Very Active Photocatalysts Based on Conjugated Polymer Nanostructures for Water Treatment and Water Splitting

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Visible-light responsive photocatalysts can directly harvest energy from solar light offering a desirable way to solve energy and environment issues.

We have shown that conjugated polymers (CPs) (in particular Polydiphenylbutadiyne, (PDPB) Poly(3,4-ethylenedioxythiophene (PEDOT), Poly(3-hexylthiophene) nanostructures (P3HT), and poly(pyrrole) (PPy) emerge as a new class of photocatalysts very active under visible light without the assistance of sacrificial reagents or precious metal co-catalysts.[1,2,3,4] These polymer nanostructures are synthesized in soft templates provided by hexagonal mesophases. These stable and cheap polymer nanostructures are easy to process and can be reused without appreciable loss of activity.

These conjugated polymer nanostructures are very active for water treatment. [1,2,3,4] P3HT nanostructures can easily be deposited on flat supports such as quartz for photocatalytic applications avoiding a separation step by centrifugation. The photocatalytic activity of these P3HT nanostructures for water treatment is highly enhanced when they are supported on a solid surface opening new perspectives in photocatalytic reactors and self-cleaning surfaces.[3]

PDPB nanostructures when dispersed in water, and in the absence of sacrificial agents or co-catalysts, can perform photocatalytic water oxidation under visible light excitation. [5] Charge recovery at the nano-PDPB directly or delayed in time was exemplified by the reduction of quinone acting as a hydrogen reservoir. In the absence of quinones as electron acceptors H_2O_2 formation was detected, stemming from the partial reduction of O_2. Recent results on hydrogen production with nanomaterials based on conjugated polymers will also be presented. [6]

Our results demonstrate that CPs nanostructures offer the perspective of development of a new generation of efficient and cheap visible light driven photocatalysts for environmental protection and water slitting.

References

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