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Light-assisted delithiation of lithium iron phosphate nanocrystals towards photo-rechargeable lithium ion batteries

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Abstract

Recently, intensive efforts are dedicated to convert and store the solar energy in a single device. Herein, dye-synthesized solar cell technology is combined with lithium-ion materials to investigate light-assisted battery charging. In particular we report the direct photo-oxidation of lithium iron phosphate nanocrystals in the presence of a dye as a hybrid photo-cathode in a two-electrode system, with lithium metal as anode and lithium hexafluorophosphate in carbonate-based electrolyte; a configuration corresponding to lithium ion battery charging. Dye-sensitization generates electron–hole pairs with the holes aiding the delithiation of lithium iron phosphate at the cathode and electrons utilized in the formation of a solid electrolyte interface at the anode via oxygen reduction. Lithium iron phosphate acts effectively as a reversible redox agent for the regeneration of the dye. Our findings provide possibilities in advancing the design principles for photo-rechargeable lithium ion batteries.