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FABRICATION OF ELECTRONICALLY ACTIVE HYBRID PHOTOSYNTHETIC REACTION CENTER PROTEINS AND METALS

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Efficient electronic junctions were fabricated by covalent binding of photosynthetic reaction center proteins to metals, semiconductors polymer poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) and solid semiconductor ITO. The primary stages of photosynthesis take place in nanometric-size protein-chlorophyll complexes photosystem I (PSI). PSI generates a photo voltage of 1 V with an absorbed light-energy conversion efficiency of 47% (~23% solar energy) and a quantum efficiency of ~100%. The robust cyanobacterial PSI was used in the fabrication of optoelectronic devices by forming oriented multilayers from genetically engineered cysteine mutants. Oriented multilayers were fabricated by covalent binding of successive layers of PSI using cross-linking molecules. Photosystem I layers were bound to metal and transparent conducting semiconductor electrodes under dry environment. The devices generated sizable photocurrent and photo voltage. The rate of photocurrent indicated the formation of a good electronic coupling between PSI and the electrodes. These devices can serve in the fabrication of hybrid bio-solid-state optoelectronic devices.

Recent Publications

1. **X-M Gong,Y Hochman, T Lev, G Bunker and C Carmeli (2009) The structure of genetically modied iron–sulfu rcluster Fx in photosystem I as Determined by X-ray absorption spectroscopy. Biochimica et Biophysica Acta 1787:97–104.**
2. **L Sepunaru, I Tsimberov, L Forolov, C Carmeli, I Carmeli and Y Rosenwaks (2009) Picosecond electron transfer from photosysnthetic reaction center protein to GaAs. Nano Letters 9(7):2751-2755.**
3. **H Toporik, I Carmeli, I Volotsenko, M Molotskii, Y Rosenwaks, C Carmeli and N Nelson (2012) Large photo voltages generated by plant photosystem I crystals. Advanced Materials 24:2988–2991.**
4. **Carmeli, I, Kumar, KS, Heifler, O, Carmeli, C and Naaman R (2014) Spin selectivity in electron transfer in photosystem I. Angewandte Chemie International Edition 53:(34) 8953-8958.**

Biography

Chanoch Carmeli is a Prof. Emeritus at Tel Aviv University, Israel. He has served as Chair & Head at the Department of Structural Biology. His research interests include nano-technology of biological molecules, photosynthetic reaction center, structural biology (EXAFS) of biological metal canters and proton turbine ATP synthase. He was a Visiting Professor at UCLA, London University, UCSB, Curie Institute, Roche Institute, Cornell University and University of California, Berkeley. He has 106 scientific publication and six patents.

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