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# Photocatalysts for Energy and Environmental Sustainability

Online at: <https://doi.org/10.1088/978-0-7503-5697-8>



# Photocatalysts for Energy and Environmental Sustainability

**Edited by**

**Vijay B Pawade**

*Department of Applied Physics, Laxminarayan Innovation Technological University,  
Nagpur 440033, India*

**Bharat A Bhanvase**

*Department of Chemical Engineering, Laxminarayan Innovation Technological  
University, Nagpur 440033, India*

**IOP** Publishing, Bristol, UK

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ISBN 978-0-7503-5697-8 (ebook)  
ISBN 978-0-7503-5693-0 (print)  
ISBN 978-0-7503-5700-5 (myPrint)  
ISBN 978-0-7503-5694-7 (mobi)

DOI 10.1088/978-0-7503-5697-8

Version: 20240301

IOP ebooks

British Library Cataloguing-in-Publication Data: A catalogue record for this book is available from the British Library.

Published by IOP Publishing, wholly owned by The Institute of Physics, London

IOP Publishing, No.2 The Distillery, Glassfields, Avon Street, Bristol, BS2 0GR, UK

US Office: IOP Publishing, Inc., 190 North Independence Mall West, Suite 601, Philadelphia, PA 19106, USA

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# Preface

In recent years, research into energy and environmental sustainability has received more importance in interdisciplinary areas of science and engineering due to the vast increase in industrial globalization. So, many research organizations and academic institutes are promoting these frontier areas as a way of developing highly efficient, environmentally friendly technology to achieve sustainability goals. Thus, photocatalysis is an emerging, simple, and low-cost technique that has the potential to resolve issues related to hydrogen generation and the photocatalytic degradation of pollutants under sunlight illumination. This textbook summarizes the fundamental mechanisms, properties, and applications of different types of photocatalysts. It contains seven chapters that cover the current progress and future scope of new and advanced photocatalytic materials, written by well-known authors in these fields. Therefore, this textbook is designed to be of benefit in undergraduate as well as postgraduate courses in science and technology. As per the global scope of environmental research, this book can provide an ideal platform for the reader to understand the concepts presented in a more systematic way, increasing their interest in the content of the book. So, we thank all the contributing authors for their efforts to enhance the depth of this book and their expertise in making this textbook attractive among the other books. We also thank IOP Publishing for introducing this textbook on new and advanced photocatalytic materials and their sustainable approach for the betterment of mankind. We sincerely hope this book can ultimately make a significant contribution to research and development activities in the field of photocatalysis.

# Editor biographies

## Vijay B Pawade

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**Dr Vijay B Pawade** is an assistant professor (Sr.Gr) in the Department of Applied Physics at the Laxminarayan Innovation Technological University, Nagpur, India. His research focuses on rare-earth-doped oxide materials and their applications in light-emitting diodes (LEDs), solar cell devices and photocatalytic processes. He has published 45 research papers in respected international peer-reviewed journals and acts as a reviewer for journals published by Elsevier, Springer, Wiley, Taylor and Francis, the Royal Society of Chemistry, and the American Chemical Society. He has contributed 12 book chapters on different themes such as nanomaterial synthesis and characterization, the applications of nanomaterials in energy conversion and storage devices, quantum dots (QDs), the spectroscopy of lanthanides, etc. He is the author of books titled Phosphor for Energy Saving and Conversion Technology (*CRC Press—Taylor and Francis*), Optical Properties of Phosphate and Pyrophosphate Compounds, and Lanthanide-Doped Aluminate Phosphors (*Woodhead Publishing—Elsevier*). He has edited five books on Nanomaterials for Green Energy (*Elsevier*), Spectroscopy of Lanthanide-Doped Oxide Materials (*Woodhead Publishing—Elsevier*), Multifunctional Nanostructured Metal Oxides for Energy Harvesting and Storage Devices (*CRC Press—Taylor and Francis*), Handbook of Nanomaterials for Wastewater Treatment (*Elsevier*), Nanoscale Compound Semiconductors and their Optoelectronics Applications (*Woodhead Publishing—Elsevier*), Phosphor Handbook: Process, Properties and Applications (*Woodhead Publishing—Elsevier*).

