Electrochemical Analysis of Photosystem I Films Deposited On Various Electrode Materials

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Electrochemical techniques such as chronoamperometry, cyclic voltammetry, and scanning electrochemical microscopy (SECM) have been utilized to investigate the interface between a photoactive membrane protein and electrode materials. Photosystem I (PSI) is a protein complex found in the thylakoid membrane in plants that is responsible for electron excitation in the process of photosynthesis. The extraordinary internal quantum efficiency of PSI, approaching 100%, has made PSI a unique material to study in non-biological settings. Our lab has developed a facile method for depositing thick films of this photoactive protein on the surface of electrodes. We recently published work in which a platinum catalyst could be integrated with a film of PSI on a gold electrode for solar energy conversion. Here we describe how tremendous photocurrent enhancements are possible by using a semiconducting electrode rather than metal electrodes. We demonstrate how this interface may be investigated by changing the doping type and density of the semiconductor as well as the electrochemical mediator. Additionally, we will discuss our work concerning integrating PSI with carbon based materials.