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Journal of Photochemistry and Photobiology A: Chemistry 148 (2002) 1–3

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Preface

Academic conferences are the cornerstone of academic research. They provide an opportunity for the participants to present their latest work or review their subject and to meet others with similar interests. Conferences promote the sharing of knowledge, debate and collaboration and often inspire new directions of research. They allow young researchers to see the great and the good of their field in action and provide the opportunity for their entrance into the academic limelight. It is unfortunate, therefore, that conferences these days are becoming large annual or bi-annual multi-event productions which are not only expensive but are also often run on a significant profit-making basis. The disappearance of the possibly more amateur conferences is neither surprising nor unwelcome; rather it is the result of the march of time and the concomitant modernisation and improvement in much of what we do and how we do it. However, sometimes in modernising processes involving people, such as the organisation of a conference, we lose some of the essence of the thing. Conferences are the meeting places of people with a similar passion, rich or poor, old or young, the famous and the not so famous, the infamous and the not so infamous. The expense of attending a conference, certainly an international one, is becoming increasingly prohibitive these days, so much so that the conference scene is in danger of becoming a circuit of circuses, where the elite and wealthy in research entertain each other with what is often hackneyed material. One source of the increased expense of international conferences arises from the choice of venue, usually an expensive hotel, rather than a University campus. Another source is the included extras, such as an overproduced Book of Abstracts, conference bag, T-shirt, trips, breaks and lunches—extras that cannot be removed from the registration fee. The duration of meetings also contributes to an increased cost, as most international conferences are overlong affairs, lasting usually a week, with a half day in the middle and a much-reduced participation on the last day. Finally, a great deal of the expense of international conferences comes from the profit-making ethos of the organisers. In fact the profit making part can be so lucrative that some conferences are veritable institutions with a sizeable permanent staff.

It was with these personal moans that we decided in 1999 to try to organise an international conference that was slightly different. Our conference was to be non-profit making, intense and with very little 'frills' but, hopefully, still fun; the conference was called the 'First International Conference on Semiconductor Photochemistry', or SP-1 for short. The conference was set for three days, from 23rd (Monday) to 25th (Wednesday) July, at the University of Strathclyde, Glasgow. A demanding program was created, for presenters and participants alike, with lectures starting at 08.30 h and finishing at 18.00 h, followed by a 90-minute poster session in the evening. A rule of 'no parallel sessions' ensured that everybody could attend everything. The intensity of the sessions was offset by substantial tea and coffee breaks, and water and beer, wine and whisky for the more relaxed and informal evening poster sessions. The registration fee was set at a very low rate for full participants and even lower for students (i.e. £100 and £50, respectively). Indeed, the rate was so low that one international conference organiser and academic complained during the conference that it set a bad example! The local tourist board handled all the accommodation bookings (for free) using local, relatively inexpensive hotels. Of course, the very low registration rate was aided by sponsorship and we would like to thank: Degussa-Huels, Millennium Chemicals, Johnson Matthey, Pilkington Technology, Statoil, Halliburton, the Robert Gordon University, the Society of Chemical Industry (SCI), the Solid State Group of the Royal Society of Chemistry (SSG), the Scottish Enterprise Glasgow (SEG), Guinness and Elsevier for their support. This sponsorship was in various forms, including, money (Degussa-Huels, Millennium Chemicals, Johnson Matthey, Pilkington Technology, the Robert Gordon University, the SSG and the SEG), free bags (Halliburton and Statoil), free advertising (Elsevier and SCI) and free drinks (Guinness). All those who wanted to lecture were given the opportunity to speak, usually for 25 min and only three specially invited lecturers were given extended lecture slots of 40 min. It was very heartening to find that all the big names in the field agreed unhesitatingly to be present at the conference, even when offered only a 25 min slot, so as to allow many others, possibly less well known, to speak. The conference finale was a civic reception at Glasgow City Chambers kindly provided by the Lord Provost and Glasgow City Council. The event proved very popular, attracting 200 participants from 28 nations and the papers contained in this special edition provide just some measure of the diversity of subjects presented and discussed. Importantly, over 30% of the conference participants were research students. A questionnaire handed out on the last day of the conference had 95% of the participants concluding that the conference was extremely well organised and excellent value for money. With our first attempt at a

1010-6030/02/$ – see front matter
PII: S1010-6030(02)00075-8

'new' type of conference an apparent success, there is a real prospect of there being another in the field run along similar lines to SP-1, i.e. SP-2, although, hopefully, bigger and better. At present the venue for SP-2 is still under discussion, but when a decision is made, it will be announced on the conference web site: http://info.chem.strath.ac.uk/SP-1/.

So why a conference on semiconductor photochemistry? For those who regularly read this journal it will come as no surprise, since semiconductor photochemistry has been one of the major research themes in the last decade and looks set to maintain this position in the foreseeable future. In almost all cases, the semiconductor under study is titanium dioxide, a cheap, chemically and biologically inert and very photoactive material. It prompts the question why no other semiconductor can match TiO_2, especially when it is recognised that it is only a UV absorber, whereas, in most cases, a visible light-activated semiconductor is what is really required. You can be sure many are working frantically to topple the rein of 'king' TiO_2—but, so far, their efforts appear in vain.

