Environmental Science and Pollution Research (2023) 30:81616–81618
https://doi.org/10.1007/s11356-023-27991-2

EDITORIAL

Recent developments on advanced materials for photonics, sensing and energy conversion energy applications (AMPSECA'2021)

Didier Robert[1] · **Abdelaziz Laghzizil**[2]

Published online: 19 June 2023
© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2023

We are honored to present this special issue of the *Environmental Science and Pollution Research* which comprises the selected papers presented at the international conference on Advanced Materials for Photonics, Sensing and Energy Conversion Energy Applications, held in Marrakech, Morocco.

This international conference takes place every 2 years in Morocco, on the topic of the photonic, the detection and applications, the planter of the researchers, plans, and different disciplines on the same platform. This large gathering of academic and industrial researchers has provided detailed information on their materials and applications in photonics, sensing, and energy. Advanced materials play a critical role in modern technology, and recent developments in materials science have opened up exciting possibilities for photonics, sensing, and energy conversion applications. These materials are designed to exhibit unique physical properties that can enable novel functionality and performance.

Photonics is the branch of physics that deals with the study of light and its properties. Advanced materials such as semiconductors, nanomaterials, and metamaterials have enabled the development of new and efficient photonic devices. For example, semiconductor-based LEDs and lasers have revolutionized the lighting industry, and nanomaterials have been used to enhance the sensitivity of photodetectors. Advanced materials such as graphene, carbon nanotubes, and quantum dots have shown great promise in sensing applications. These last in particularly are nanoscale semiconductors with unique electronic and optical properties and have been used to develop highly efficient sensors for detecting light and other physical quantities. Energy conversion is the process of converting one form of energy into another, such as converting sunlight into electricity. Advanced materials such as perovskite solar cells, organic photovoltaics, and thermoelectric materials have enabled the development of new and efficient energy conversion devices. For example, perovskite solar cells, which are a type of thin-film solar cell, have shown remarkable efficiency in converting sunlight into electricity. Organic photovoltaics, which are based on organic materials such as polymers and small molecules, have the potential to enable low-cost and flexible solar cells.

Currently, advanced materials are critical for the development of new and efficient photonic, sensing, and energy conversion devices. Recent developments in materials science have led to the discovery of new materials with unique properties and improved performance. These materials have the potential to revolutionize various fields and pave the way for a more sustainable and efficient future.

This special issue includes the recent innovations such as the preparation of novel colloidal system based on carboxymethyl cellulose and Pd nanoparticles via an ecofriendly auto-reduction process under mild conditions (A. A. Mekkaoui et al 2023). These compounds have been used for the catalytic reduction of various nitroarenes bearing electron withdrawing or donating substituents which was carried out and monitored by UV–Vis spectroscopy. Another work present the characterization of the dust particles in South India through an image analysis of glass

Responsible Editor: Philippe Garrigues

✉ Didier Robert
didier.robert@univ-lorraine.fr

[1] Institut de Chimie Et Procédés Pour L'EnergieL'Environnement Et La Santé (ICPEES), 12 CNRS-UMR7515, University of Strasbourg, Saint-Avold Antenna, Université de Lorraine, 12 13 Rue Victor Demange, 57500 Saint-Avold, France

[2] Laboratory of Applied Chemistry of Materials, Faculty of Sciences, Mohammed V University, 7 in Rabat, Av. Ibn Battouta, BP 1014 Rabat, Morocco

samples inclined at a tilt of 0° and 13° for four different exposure periods (approximately 30 to 40 days/exposure period) (Laarabi B. et al. 2023). The results obtained in this study are very useful for the development of high-precision soiling sensors that are based on image analysis and outdoor soiling microscopes, which are the main components for an efficient and economic cleaning of solar PV modules. Another article of this special issue concerns an experimental investigation of photoluminescence properties of Znq2 thin films co-doped with different concentrations of 4-(dicyanomethylene)-2-methyl-6-(4-dimethylaminostyryl)-4H-pyran (DCM) which was performed (Laouid A., et al. 2023). The authors demonstrated that the doping influences the optical properties of Znq2 and makes it a potential candidate for optoelectronic applications. An article is devoted to the research of soiling mitigation solutions and cleaning techniques have been developed to maintain high efficiency of photovoltaic (PV) panels (Dahlioui D., et al. 2023). First of its kind, the investigation of the adaptability of the cleaning systems to solar trackers has been performed. Most of these systems are dedicated to fixed installations whereas only few systems that can be adapted to solar trackers are presented in the updated cleaning system background. For this reason, this paper presents an innovative approach which consists of combining trackers with an integrated cleaning system that has been designed. It has been found that the cleaning technique based on the telescopic arm would be more effective if the tracker is installed in an arid region where soiling is higher than Rabat. In this case, the payback time of the cleaning solution is faster (8 to 9 years), hence its profitability. In the same field, an image analysis technique combining a new-generation optical microscope (Leica DM6 M) and Cleanliness Expert image acquisition and processing software has been proposed for the study of dirt particles on PV modules in three different regions: Souss-Massa region, Drâa-Tafilalet region, and Rabat-Salé-Kénitra region (Chamali H., et al. 2023). The results obtained in this study have shown that three images will be enough to represent the whole area of the sample. In addition, the dominant particle diameters by number are in the range of 1–5 µm. Finally, the last paper is devoted to the development of novel self-cleaning technologies of photovoltaic panels, especially those based on semiconductor photocatalysis system (Akharkhach B., et al. 2023). The authors studied electronic and optical properties of bulk rutile TiO_2 doped with Br or Cl at an O site using first principle calculations. The results showed that this doping configuration can be achieved experimentally and exist stably under Ti–rich growth condition.

