Title:	Self-Assembled Oligothiophenes for Photocatalytic Hydrogen Production and Simultaneous Organic Transformation
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Keywords:	Self-Assembled Oligothiophenes Photocatalytic Hydrogen Production and Simultaneous Organic Transformation
Issue Date:	2022
Publisher:	ACS Publications
Citation:	ACS Applied Nano Materials, 5(10), 14746-14758.
Abstract:	Herein, we have fabricated self-assembled semiconducting organic nanomaterials with various morphologies (1D-fiber, 2D-flakes, and 2D-nanosheets) made of small conjugated oligomer 2,2′:5′,2″:5″,2‴-quaterthiophene (α-QTH) by a simple solution-based coprecipitation method. By simply varying the good-solvent-to-bad-solvent ratio, we can critically tune the self-assembly process and eventually can control the intermolecular interactions of the constituent molecules in these self-assembled nanostructures. Different types of self-assembled nanostructures have been utilized for photocatalytic solar H2 production. The H2 production efficiencies directly depend on the morphology of self-assembledselfassembled nanomaterials as well as intermolecular interactions of QTH molecules. The overall photocatalytic properties are further correlated with the ongoing photophysical properties by means of detailed steady-state and time-resolved fluorescence spectroscopy and dimer-based time dependent-density functional theory (TD-DFT) calculations. Furthermore, femtosecond transient absorption spectroscopy has been utilized to explore the detailed photoinduced exciton dynamics by global analysis of spectrally resolved pump–probe traces. In addition to that, the overall photocatalytic activities are further supported by an in-depth electrochemical study. Finally, a boost in photocatalytic H2 production has been observed by using 4-methylbenzyl alcohol (4-MBA) as a specific hole scavenger for the completion of the redox cycle. Therefore, the present system can be utilized for simultaneous solar H2 production and the specific organic transformation through a green and cost-efficient approach.
Description:	Only IISER Mohali authors are available in the record.
URI:	https://doi.org/10.1021/acsanm.2c03061 (https://doi.org/10.1021/acsanm.2c03061) http://hdl.handle.net/123456789/4912 (http://hdl.handle.net/123456789/4912)
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