Colloidal CdSe Tetrapod Nanocrystals for Thin Film transistors

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Colloidal semiconductor nanocrystals have drawn keen attention as one of the most attractive materials for high performance thin-film electronic/optoelectronic devices for many years, due to their superior electrical transport and well-known unique physical properties. However, the carrier transport through the assemblies of nanocrystals is limited by inefficient inter-nanocrystal hopping processes. In order to overcome such limitation, many alternative steps have been tested. Typical approach is to replace bulky ligands attached on nanocrystal surfaces or to control the structure or shape of nanocrystals. In this study, we utilized tetrapod (TP)-shaped colloidal CdSe semiconductor nanocrystals with arm lengths up to 100 nm. In the framework of ionic gel-gate thin film transistor system, CdSe tetrapod networks treated with sodium hydroxide showed the electron mobility up to 10 cm2V-1s-1, which is about a 10-fold improvement when compared with the values obtained from the assemblies of spherical CdSe nanocrystals. This enhancement is attributed to the extended delocalization of carriers within a tetrapod nanocrystal and, at the same time, the reduced number of carrier hopping necessary within the same path length of CdSe TP networks.