DE GRUYTER

ADVANCED NANOMATERIALS FOR CARBON CAPTURE, ENVIRONMENT AND UTILIZATION FOR ENERGY SUSTAINABILITY

GUEST EDITORS

Awais Ahmad, Department of Organic Chemistry, University of Cordoba, Cordoba, Spain
awaisahmed@gcuf.edu.pk

DongWhi Choi, Department of Mechanical Engineering, Kyung Hee University, Republic of South Korea
dongwhi.choi@khu.ac.kr

Muhammad Sufyan Javed, School of Physical Science and Technology, Lanzhou University, China
safisabri@gmail.com

DESCRIPTION

The escalating demand for energy consumption, coupled with climate change, has brought the need to manage greenhouse gas emissions. The rise in energy consumption, driven by industrialization and population explosion, has reached high levels which led to the scarcity of fossil fuels.

Conventional clean energy sources, such as wind and solar energy, are not able to meet the surging demands for energy. This sequence of events urges for an innovative and advanced solution for sustainable energy. One of the most effective ways to reduce the rapidly increasing carbon dioxide (CO2) emissions is carbon capture. In this era of material science and nanotechnology breakthroughs, new frontiers have opened up, promising more effective CO2 capture, separation, conversion, and utilization in the pursuit of energy sustainability. Carbon capture and utilization technology are now positioned as promising strategies for addressing environmental challenges, moving in an era where sustainable, economical carbon-based fuels and chemicals are generated from renewable biomass sources. These technologies encompass CO2 recycling, capture from fossil fuel or air, or a combination of both. CO2 from industrial flue gases as well as from ambient air and engineered sequestration is effectively captured, removed, and separated due to the advanced abilities of nanomaterials. These nanomaterials are categorized in two groups one that absorbs CO2, like activated carbon and metal-organic frameworks, and the other those that react with CO2 to produce materials like carbonates and polymers or fuels (less harmful). Nanomaterials also unlock the potential for novel filters, characterized by enhanced transport efficiency, performance, durability, and heat resistance. The extraordinary abilities of nanomaterials positioned them as a potential candidate for developing a carbon-capturing technology that leads toward sustainable solutions. In the carbon capturing and conversion process, nanomaterials bring useful process and energy characteristics to the fore, including ultra-high surface areas, porosities, electrical conductivity, and tunable chemical functionality. Nanomaterials serve as excellent catalysts due to their cost-effectiveness and easy separation from the reaction medium. Not stopping here nanomaterial-based adsorbents surpass conventional adsorbents like zeolites due to their superior surface area, greater active site density, and negligible mass diffusion resistance within nanoparticle pores. These technologies also tackle the surging issue of global warming, due to excessive CO2 emissions into the atmosphere, by converting CO2 into valuable chemicals like methanol, ethylene, and more. Fundamental research in this domain is paving the way toward a low-carbon future characterized by high energy efficiency. In this context, the central

role of nanomaterials in carbon capture and utilization which leads to a sustainable environment is discussed.

As we turn our attention to environmental protection, the special edition emphasizes the crucial role that nanomaterials play for tackling the challenges associated with water purification and desalination. The ability of nanomaterial-based membranes and adsorbents to effectively remove salts and pollutants from water supplies makes them a vital tool in the global drive to ensure access to safe drinking water.

This edition also looks at the subject of environmental monitoring, where nanomaterial based sensors and devices make it simple to spot pollutants and dangers right away in a diverse situations. We now have the means to actively control and preserve the environment by using the technology.

The special issue also looks into how nanoparticles might help with pollution management and control. Utilizing photocatalysis, nanoparticles like titanium dioxide are used to break down organic contaminants in both water and the atmosphere. Nanoscale adsorbents have the ability to trap and remove pollutants from water and air sources, including organic and heavy metal pollutants.

Possible topics include, but are not limited to the following:

- Advanced nanomaterials for carbon capture and utilization
- Sustainable energy management with advanced nanomaterials
- Applications of nanomaterials in carbon science and energy sustainability
- Implications of nanomaterials on carbon capture, storage and utilization
- Efficient synthesis of novel nanomaterials for carbon capture and utilization
- Hybrid and advanced nanomaterials towards environmental remediation
- Photoredox reactions towards sustainability
- Nanostructured fuels from biomass for sustainable energy management
- Nanomaterials in energy storage conversion and utilization
- Efficient carbon capture and storage technologies for sustainable energy management with nanomaterials

PUBLICATION SCHEDULE / HOW TO SUBMIT

Open for submissions: 1st October 2023
Paper submission deadline: 30th June, 2024

When entering your submission please choose the option type of an article: “Advanced nanomaterials for carbon capture, environment and utilization for energy sustainability ” Submissions for the special issue are now open. In case of any technical problems, please contact the Managing Editor of ***Nanotechnology Reviews*: Juliusz Skoryna, Ph.D.**, Juliusz.Skoryna@degruyter.com