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Book review

Semiconductor Electrodes and Photoelectrochemistry
St. Licht (editor), Volume 6 of *Encyclopedia of Electrochemistry*, A. Bard, M. Stratmann (editors), Wiley-VCH, Weinheim, 2002, ISBN: 3-527-30398-7, X+597 pages, € 349.00

The introduction by K. Rajeshwar presents the development of semiconductor photochemistry, documented by 298 references. Unfortunately the early stages of this development are omitted. Thus, the mercury-electrode photoelectrochemistry called photopolarography (H. Berg, Jena) or photovoltammetry was established already in the 1960s [Naturwissenchaften 47 (1960) 320; Nature 19 (1961) 1270; Electrochim. Acta 9 (1964) 425], and G. Barker (Harwell) and M. Heyrovsky (Prague) investigated the ''photo electron'' capture by scavengers in solution. Only afterwards the laboratories of Frumkin and Gerischer started experiments with irradiation of other metals and in particular TiO_2.

All six chapters of this book (Fundamentals, Experimental techniques, Semiconductors, Solar energy conversion without dye sensitation, Dye-sensitized photoelectrochemistry, and Nonsolar energy application) deal with photoelectrochemistry from the point of view of light/sun interaction with semiconductor/electrolyte systems, especially TiO_2, but not ''classical'' metal electrodes. In the center of interest are all sorts of solar energy conversions for industrial and private purposes, as well as the increase of their efficiencies.

For bioelectrochemists and photobiologists, Chapter 6, dealing with photocatalysis on the basis of TiO_2, is of main interest. In 1977, Bard and coworkers started experiments in which reduced forms of oxygen ($\cdot O_2^-$, $\cdot O_2H$, H_2O_2, HO_2^-, $\cdot OH$, $\cdot O^-$) are produced by irradiation with 300–400 nm light. These species decompose organic compounds and thus can be used for cleaning materials, air and water, but also for disinfection from microorganisms if sensitized by added ruthenium–pyridine complexes. Of considerable interest is the killing of cancer cells, e.g. U937 leukemia cells, using colloidal TiO_2. Skin cancers of mice were injected with finely powdered TiO_2 and illuminated by means of fiber optics (A. Fujishima et al., Photocatalysis: Fundamentals and applications, BKC, Tokyo, 1999). This treatment is comparable to that of photodynamic effects obtained with dyes (thiopyranin, protoporphyrin) which are illuminated in the visible range (400–800 nm). The two techniques differ not only in the wavelengths used, and therefore should be compared with respect to their efficacies for cancer therapy. Last not least the novel technique of optimal image recording by means of photoelectrochemical processes should be mentioned.

Containing a large number of references until 2001 this monograph presents the state of the art of semiconductor photoelectrochemistry.

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