## Bharat A Bhanvase

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**Dr Bharat A Bhanvase** is currently working as professor and head of the Chemical Engineering Department at the Laxminarayan Innovation Technological University, Nagpur, India. His research interests are focused on wastewater treatment, cavitation-based synthesis of nanomaterials and nanocomposites, solid waste processing, process intensification, microfluidics, nanofluids, etc. He obtained his PhD in Chemical Engineering from the University of Pune. He has published 103 articles in international journals, and four in national journals; he has presented 17 papers in international conferences and 12 in national conferences. He has written 55 book chapters in internationally renowned books, nine edited books, and one authored book. He has obtained four Indian patents and applied for six Indian patents. He received IChE Awards in 2021 (the Chemical Weekly Award, the IChE NRC Award, and the Kuloor Memorial Award) for the best paper published in the ‘Indian Chemical Engineer’ in

its 2020 issues. He is a fellow of the Maharashtra Academy of Sciences (MA Sc) and a fellow of IChE. He was the recipient of the Best Scientist Award from Rashtrasant Tukadoji Maharaj Nagpur University in 2017. He also received a Young Scientists (Award) start-up research grant from the Science and Engineering Research Board, New Delhi (India) in 2015. He has guided 28 M.Tech. students and one PhD student; two M.Tech. and three PhD students are currently working with him.

# List of contributors

**Timur Sh Atabaev**

Department of Chemistry, Nazarbayev University, Astana 010000, Kazakhstan

**B A Bhanvase**

Department of Chemical Engineering, Laxminarayan Innovation Technological University, Nagpur 440033, India

**Shubham Bonde**

Department of Chemical Technology, Laxminarayan Innovation Technological University, Nagpur 440033, India

**Thi Minh Cao**

HUTECH University, 475A Dien Bien Phu Street, Binh Thanh District, Ho Chi Minh City, Viet Nam

**Somnath C Dhawale**

Department of Chemistry, Dr Babasaheb Ambedkar Marathwada University, Chatrapati Sambhajnagar 431004, MH, India

**Darya Goponenko**

Department of Chemistry, Nazarbayev University, Astana 010000, Kazakhstan

**G A Suganya Josephine**

Department of Chemistry, Center for Nanotechnology Research, Aarupadai Veedu Institute of Technology—Vinayaka Mission Research Foundation, Rajiv Gandhi Salai, Paiyanoor, Kanchipuram 603104, India

**Gauri Kallawar**

Department of Chemical Technology, Dr Babasaheb Ambedkar Marathwada University, Aurangabad 431004, MS, India

**İbrahim Hakki Karakaş**

Department of Food Engineering, Bayburt University, Bayburt, Turkey

**Zeynep Karcioğlu Karakaş**

Department of Environmental Engineering Atatürk University, Erzurum, Turkey

**S Rubesh Ashok Kumar**

Department of Chemistry, Center for Nanotechnology Research, Aarupadai Veedu Institute of Technology—Vinayaka Mission Research Foundation, Rajiv Gandhi Salai, Paiyanoor, Kanchipuram 603104, India

**D Vasvini Mary**

Department of Chemistry, Center for Nanotechnology Research, Aarupadai Veedu Institute of Technology—Vinayaka Mission Research Foundation, Rajiv Gandhi Salai, Paiyanoor, Kanchipuram 603104, India

**Phuong Hoang Nguyen**

HUTECH University, 475A Dien Bien Phu Street, Binh Thanh District, Ho Chi Minh City, Viet Nam

**V B Pawade**

Department of Applied Physics, Laxminarayan Innovation Technological University, Nagpur 440033, India

**Viet Van Pham**

HUTECH University, 475A Dien Bien Phu Street, Binh Thanh District, Ho Chi Minh City, Viet Nam

**Bhaskar R Sathe**

Department of Chemistry, Dr Babasaheb Ambedkar Marathwada University, Chatrapati Sambhajnagar 431004, MH, India

**Kamila Zhumanova**

Department of Chemistry, Nazarbayev University, Astana 010000, Kazakhstan