References

Akharkhach B, Barhdadi A (2023) Electronic structure and optical properties of Br- and Cl-doped rutile TiO2 for application in self-cleaning and photovoltaic panel's coatings: first-principle calculations. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-023-26464-w

Chamali H, Dahrouch A, Laarabi B, Fathi E, Barhdadi A (2023) Evaluating the distribution of soil particle size on glass samples by a new generation of optical microscopy for solar PV applications. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-022-23436-4

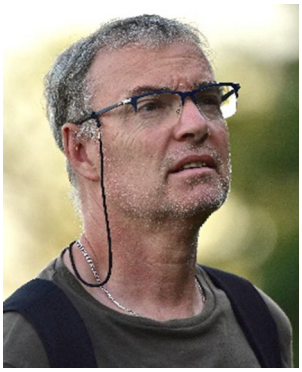
Dahlioui D, Alaoui SM, Laarabi B, Barhdadi A (2023) Waterless cleaning technique for photovoltaic panels on dual-axis tracker. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-022-23218-y

Laarabi B, Rajasekar N, Gopi NP, Barhdadi A (2023) Characterization of dust particles in South India and investigation on soiling image analysis for photovoltaic application. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-022-22630-8

Laouid A, Belghiti AA, Wisniewski K, Hajjaji A, Sahraoui B, Zawadzka A (2023) Generation of red light with intense photoluminescence assisted by Forster resonance energy transfer from Znq2 and DCM thin films. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-022-23217-z

Mekkaoui AA, Orfi A, Bejtka K, Laayati M, Labyad SA, EL Firdoussi L, Pirri FC, Chiodoni A, EL Houssame S (2023) Carboxymethyl cellulose nanocolloids anchored Pd(0) nanoparticles (CMC@Pd NPs): synthesis, characterization, and catalytic application in transfer hydrogenation. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-022-21838-y

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Didier Robert is assistant professor at the ICPEES (Institute of Chemistry and Process for Energy, Environment and Health-CNRS) at Saint-Avold in France (Universities of Strasbourg and Lorraine). His research is focused on the controlled synthesis and design of nanomaterials dedicated to photocatalysis, for applications in the fields of the environment. He is the author of 120 international publications in the field of chemistry and photocatalysis and 7 books (or chapters). His Scopus *h*-index is 47 with total citation > 10,600 (2023). He is the creator of international conference series: European Meeting on Solar Chemistry and Photocatalysis: Environmental Application SPEA, since 2000. He is the editor in chief and co-founder of the journal *Environmental Chemistry Letters*, published by Springer since 2003 and most recently co-editor of the book series "Environmental Chemistry for Sustainable Word" from Springer. He has taught courses to undergraduates and doctoral students in the fields of organic chemistry and environmental chemistry.

Abdelaziz Laghzizil is a professor at Mohammed V University in Rabat. He has worked in the research field of materials science chemistry in collaboration with several national and international teams and is responsible for several projects bi- or multilateral involving public or institutional partners. His research activities focus in particular on the controlled synthesis and design of nanomaterials dedicated to environmental applications and electrical properties. Thus, two main research themes are developed. The first concerns the synthesis of nanomaterials, their functionalization, and the development of specific architectures. The second approach is the development of adsorbent/photocatalyst materials for water treatment. He is the author of more than 85 international publications in the field of materials chemistry (Scopus *h*-index of 25, https://orcid.org/0000-0001-9608-0583). He has taught license and master's students in chemistry and supervised several doctoral students in various fields of materials and environmental chemistry. He was invited as chair and examiner for thesis defenses. Pr. Laghzizil is a member of the commissions of national and international project assessors of the CNRST and the UMP6 and served as reviewer for several academic journals, many of which are the top-ranked in its fields. He was also a member of several commissions for the recruitment of assistant professors, whether in universities or in military establishments in addition to being a member of commissions for the promotion of teacher-researchers.