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## TiO<sub>2</sub> Nanomaterials Sensitized by Porphyrins – Study of Electron Injection and Back Recombination Processes

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Over the past few years, sensitization of large band gap semiconductors by organic dyes has received considerable attention in research due to the potential applications of such Dye/Semiconductor (D/SC) systems. One of the important applications of such D/SC systems is in the photoanodes of Dye Sensitized Solar Cells (DSSCs), the semiconductor of choice in such systems being TiO<sub>2</sub><sup>[1]</sup>. Effective electron transfer from the excited dye to the TiO<sub>2</sub> conduction band requires good electronic coupling between the two. Hence the scientific focus is on dye sensitization of TiO<sub>2</sub>. Among various categories of dyes used as photosensitizers, Porphyrins are promising because of their strong Soret absorption and moderate Q-band absorption. The present talk will focus on the work done at our laboratory on the synthesis of interesting TiO<sub>2</sub> based nanomaterials i.e. nanoparticles and nanosheets and their subsequent sensitization by porphyrins. The emission intensity of the porphyrin dyes is quenched by the TiO<sub>2</sub> based nanomaterials and the dominant process for this quenching has been attributed to photoinduced electron injection from the excited state of porphyrin to the nanomaterials. We have shown how the Porphyrin/TiO<sub>2</sub> systems show extremely fast rates of electron injection (10<sup>11</sup> s<sup>-1</sup> for the porphyrin/nanosheet system) while the rate of back recombination is much retarded (10<sup>3</sup> s<sup>-1</sup> for the porphyrin/nanoparticle system). Both these effects will be beneficial for efficient functioning of future solar cells based on such photoanode materials.

### References

- [1] B. O'Regan, M. Gratzel, *Nature* **353** (1991) 737-740.

### Biography:

Swati De did her PhD in 1998 under Professor Kankan Bhattacharyya, a renowned spectroscopist. She joined the Department of Chemistry, University of Kalyani, India as an Assistant Professor in 1999. She has been there since and is presently Professor. She did her post doctoral work with Professor Villy Sundstrom at Lund University, Sweden.

She has published several research papers, one invited Book Chapter in the *Encyclopedia of Biocolloid and Biointerface Science*, John Wiley and Sons. She has an h-index of 19 (Scopus). She has completed guidance of 7 Ph.D students and several others are working. Her research interests are: Application driven synthesis of nanomaterials and Fluorescence probing of membrane mimicking systems.