NANOSTRUCTURED ARCHITECTURES OF TRANSPARENT CONDUCTING OXIDES FOR BIOINSPIRED OPTOELECTRONICS

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Photoelectrochemical energy conversion based on the natural systems such as enzymes or photosystems is an attractive and intensively explored concept, which could benefit from the evolution-optimized conversion efficiency of the biological units. The development of bioelectronic devices requires connecting the biological systems in an optimized way to the electrodes and understanding the fundamental issues in the context of their interfacing. We have developed transparent electrodes with custom designed porous 3D-electrode architectures enabling incorporation of large amounts of biomolecules and featuring optical transparency allowing interaction with light. Our approach is based on the assembly of nanoparticles of transparent conducting oxides such as antimony-doped tin oxide (ATO) and indium tin oxide (ITO) directed by different templates for porosity such as novel amphiphilic polymers (PEO-b-PHA) or PMMA beads [1-2]. The high crystallinity of the nanoparticles serving as building blocks enables the formation of fully crystalline porous transparent scaffolds with high electrical conductivity and accessible porosity, which can incorporate various redox moieties ranging from small redox proteins to large protein complexes and show greatly enhanced electrochemical response proportional to the electrode surface area [3-4].

Keywords: Nanostructured transparent conducting oxides, Nanoparticles, Optoelectronic devices

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