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Optical properties of plasmon-coupled charge carriers in $CuInS_2$ and $CuInS_2$/ZnS QDs[1] QUINTON RICE, Hampton University, SANGRAM RAUT, RAHUL CHIB, University of North Texas Health Science Center, ANDERSON HAYES, Hampton University, ZYGMUNT GRYCZYNSKI, Texas Christian University, IGNACY GRYCZYNSKI, University of North Texas Health Science Center, YOUNG-KUK KIM, Korea Institute of Materials Science, BAGHER TABIBI, JAETAE SEO, Hampton University, HU TEAM, UNT TEAM, TCU TEAM, KIMS TEAM — The optical properties of plasmon-coupled charge carriers in copper indium disulfide (CIS) and CIS/ZnS QDs were investigated by time-resolved and temperature-dependent photoluminescence (PL) spectroscopy. The fractional Purcell enhancement of plasmon-coupled charge carriers in CIS was observed at shorter, intermediate, and longer spectral regions. The PL lifetimes at surface-/interface-trapped states and shallow-defect states are relatively shorter than those at at deep-trapped states. The temperature-dependent PL studies revealed that the plasmon-exciton coupling reduces the PL thermal quenching, and the charges at surface-/interface-trapped states and shallow-defect states are thermally active compared to the charges at deep-trapped states. The reduction of non-radiative decays in addition to the strong local field leads to the large PL enhancement. The larger PL enhancement of plasmon-coupled CIS/ZnS in comparison with that of plasmon-coupled CIS is accredited to the significant defect-mediated Purcell enhancement for bright emission materials. The Purcell enhancement of plasmon-coupled QDs is attributable to the coupling between plasmon and defect-related carrier pairs through Coulomb interaction and the local field enhancement.

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