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Ferritin-encapsulated PbS quantum dots for use in Dye Sensitized Solar Cells KAMERON HANSEN, CAMERON OLSEN, RYAN PETERSON, ALESSANDRO PEREGO, JOHN COLTON, RICHARD WATT, Brigham Young University — Lead ll Sulfide (PbS) is an intrinsic semiconductor with direct band-gap in the IR range, and thus is an attractive candidate for use as a photon-absorber in dye-sensitized solar cells. However, PbS quantum dots inside the mesoporous TiO_2 layer have been known to be unstable and suffer from severe clustering. We experiment encapsulating PbS QD in native protein ferritin with the goal of improving the stability and spatial homogeneity of PbS+TiO_2's photovoltaic response. We build off reported colloidal chemistry methods to synthesize PbS QD inside ferritin, and we provide detailed characterization of the resulting quantum dots' quality, size, and optical properties. Specifically, inductively coupled plasma mass-spectroscopy is used to measure lead concentrations, Bradford protein assay to measure protein concentration, photoluminescence and optical absorption spectroscopy to measure band-gap energies, and HRTEM to measure core diameters. Our results show no significant difference between the aerobic and anaerobic synthesis methods. DSSCs are fabricated using PbS-FTN as the dye, and an overall efficiency of 0.19 percent is achieved.

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