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Colloidal quantum dots solids for photovoltaics

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Colloidal quantum dots (CQDs) have been attracted many attentions on various electronic applications, like light emitting diodes (LEDs), photo detectors (PDs), photovoltaics (PVs) etc. due to their unique intrinsic properties, like tunable energy band-gap, stability against ambient circumstance. Comparing with cadmium chalcogenides CQDs, the lead chalcogenides CQDs reveal much weaker exciton binding energy because of the smaller effective electron mass, which is beneficial for the extraction of electrons and therefore suitable for applications in PVs rather than LEDs.
The functional CQDs'array films made by one of various solution processes, like spin coating, spay-coating or dip coating in room conditions would inevitably have disordering film structure and bring in many trap states. The thermal treatment is a regular method in organic PV device fabrication for the annealed crystalline of polymer but rarely used in CQDs film for fabricating related devices. In this work, we proceeded the thermal treatments on our CQDs'films with different temperatures and used grazing incidence small angle / wide angle x-ray scattering (GISAXS/ GIWAXS) to investigate the inner structure of thermal treated CQDs' films, including the super-lattice structure, inter dot spacing and the Nano-crystals orientations. We also used pump-probe transient absorption (TA) spectroscopy to observe the order of energy distribution and qualitatively evaluate the yield of generated excitons.

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