

*Halide-Functionalization of Lead Sulfide Quantum Dots for Conductive Thin Films*

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Lead sulfide quantum dots (PbS QDs) have shown great promise in recent years as sensitizers for next-generation solar cells and active layers for thin-film transistors. Controllable halide-functionalization of the surfaces of PbS QDs holds promise for improving the performance of QDs within these applications by passivating surface states and improving interdot charge transfer. This presentation will report on work to generate ultrathin, close-packed films of halide-functionalized PbS QDs suitable for incorporation into thin-film devices. Ultrathin films of oleate-capped PbS QDs were self-assembled on a liquid subphase and subsequently ligand-exchanged using various tetraalkylammonium halide salts. Displacement of the native oleate by the halide was confirmed by measuring contraction of the film and by monitoring the concentration of displaced oleate in the liquid subphase with nuclear magnetic resonance spectroscopy. These results show that these halides are able to displace the native oleate and that the rate of film contraction is limited by this rate of oleate displacement. Comparisons of different halide salts show that the use of sterically bulky counterions facilitates oleate displacement. This work provides a general toolbox that will enable future studies of the effects of halide-functionalization of charge transport properties of QD thin films.