Orthogonal Processing for Soluble-Processable Quantum Dot Light Emitting Devices

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Abstract

Colloidal semiconductor nanocrystals, so called quantum dots (QDs), have been known to have wide emission range according to their crystal size, high luminous efficiency and good color purity. These advantages coupled with the solution processability of QDs provide enough motivation to studying Quantum dot Light-Emitting Diodes (QLEDs) for next generation display technology. It is, on the contrary, probable that the solution processability of QDs turns into an obstacle when multi-layered device structures are to be fabricated for an efficient device operation. Solutions of QDs in organic solvents can erase or at least cause delamination of underlying hole-transporting layers mainly composed of vacuum-depositable small molecules during the QD casting stages. Without doubt, damaged hole-transporting films lead to lower luminescence efficiency and early device failure.

This recognition made us develop unique QD solutions using highly fluorinated solvents, which are inherently benign to non-fluorinated organic materials. By way of ligand exchange surrounding QDs with highly fluorinated thiol ligands, the QD solutions could form uniform films on top of organic hole-transporting materials, which allowed fabrication of QLEDs having the same device structure as ordinary small molecule-based OLEDs. Along with QD modifications, device characteristics of fluorinated QDs will be reported here.

References

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Figures

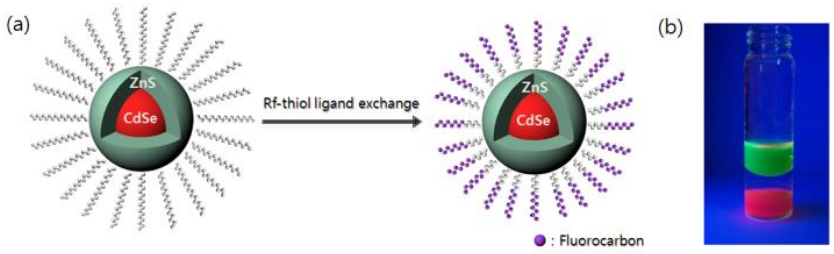

Figure. QD Ligand Exchange for dissolving in Highly Fluorinated Solvents