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Temporal Distributions of Optical Energy Transitions and Photoluminescence Quenching in CuInS2 with ZnS Capping and Alloy
QUINTON RICE, Hampton University, SANGRAM RAUT, University of North Texas, WAN-JOONG KIM, Electronics and Telecommunications Research Institute, RYAN RICH, RAFAL FUDALA, University of North Texas, MAHMOUD ABDEL-FATTAH, BAGHER TABIBI, Hampton University, IGNACY GRYCZYNSKI, ZYGMUNT GRYCZYNSKI, University of North Texas, SUNGSOO JUNG, Korea Research Institute of Standards and Science, JAETAE SEO, Hampton University — The semiconductor nanocrystals of $CuInS_2$ are of great interest for optoelectronic and biomedical applications, because of no intrinsic toxicity related to the heavy metals of cadmium or lead chalcogenide nanomaterials, large tunability, and high color purity. The photonic energy evolution of $CuInS_2$ quantum dots includes surface-trapped state recombination and defect-related donor-acceptor transition. The interface defect states of $CuInS_2$/ZnS and quantum confinement modification of $ZnCuInS_2$ adjust the temporal evolution of photonic transitions. The temporal evolution of shorter lifetime at surface-trapped states or interface states and longer lifetime at intrinsic defect-related states are widely distributed with relative distinct probabilities through the entire PL spectral region. The temperature-resolved PL reveals that the surface or interface-trapped electrons are thermally active even at low temperatures, but the electrons at intrinsic defect-related states are relatively stable. Acknowledgement: The work at HU is supported by NSF HRD-1137747 and ARO W911NF-11-1-0177.

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