# Surface ligand engineering of PbSe nanocrystal quantum dots for improved stability

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Intriguing physicochemical properties of colloidal lead selenide nanocrystal quantum dots (PbSe NQDs) offer the opportunity for various applications. However, PbSe NQDs degrade rapidly under ambient conditions and this vulnerability strongly hinders the reliable applications of PbSe NQDs. Although surface ligands serve as a protecting layer from oxidation, inherently under-coordinated sites provide the significant chance for attack by oxygen.

We have developed for the first time that ligand engineering approach to effectively passivate the surface of PbSe NQDs. Our experimental observation by nuclear magnetic resonance (NMR) spectroscopy directly reveals that surface ligand engineered PbSe NQDs are passivated by phosphonic acid derivatives. Absorption spectroscopy shows the highly improved air stability of surface ligand engineered PbSe NQDs. Furthermore, based on understanding the surface ligand engineering, we have successfully achieved the versatile utilization of various ligands in PbSe NQDs for improving the air stability.