Light-Induced Proton Pumping with a Semiconductor: Vision for Photoproton Lateral Separation and Robust Manipulation

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In the work we focus, for the first time, on the possibility of efficient transformation of electromagnetic radiation energy into local pH shift simulating a proton pump in biological cells. Under ultraviolet illumination of mesoporous TiO2 films a series of photocatalytic reactions was shown to result in a local change in pH of solution. The efficiency of proton generation was monitored by in situ ion selective microelectrode technique (SIET) for mapping the activity of protons over the surface under local irradiation. Imaging and localization of the positions of hole or electron-induced reactions across the TiO2 surface relative to the irradiation spot were also measured with the scanning vibrating electrode technique (SVET) (Figure below). In general, the developed nano-engineered systems represent a generic technological tool, which opens numerous applications in chemical technology, biotechnology and bioanalytical chemistry, including:

· addressable microsamplers and microdispensers well-compatible with laboratory-on-chip;
· light-healing dynamic surfaces;
· anti-fouling surface;
· stimuli-trigged nanocapsule arrays and membranes;
· 'smart' supports for growing cells and tissues;
· controlled implant coatings;
· drug delivery;
· (bio-)sensors.

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