Series Preface

With remarkable vision, Prof. Otto Hutzinger initiated *The Handbook of Environmental Chemistry* in 1980 and became the founding Editor-in-Chief. At that time, environmental chemistry was an emerging field, aiming at a complete description of the Earth's environment, encompassing the physical, chemical, biological, and geological transformations of chemical substances occurring on a local as well as a global scale. Environmental chemistry was intended to provide an account of the impact of man's activities on the natural environment by describing observed changes.

While a considerable amount of knowledge has been accumulated over the last three decades, as reflected in the more than 70 volumes of *The Handbook of Environmental Chemistry,* there are still many scientific and policy challenges ahead due to the complexity and interdisciplinary nature of the field. The series will therefore continue to provide compilations of current knowledge. Contributions are written by leading experts with practical experience in their fields. *The Handbook of Environmental Chemistry* grows with the increases in our scientific understanding, and provides a valuable source not only for scientists but also for environmental managers and decision-makers. Today, the series covers a broad range of environmental topics from a chemical perspective, including methodological advances in environmental analytical chemistry.

In recent years, there has been a growing tendency to include subject matter of societal relevance in the broad view of environmental chemistry. Topics include life cycle analysis, environmental management, sustainable development, and socio-economic, legal and even political problems, among others. While these topics are of great importance for the development and acceptance of *The Handbook of Environmental Chemistry,* the publisher and Editors-in-Chief have decided to keep the handbook essentially a source of information on "hard sciences" with a particular emphasis on chemistry, but also covering biology, geology, hydrology and engineering as applied to environmental sciences.

The volumes of the series are written at an advanced level, addressing the needs of both researchers and graduate students, as well as of people outside the field of

"pure" chemistry, including those in industry, business, government, research establishments, and public interest groups. It would be very satisfying to see these volumes used as a basis for graduate courses in environmental chemistry. With its high standards of scientific quality and clarity, *The Handbook of Environmental Chemistry* provides a solid basis from which scientists can share their knowledge on the different aspects of environmental problems, presenting a wide spectrum of viewpoints and approaches.

The Handbook of Environmental Chemistry is available both in print and online via www.springerlink.com/content/110354/. Articles are published online as soon as they have been approved for publication. Authors, Volume Editors and Editors-in-Chief are rewarded by the broad acceptance of *The Handbook of Environmental Chemistry* by the scientific community, from whom suggestions for new topics to the Editors-in-Chief are always very welcome.

Damià Barceló
Andrey G. Kostianoy
Editors-in-Chief

Volume Preface

Since the publication of part 2 of Environmental Photochemistry in 2005, this topic has continued to be an area of extensive research activity. Consequently it was felt that there was an opportunity to produce a third volume of this series, which would provide a further platform to present some of the latest aspects of research in environmental photochemistry. As illustrated in this volume, photochemical processes continue to play a significant role in a variety of environmental applications. These range from energy conversion and storage through to environmental remediation and protection. The previous volumes considered a number of these topics already ranging from fundamental photochemical processes in the environment through to applications of photochemical technology for environmental protection. This volume follows in the same philosophy of parts 1 and 2 of Environmental Photochemistry considering both fundamental science and applications of photochemical technology.

The initial chapters consider some fundamental aspects of photochemical/catalytic processes and materials. The chapter by Minero presents a detailed consideration of surface modified photocatalytic materials. The modification of metal oxide photocatalysts is further developed in the chapter by Wang et al. on doping of layered transition metal oxides. Ismail and Bahnemann discuss developments, mechanistic studies and applications of mesoporous semiconductor photocatalytic materials for environmental remediation. The following chapters consider fundamental aspects of the overall photocatalytic process. A comprehensive consideration of the various kinetic processes involved in photocatalytic reactions is developed in the chapter by Rabani and Goldstein. The chapter by Howe demonstrates the application of infrared and electro paramagnetic resonance spectroscopy for probing reaction pathways and intermediates produced in photocatalytic reactions.

Engineering applications of photochemical processes are also presented. The chapter by Alfano et al. presents modelling photo-Fenton reactors for water treatment and is demonstrated for both lab and pilot scale reactor units. The use of LED

light sources as alternative light sources to conventional UV lamps is described in the chapter by Tokode et al.

Applications of photochemistry for energy conversion, photofenton water treatment and chemical synthesis are described in the chapters by Skillen et al., Oliveros et al. and Kisch, respectively. The chapter on the use of photocatalysis for water splitting considers both one- and two-step photocatalyst systems together with an over view of the mechanistic reactions involved in the water splitting process. The development of photoreactors for water splitting is also discussed. The chapter by Oliveros et al. on photo-Fenton processes for water treatment covers the fundamental reactions involved in the Fenton reaction, through to the current state of process development and application. The uses of semiconductor photocatalysis for chemical synthesis, specifically for novel atom-economic organic reactions, are detailed in the chapter by Kisch.

In conclusion, environmental photochemistry remains a very active field of research from which a range of practical applications with vast commercial potential is emerging. Part 3 of Environmental Photochemistry further contributes to the knowledge of photochemical and photocatalytic processes for environmental applications. It will be fascinating to see how this topic further develops over the next decade.

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