

InP Quantum Dot – Organosilicon Nanocomposites

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InP quantum dot (QD) - organosilicon nanocomposites were synthesized and their photoluminescence quenching was mainly investigated because of their applicability to white LEDs (light emitting diodes). The as-synthesized InP QDs which were capped with myristic acid (MA) were incompatible with typical silicone encapsulants. Post ligand exchange the MA with a new ligand, 3-aminopropyldimethylsilane (APDMS), resulted in soluble InP QDs bearing Si-H groups on their surface (InP-APDMS) which allow embedding the QDs into vinyl-functionalized silicones through direct chemical bonding, overcoming the phase separation problem. However, the ligand exchange from MA to APDMS caused a significant decrease in the photoluminescent efficiency which is interpreted by ligand induced surface corrosion relying on theoretical calculations. The InP-APDMS QDs were cross-linked by 1,4-divinyltetramethylsilylthane (DVMSE) molecules via hydrosilylation reaction. As the InP-organosilicon nanocomposite grew, its UV-vis absorbance was increased and at the same time, the PL spectrum was red-shifted and, very interestingly, the PL was quenched gradually. Three PL quenching mechanisms are regarded as strong candidates for the PL quenching of the QD nanocomposites, namely the scattering effect, Förster resonance energy transfer (FRET) and cross-linker tension preventing the QD's surface relaxation.

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