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Preface

Since more than three decades, photocatalysis, and especially that based on TiO_2, have attracted considerable scientific and practical interest. Therefore, the objective of this special issue of *Catalysis Today* will not provide an exhaustive overview including fundamentals and applications of photocatalysis since well-documented books and reviews have already served this goal.

The discovery of new photocatalysts and new processes with continuously enhanced performances and controlable behaviors is nowadays one of the driving forces for modern (photo)catalysis, with a promising crossover with unexpected border fields. Research has therefore to be focussed on the development of new photocatalytic materials and new processes, and, in parallel, on the necessary understanding of mechanisms and reaction steps at the molecular level.

Consequently, the objective of this issue is to highlight some recent advances in different topics of photocatalysis by a selection of research teams. Twenty-one articles and reviews have been gathered, involving 27 teams and two industrial partners from 12 countries. Among different possible classifications, the work presented has been divided into three main complementary topics:

- *Use of non-conventional photocatalytic materials*. Up to now, pure TiO_2 still remains the most widely used active photocatalyst. Alternative photocatalytic materials is thus a way of research for improving the process efficiency or adapting the material to specific applications (visible-light versus UV-A activation, hydrogen production versus oxidative applications substitution of noble metals). New morphologies, titania-free materials, TiO_2 with ad-atoms, coupling phenomena or grafted materials are concerned.

- *Modeling, mechanistic and theoretical aspects of photocatalysis*. Such aspects are of high importance, although scarcely reported. However, several articles focus on this area. For instance, and by analogy with heat transfer in thermal catalysis, the distribution of light at the catalyst surface and inside the photoreactor are crucial parameters to control, modelize and optimize the activity at the level of the catalytic surface site.

- *Photocatalytic applications in gas and liquid phase and in self-cleaning properties*. Beside the scarcely reported selectivity of photocatalytic reactions for partial oxidation applications, liquid phase reactions deal with (i) the coupling of solar photocatalytic and biological treatments for polluted waters and (ii) the solar disinfection of bacteria-contaminated water, including scaling up and pilot applications. Gas phase reactions implies the oxidation of sulfides, aromatics and hydrazine reactants, and the possible coupling of photocatalysis with cold plasma.

Through the collected articles, representing a small part of the up-to-date research in photocatalysis, we hope to be successful in illustrating photocatalysis as an improving and exciting research field, whatever its complementary fundamental or applied approach.

Finally, we would like to point out the interest of research groups to work together at both national and international levels for driving the photocatalysis beyond its limits, as a part of the overall catalysis theme.

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