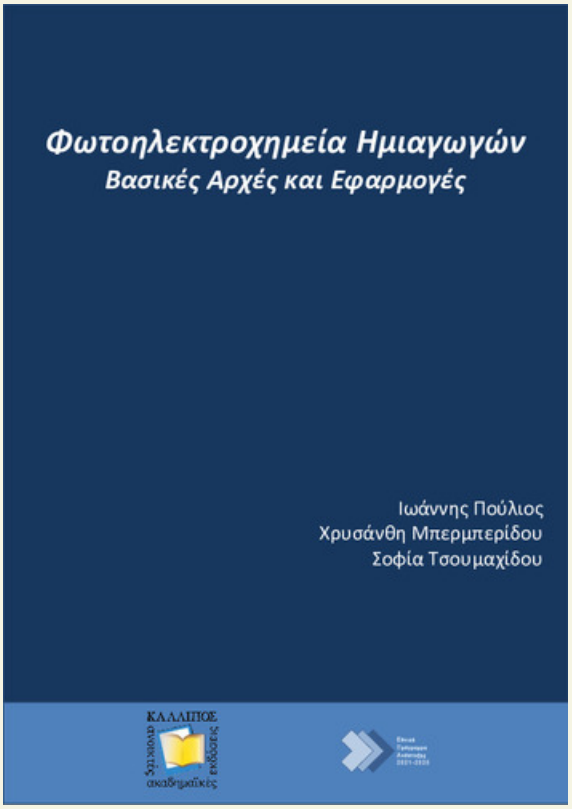

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Abstract

Photoelectrochemistry of semiconductors is a relatively new field of Electrochemistry, dealing with the electrochemical processes occurring at the interfaces of semiconducting materials with electrolytic solutions, both in the absence and presence of illumination. It is an interdisciplinary field that relies on principles from Semiconductor Physics, Electrochemistry, and Photochemistry. Although the first known reference to the photoelectrochemical phenomenon was made by Bequerel 170 years ago, the real development of this scientific field began after 1950. This growth was due to the availability of single-crystal semiconductors suitable for fundamental research and a better understanding of many physicochemical properties of these materials. The peculiarities the semiconductor/electrolyte heterojunctions present compared to their metal/electrolyte counterparts under light, make semiconducting materials particularly suitable for applications in solar energy utilization, environmental protection, organic synthesis, chemical etching, anti-corrosion protection, and many other fields. The photoelectrochemical phenomenon, along with the photovoltaic effect and plant photosynthesis, are the only methods capable of directly converting solar energy into useful energy. The potential provided by Photoelectrochemistry for the direct conversion of sunlight into chemical or electrical energy led to its rapid development after the 1970s. During that period, the first photoelectrochemical cells for converting solar energy into electricity appeared, significantly contributed to by eminent electrochemists like H. Gerischer, A. Bard, R. Memming, A. Fujishima, and H. Grätzel, among others. These cells constitute an intermediate state between common galvanic cells and photovoltaic cells, and with appropriate modifications, they achieve not only the conversion of solar energy into electricity but also the direct splitting of water into hydrogen and oxygen or the reduction of CO2 into useful chemical compounds. Among other applications, the inactivation of toxic substances and pathogenic microorganisms in water and air is of particular interest, integrating solar energy into the purification process (heterogeneous photocatalysis, photoelectrocatalysis, self-cleaning surfaces), a field with intense research activity over the last three decades.

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