on our previous work,[1] we examine non-radiative energy transfer (NRET) between NQDs grafted on a hydrogenated Si surface via amine modified carboxy-alkyl chain linkers. A macroscopically thick, size–gradient NQD film is prepared on top of crystalline Si layer to explore directed energy tranfer into the substrate. Steady-state and time-resolved photoluminescence studies show effective energy transfer between adjacent layers and into the Si substrate with the transfer efficiency exceeding 90% among layers. This demonstrates the viability of NQD-Si hybrid structures for photovoltaic devices.

[1] H. M. Nguyen et al., *APL* **98**, 161904 (2011)

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