

TiO₂-based Nanomaterials with Photocatalytic Properties for the Advanced Degradation of Xenobiotic Compounds from Water. A Literature Survey

Mălina Răileanu · Maria Crișan · Ines Nițoi ·
Adelina Ianculescu · Petruța Oancea ·
Dorel Crișan · Ligia Todan

Received: 16 November 2012 / Accepted: 28 March 2013
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Abstract In recent years, the photochemistry of nano-semiconductor particles has been one of the fastest growing research areas in the physical chemistry field. TiO₂ is considered as the most thoroughly investigated semiconductor in the literature, due to its photocatalytic activity, excellent functionality, thermal stability, and non-toxicity. It seems to be the

most promising for the photocatalytic destruction of organic pollutants. The challenge for scientific materials is to find a processing method in which the crystalline phase as well as the size and morphology of TiO₂ nanocrystals can be controlled. The concept of the present paper consists of a comprehensive study regarding the level of knowledge in the synthesis of TiO₂-based nanopowders and their application in the advanced degradation of aromatic nitrocompounds. The objectives are related to: critical analysis of the synthesis techniques of the TiO₂-based nanopowders, underlining the importance of using the sol–gel method evaluation of the morphological and structural specific characterization of these techniques; and a comprehensive study of the operational parameters of the pollutant photocatalytic degradation. The relative simple sol–gel method is the most widely used, being considered as a versatile means of developing catalytic materials, as well as an important experimental tool in understanding their physical and chemical properties. In order to enhance TiO₂ photocatalysis and to extend the response into the visible domain, titanium has been doped with metals, nonmetals, and ionic components. A recent literature survey concerning some transition metals-doping (Fe, Co, and Ni) of TiO₂ nanopowders by the sol–gel method was also included.

M. Răileanu · M. Crișan (✉) · D. Crișan · L. Todan
Ilie Murgulescu Institute of Physical Chemistry,
Romanian Academy,
202 Splaiul Independentei,
060021 Bucharest, Romania
e-mail: mcrisan@icf.ro

M. Crișan
e-mail: msidcrisan@yahoo.com

I. Nițoi
National Research and Development Institute
for Industrial Ecology, ECOIND,
71-73, Drumul Podu Dâmboviței Street,
060652 Bucharest, Romania

A. Ianculescu
Department of Oxide Materials Science and Engineering,
“Politehnica” University of Bucharest,
1-7 Gh. Polizu, P.O. Box 12–134, 011061 Bucharest,
Romania

P. Oancea
Department of Physical Chemistry, Faculty of Chemistry,
University of Bucharest,
4-12 Bd. Regina Elisabeta,
Bucharest 030016, Romania

Keywords Titanium dioxide · Fe- · Co- · Ni-doped
TiO₂ · Nanopowders · Sol–gel process · Photocatalysis ·
Xenobiotic compounds