One of the major thrusts in semiconductor photochemistry is in dye-sensitised solar cells, where the primary function of the semiconductor is as a medium for the efficient collection and transfer of photo-injected electrons from the adsorbed dye molecules on the irradiated electrode to the dark counter electrode through an external circuit. These cells appear very efficient and long lasting and are now under a limited scale of commercial production. The fundamental processes involved in the operation of these cells include: the photo-induced transfer of an electron from the adsorbed dye into the semiconductor, electron transfer through the semiconductor material, reduction of the oxidised dye by the redox couple in the cell electrolyte, usually I_3^-/I^-, and the undesirable back reaction between the oxidised dye and the injected electron. The first eight papers (MS 1–8) of this special edition reflect some of the range of research activity in this area and include studies of new dye sensitisers and fabrication processes and studies of the fundamental processes.

In two major areas of semiconductor photochemistry, the photogenerated electron is used to carry out a reduction reaction and the hole is used to carry out an oxidation reaction. If the change in Gibbs free energy for the overall reaction, i.e. ΔG^0, is positive for the uncatalysed process, then this is an example of semiconductor photosynthesis; and if ΔG^0 is negative, then it is an example of semiconductor photocatalysis. The next four papers in this special edition, i.e. MS 9–12, deal with that Holy Grail of photochemistry, the conversion of solar energy to chemical energy, through the photodissociation of water, driven by semiconductor photosynthesis. The reported systems here and elsewhere are still inefficient and require UV light, but it is only by carrying out such research can the necessary breakthroughs be made.

In contrast with semiconductor photosynthesis, semiconductor photocatalysis is a large and expanding area of research. Thus, all subsequent manuscripts in this special edition deal with semiconductor photocatalysis. For example, manuscripts 13–16 deal with the use of semiconductors to destroy volatile organics to produce carbon dioxide and hydrogen (without oxygen present) or water (with oxygen present). The use of semiconductor photocatalysis to destroy volatile organic carbons (VOCs) is becoming increasingly popular and it is somewhat surprising that there are not more papers on this topic in this volume. Manuscripts 17–22 describe the use of semiconductor photocatalysis for the destruction of dyestuffs and manuscripts 23–28 cover the destruction of other organics, such as phenol and benzene. The use of semiconductor photocatalysis to destroy organics, such as dyestuffs and phenols, dissolved in water has been a popular research theme over the last decade and some prototype water purification reactors are already available commercially. However, it is far from certain that such devices will ever attain mass production, instead they appear likely to be restricted to only very specialised applications. In contrast, semiconductor-coated glass is now a major commercial product (Pilkington Glass (UK and Europe), PPG (USA) and Saint Gobain (France)). This product acts as a light induced, self-cleaning glass and works through the process of semiconductor photocatalysis. In self-cleaning glass the pollutant is the thin layer of greasy organic material that initially deposits on glass and allows dirt and soot to then accumulate. Since semiconductor photocatalysis is now a major commercial enterprise, it is clear that a great deal of research into semiconductor photocatalysis, especially with regard to semiconductor films, can be expected over the next few years.

Manuscripts 29–33 deal with semiconductor photochemistry and metals, either as a method for metal removal from water, as in MS 29, or with regard to the deposition of metals as catalysts for enhancing the overall process of the photo-oxidation of organics by oxygen, sensitised by the semiconductor. In the latter systems, the research presented in this special edition shows that the deposited metal catalyst, usually Pt, is able to enhance or hinder the process of semiconductor photocatalysis depending on the type of TiO_2 used and the nature of the pollutant. More work is needed in this area for a better understanding of the role(s) of such metal 'catalysts'.

As noted above, in most of the papers reported in this special edition the semiconductor photocatalyst is TiO_2. It is of no surprise, therefore, that a great deal of effort is currently being directed to find ways to make TiO_2 work more efficiently. Manuscripts 34–44 deal with a myriad of approaches, from the use of ultrasound and microwaves to magnetic fields! Only time will tell if such systems are practical, robust and commercially viable. Manuscripts 45 and 46 deal with the use of semiconductor photocatalysis for the destruction of biological material and manuscripts 47 and 48 deal with the use of semiconductors in photoelectrochemical cells to purify water and for other, more fundamental, studies. Manuscript 49 deals with some more fundamental issues associated with semiconductor photocatalysis.

One major research theme in semiconductor photochemistry is not given adequate representation in this special edition, namely, the photo-induced superhydrophilicity of TiO_2 films. This phenomenon is reversible in the dark and appears to arise from the photogeneration of hydrophilic Ti(III) sites, which are then oxidised subsequently in the dark by oxygen. Only MS 43 deals with the subject, although Professor Fujishima, one of the pioneers in this field, described it very well in his plenary lecture. This phenomenon is one of the key reasons for the sudden commercialisation of TiO_2-coated self-cleaning glass (the other being semiconductor photocatalysis), since it renders the glass more wettable, easier to clean by rain, and less easy to sully. It is exceedingly likely that research into photo-induced superhydrophilicity will increase markedly over the next few years.

To conclude, semiconductor photochemistry is a strong and vibrant field of international research, as reflected by the number of participants and the wide range in their countries of origin at SP-1. It appears likely that the field will continue to thrive and prove commercially lucrative. It is hoped that upon reflection SP-1 will be seen to have contributed positively something to both the field of semiconductor photochemistry and the nature of international conferences.

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