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Preface

This Catalysis Today issue contains papers presenting fundamental understanding of photocatalytic conversions on semiconductor surfaces. The latest advances on structure activity relationships and descriptions of the mechanism of photocatalytic conversions are summarized. We would like to gratefully acknowledge all contributors to this issue for their outstanding efforts and providing contributions of high quality.

The focus of the issue is on TiO_2, covering descriptions of bulk and surface effects, as well as photoreactivity promotion by doping with non-metals and metals. In the following we will briefly summarize these contributions. The first paper focuses specifically on the power of EPR spectroscopy in revealing active sites of anion doped TiO_2. The principles of the technique, difficulties in interpretation of the results, as well as lessons learned from the analysis of TiO_2 of variable composition have been summarized. The second contribution is an ab initio investigation of the effects of non-metal doping (B, C, N and F) on the performance of Anatase. The third contribution provides more detail on the effects of N-doping on performance in the photocatalytic abatement of NO*x*. Fundamental understanding of surface modification by fluorine is provided in the next contribution. This is followed by a description of an operando DRIFTS (infrared) study of the role of hydroxyls groups in trichloroethylene photo-oxidation over titanate and TiO_2 nanostructures. The next contribution discusses the effect of Au on TiO_2 based catalysis in the hydroxylation of benzene. The last paper in this issue provides novel information on the photocatalytic properties of silica supported sodium decatungstate in the photocatalytic oxidation of glycerol.

Many aspects of TiO_2 based photocatalysis have been thoroughly analyzed and a picture emerges of the importance of various structural and surface chemical parameters. We strongly believe future studies should focus on both physical (lifetimes of excited states, fluorescence) and surface chemical characterization of existing and novel photocatalysts. In situ spectroscopies (e.g. Infrared, Raman), modeling, and theory should be extensively exploited with the aim to obtain a clear understanding of the photocatalytic behavior. This will ultimately allow for a rational and successful design of new semiconductor materials, which posses the following characteristics of (i) a low toxicity, (ii) efficient absorption of visible light, (iii) stability (absence of photo-corrosion), (iv) high surface area, (v) large availability and (vi) low cost. We hope this Catalysis Today issue inspires to initiate these studies.

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