

Editorial

Introduction by guest editors

This Special Issue of *Catalysis Today* includes a selection of some of the works presented at *The third European Meeting on Solar Chemistry and Photocatalysis: Environmental Applications (SPEA-3)*, held in Barcelona (30 June–2 July 2004). Some of the Congress's features can summarize it for us: The Scientific Committee was formed by 28 people from nine different countries (Argentina, Chile, France, Germany, Italy, Spain, Switzerland, USA and Venezuela). One hundred and forty-one delegates from 25 countries attended the congress. One hundred and thirty-nine communications were presented, 34 oral presentations and 105 posters. Two plenary lectures, one round table and two poster session discussions completed the congress. Together, they provide a very good idea of the state of the art of environmental applications of photocatalysis and solar chemistry.

The Congress focussed on photochemical and photocatalytic pollution treatment (air, soil and water) applications. The different topics covered were classified into nine areas: (1) water treatment and disinfection; (2) air treatment; (3) soil remediation; (4) green synthesis by solar-chemistry, photochemistry and photocatalysis; (5) development of new materials for photochemistry and photocatalysis; (6) developments and perspectives in environmental photochemistry; (7) commercial applications; (8) environmental management; (9) general questions.

As mentioned above, this Special Issue has been compiled from the scientific reports generated by the congress. It covers a wide spectrum of subjects involved in the field of photocatalysis within the scope of *Catalysis Today*. Evidently, photocatalysis means the combination of photochemistry and catalysis. Both light and catalyst are necessary to achieve or to accelerate a chemical reaction. Thus, photocatalysis may be defined as the “acceleration of a photoreaction by the action of a catalyst”. Heterogeneous processes employ semiconductor slurries for catalysis, whereas homogeneous photochemistry is used in a single-phase system. In the case of homogeneous photocatalytic processes, the interaction of a photon-absorbing species (transition metal complexes, organic dyes or

metalloporphyrines), a substrate (e.g. the contaminant) and light can lead to chemical modification of the substrate. The photon-absorbing species is activated and accelerates the process by interacting through a state of excitation. In the case of heterogeneous photocatalysis, the interaction of a photon produces the appearance of electron/hole pairs, the catalyst being a semiconductor (e.g. TiO_2 , ZnO , etc.). In this case, the excited electrons are transferred to the reducible specimen at the same time that the catalyst accepts electrons from the oxidizable specimen, which occupies the holes. In both directions, the net flow of electrons is null and the catalyst remains unaltered.

Given its characteristics, photocatalysis appears today to be a good tool for the treatment of recalcitrant or refractory pollutants to classical techniques such as biological treatment. This Special Issue illustrates the use of photocatalytic techniques (the so-called advanced oxidation processes, AOPs), among which heterogeneous photocatalytic wastewater treatment and gaseous stream treatment, photocatalytic disinfection, photocatalyst preparation, photo-electro-catalysis, homogeneous photocatalysis (photo-Fenton), as well as combinations of photocatalysis with other AOPs (ozone, sonication, etc.), are worth mentioning. Other studies on fundamentals and engineering of photocatalytic reactions are also presented. The point that ties all of these techniques together is the production of hydroxyl radicals, which are responsible for the oxidation processes.

The papers included here report on work carried out at different scales, from laboratory to pilot-plant, using several different sources of light, including sunlight. The type of description is also different in each case, from mechanistic discussions, kinetic fit and analyses, research on new catalysts, and system modelling as a prerequisite for scale-up. Indeed, we believe that the 27 papers included in this Special Issue represent a good overview of the state of the art of photocatalysis, covering a variety of aspects of these applications, and involving institutions from all over the world (Europe, USA, Japan, Korea and South-America).

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