Comment on Photoelectrochemistry

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Workshop III at the IPS10-meeting was organized by H. Tributsch and F. Willig. The workshop consisted of three sessions, each taking place on a separate day with a duration of 80 minutes. Each session comprised three short key note lectures and a discussion period. The lectures addressed topics of fundamental importance for the understanding and utilization of photo-electrochemical processes at semiconductor electrodes.

The first session of the workshop was devoted to interfacial electron transfer. It was a fortunate situation that the three speakers of the first session represented with their work a great deal of the current know-how and the recent progress in this field, particularly in developing appropriate measuring techniques and a better understanding of the most basic processes in semiconductor photoelectrochemistry, i.e. electron transfer across the semiconductor/redox electrolyte interface. In their lectures N.S. Lewis, A.J. Nozik, and R.J. Dwayne Miller, addressed different aspects concerning the time scale and the mechanism of the interfacial electron transfer reactions at semiconductor electrodes. The second session of the workshop was devoted to the mesoscopic (nm-structured) TiO2 electrode. Experiments on stationary and time-resolved measurements of the photocurrent in this electrode were described in a first lecture by Sten-Eric Lindquist and in a second lecture by Anders Hagfeldt. This type of electrode has recently attracted considerable attention, mainly because of its potential for an application as a new type of solar cell. The third lecture in this session was delivered by Jacques-E. Moser. It bridged the topics of the first and second session in dealing with dye sensitized charge injection and recombination at the surface of the nm-structured TiO2 electrodes. In the third session K. Uosaki showed in his lecture that nm structures can be formed electrochemically also on initially flat p-GaAs wavers. T.J. Schaafsma gave a talk on photocurrents generated by porphyrins in contact with wide band gap semiconductors like TiO2 and SnO2. However, in contrast to the dye-sensitized nm-structured TiO2 cell, this cell was all solid state. In the following talk S. Licht discussed the iodide, iodine redox system, which has been frequently employed in various photoelectrochemical cells. In the
last talk of the workshop Parmon outlined a new proposal concerning the mechanism of water splitting at iron-hydroxides.

Since the field is very alive and therefore the discussion at some points still controversial, the organizers and the speakers agreed that they can best represent the important points of the discussions during the workshop by adopting the following format for this report. Each speaker at the workshop has summarized his main points in a two to three page contribution with some key references. Except for one contribution, all the lecturers at the workshop have provided such a summary. These summaries are presented on the next 30 pages in the sequence in which they were delivered at the workshop with each author of the summary indicated.

To enable a quick survey, the original short list of key references has been kept at the end of each separate lecture summary, rather than composing a new joint list of references at the end of this report. The summaries of the different lectures are followed by a few pages added by the two organizers of the workshop. They were added with the intention to help readers who are not specialists in this field to note the main points and relate them to the current state of the art. The background information and comments should be considered as the personal views of the two organizers. The names of the contributors to this workshop appear as authors in the same sequence as the lectures were delivered during the workshop. At the end of the list the names of the two organizers are added.