Universität Basel

Research Project

In-situ monitoring of the photochemical coupling of oligothiophenes to surface bound metal complexes in nano-porous materials

Third-party funded project

Project title In-situ monitoring of the photochemical coupling of oligothiophenes to surface bound metal complexes in nano-porous materials
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A well defined functionalisation of nano-porous semiconductor networks on solid substrates promises the development of materials with unmatched properties. A prime example for this statement is the dye-sensitized nano-crystalline solar cell (DNSC “Grätzel Cell”), which has triggered numerous fascinating research projects as well as the prospect of low cost photovoltaic cells. At the center of DNSCs is the interface between the dye and the electrolyte. In order to build the most efficient solar cells, it is still necessary to have liquid organic solvents with iodine/iodide as redox active part. For a number of reasons it is desirable to replace the solvent by solid hole conductors. Moreover, it seems to be attractive to covalently bind the dye to the polymeric hole conductors, and this has been attempted by a few groups. It has been reported that working devices can indeed be built in this way. Nevertheless, the overall solar to electrical energy conversion efficiency of these solar cells is low and no detailed analysis of the polymers or the chemical bond between the polymer and the dye has been reported.
This reflects the fact that while the properties of the nano-porous electrodes are intriguing, it is difficult to unambiguously characterize the processes taking place inside the films.
In this context this proposal aims at the detailed analysis and in-situ control of the photoelectrochemical coupling of the surface bound dye with thiophene oligomers. The ultimate goal of this research project is to find the conditions for coupling and to prove that coupling takes place. For this purpose a versatile instrument has been developed based on scanning electrochemical microscopy (SECM), which is expanded with a light source to perform photoelectrochemistry and with an optical fibre to follow the coupling process spectroscopically.

Keywords nanotechnology, dye-sensitized, conducting polymers, thiophene, surface synthesis, solar cell
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