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Block Copolymer Nano-Structured Materials

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Comments
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Michael Fryd and Bradford B. Wayland
Block Copolymers as Nanoscale Reactors to Form Semiconductor Composite Materials
Schematic Dye Sensitized Solar Cell (DSC)
Chromophore Sensitized Photoanode (A) and Photocathode (B)
Nanostructures of PS-b-PAA Films

R. J. Composto, C. Xu
Porphyrin Chromophore Covalently Linked to the Hydrophilic Block of PS-b-P(Sty/MANH)

Xuefeng Fu
Modified DSC Type Cell

Wayland, Fryd, Dai, Park, Fischer

Photosensitized mesoporous semiconductor: with and without polymeric template
A Solid State Cell Formed by Self Assembly of Amphiphilic Block Copolymers in Thin Films
Tuning the Photosensitizer Energy Levels

![Diagram showing energy level diagrams for porphyrins.]

**A**
- 
- e releasing por
- e withdrawing por
- π
- π*

**B**
- LUMO
- HOMO
- por
- por^+-por
- por^+

---

**R₁** -- Provide systematical tuning of the energy levels:

\[ R₁ = \text{electron releasing} \]

**R₂** -- Provide ionic properties to porphyrin (for self assembly and water solubility)

\[ R₂ = \text{X (electron withdrawing)} \]

**R₃** -- Attachment of porphyrin to the semiconductor:

\[ R₃ = \left[\text{CH=CH}_n\text{CO}_2\text{H}, \text{CH=CH}_n\text{CS}_2\text{H} \right]; n = 0,1,2,3... \]

**R₄** -- Incorporation or attachment of porphyrin to polymer:

\[ R₄ = \text{OH} \]
Photosensitizer – Semiconductor Interfaces

\[ \text{Ti(OR)₄ + H₂O} \rightarrow \text{TiO₂ formed in situ} \]
Quantum Dot Photosensitized Semiconductors

So-Jung Park

TiO$_2$ nanowires grown in a block copolymer template

TiO$_2$ nanowire array

Remove template

COOH

COOH

QD

(A)

(B)

(C)

25 nm

PL intensity

Wavelength (nm)
Encapsulation of Quantum Dots by Block Copolymer Nanostructures

Brenda S. Gaytan, So-Jung Park, Weihong Cui

PS-b-PAA

PS-b-PAA → DMF/H2O → QD → Encapsulated Quantum Dots
• TEM images of the stabilized QDs

• Fluorescence of the stabilized QDs
Fabrication of Pt Nanoparticles for PEFC

Weihong Cui

- Schematic illustration of the Pt nanoparticle synthesis

- AFM and TEM images of the Pt particles stabilized by block copolymers