International Journal of Polymer Science

Special Issue on

Synthesis and Applications of Biopolymer-Based Advanced Nanoporous Solids

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Advanced nanoporous solids, such as silicates, layered double hydroxides, carbons, metal organic frameworks (MOFs), and the more recent covalent organic framework (COFs), show high specific surface area, tunable and controlled porosity, well-controlled particle size, homogeneous distribution, and good interaction between interfacial surfaces in addition to further properties in the function of their chemical composition. Advanced nanoporous solids can also have magnetic properties, exist as semiconductors, or exhibit interesting electrical properties that can be tailored to specific applications. In addition to synthetic polymers, biopolymers, such as proteins, nucleic acids, or polysaccharides (the most abundant family of naturally occurring polymers), have been considered in recent years as a source of innovative bio-based materials due to their biocompatibility and biodegradability. Therefore, the combination of biopolymers with different solids, such as nanoporous materials, can result in (bio)polymer-based nanocomposites that display a range of interesting functional properties. This allows for their use in a wide range of advanced applications, including sensors, bioplastics, environmental remediation (performing as adsorbents, filters, or catalysts), sustainable processes for resource production and energy transformation and storage, and biomedical purposes (such as drug delivery or tissue engineering).

Recently, there has been growing interest in polymer–metal–organic frameworks (polyMOFs), where polymer units are included as structural components of advanced porous solid. This has opened new strategies and further consideration of porous materials in the field of polymer science. In the context of fabrication, the synthesis of these functional biohybrid nanostructures can be carried out following bottom up strategies, where (bio)polymers and inorganic units are combined through molecular self-assembly - a phenomenon related to the physical and chemical interactions occurring at the nanoscale. Several bottom-up strategies include solvent casting, layer-by-layer (LbL), in situ methods, intercalation, or grafting processes. These different strategies can result in different properties and functionalities of the bio-nanocomposite material. In addition, additive manufacturing methods may, in the future, play a crucial role in the fabrication and engineering of materials and components based on bio-nanocomposites.

This Special Issue aims to collect both original research and review articles with a focus on recent innovations in the synthesis, characterization, and advanced applications of hybrid nanostructures based on biopolymers and advanced nanoporous solids.

Potential topics include but are not limited to the following:

- Design, synthesis, modeling, and simulation of hybrid materials involving (bio)polymers and porous solids
- Innovative techniques for characterization of (bio)hybrids and (bio)nanocomposites
- Chemical and biological sensing
- (Bio)polymer-based nanocomposites as biofriendly micro/nanomotors
- Biological metal-organic frameworks (BioMOFs), polyMOFs, and polymer covalent organic frameworks (polyCOFs)
- Design and synthesis of (bio)polymer-based porous solids for supercapacitors and energy conversion and storage devices
- Applications of biopolymer-based nanocomposites in environmental remediation, for example, for membranes of separation, gas filters, molecular sieves, adsorbents, and environmental catalysts
- Applications of biopolymer-based nanocomposites in sustainable processes like adsorption, heat transformation and storage, water harvesting, water splitting, and blue energy
- Applications of (bio)polymer-based nanocomposites in health care applications, for example, drug delivery, tissue engineering, regenerative medicine, porous scaffolds, in vivo separation and purification, or in vivo sensing and analysis
- Current and future perspectives of (bio)polymer-based advanced nanoporous materials

Authors can submit their manuscripts through the Manuscript Tracking System at https://review.hindawi.com/submit?specialIssue=638855.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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