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Decoding the Self-assembled Plasmonic Nano-structure in Colloidal Quantum Dots for Photodetectors

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Hybrid plasmonic nanostructures have raised great interest for being used in a variety of optoelectronic devices, due to the surface plasmon resonance (SPR). Charge carriers trapped in colloidal quantum dots (QDs) at localized surface defects is a key issue in photodetectors. Self-assembled hybrid metal/quantum dots can couple plasmonics and quantum properties to photodetectors and modify their functionality. Arranged and localized hybrid nanostructures impact on excitons traps and light harvesting. Here, we demonstrate a coupling hybrid structure using self-assembled gold nanoparticles (Au NPs) doped in PbS QDs solid for mapping the interface structures and the motion of excitons. Grazing incidence small angle X-ray scattering (GISAXS) was used to characterize the order of the Au NPs in the hybrid structure. Furthermore, by correlating the sizes of the Au NPs in the hybrid structure with corresponding differences in photodetector performance, we could obtain the interface carriers trapping influences in the coupling structure.

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