Additive Manufacturing of Functional Carbon-Based Materials for High-Efficiency Energy Storage

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DESCRIPTION

The additive manufacturing of functional carbon-based materials has become a revolutionary approach to the development of the next-generation energy storage systems. Additive Manufacturing (AM) can be used to produce highly complex, lightweight and customized energy devices with optimized performance by providing precise control over structural design, composition and architecture. Graphene, carbon nanotubes, carbon aerogels and porous carbons are carbon-based materials that are central to this transformation because of their outstanding electrical conductivity, large surface area, mechanical strength and chemical stability. The incorporation of such materials into 3D printing systems allows the creation of customized electrodes, flexible storage systems and high-power energy devices with improved functionality. With the global movement towards renewable energy systems, electric vehicles and portable electronics are on the rise, carbon-enabled AM technologies are increasingly critical in delivering scalable, efficient and sustainable energy storage solutions and the gap between laboratory innovation and industrial application is being narrowed.

Although the potential of this field is enormous, there are several technical and practical challenges to overcome on the way to the realization of consistently high-performance printed energy devices. The most important constraints are the ability to control structural uniformity, homogeneous dispersion of carbon nanomaterials and improve electrochemical performance in 3D-printed components. The challenges of ensuring strong interfacial bonding between carbon-based fillers and polymer or ceramic matrices further limit the efficiency of the devices and their mechanical stability. Scalability is another main challenge due to the production of large-volume, defect-free structures with precision and reproducibility is complicated. In order to overcome these issues, researchers are exploring hybrid nanocomposite inks, multi-material and multi-scale printing methods, laser-assisted sintering and machine learning-driven design optimization. Also, sustainable precursors and environmentally friendly fabrication methods are becoming of interest in order to create high-performing green energy storage devices. The field seeks to develop next-generation carbon-based AM energy materials by incorporating these innovations, which will enhance excellent electrochemical efficiency, structural integrity and sustainability and accelerate the transition toward advanced energy storage technologies to a broad range of applications.

We invite submissions that address the development and application of additive manufacturing of functional carbon-based materials for high-efficiency energy storage. Submissions in the domain of innovative material design, 3D printing approaches, electrode design, electrochemical activity and scalable manufacturing are especially encouraged. Research on hybrid nanocomposite inks, multi-material printing, sustainable precursors and machine learning-driven optimization are also welcome. The purpose of this special issue is to contribute to the development of the knowledge on how carbon-enabled additive manufacturing can provide efficient, customizable and sustainable energy storage solutions to the next-generation devices.

SCOPE

We welcome articles exploring topics including, but not limited to:

- Laser-Sintered Carbon Aerogels for High-Performance Battery Applications
- Hybrid Carbon-Metal Nanocomposites for Next-Generation Supercapacitors
- Carbon-Based Aerogel Electrodes via Freeze-Casting for Enhanced Energy Density
- Microwave-Assisted Synthesis of Porous Carbon for High-Power Energy Storage
- Template-Assisted Carbon Nanostructures for Lithium-Ion and Sodium-Ion Batteries
- Electrochemical Performance of Carbon Foam Electrodes for Grid-Scale Storage
- 3D-Structured Carbon Nanocomposites Using Direct Ink Writing for Flexible Batteries
- Plasma-Modified Carbon Materials for Enhanced Energy Storage Applications
- Carbon-Coated Metal Oxides via Chemical Vapor Deposition for Energy Storage
- Hierarchical Carbon Architectures from Bio-Precursors for Sustainable Batteries
- Additive Manufacturing of Carbon-Based Hybrid Electrodes for Fast-Charge Devices
- 3D Laser-Assisted Patterning of Graphene Aerogels for High-Efficiency Storage

HOW TO SUBMIT

Deadline: April 10, 2026

Before submission authors should carefully read the Instruction for Authors. Manuscripts have to be written in LATEX (preferable), AMS-TEX, AMS-LATEX or MS Word - standard DOCUMENT (.DOC). We do not accept papers in Plain TEX format. If additionally a PDF file is supplied, the peer review process will speed up. Authors are encouraged to submit the final version of the paper using the De Gruyter Open LATEX template.

All submissions to the Special Issue must be made electronically via the Editorial Manager submission and tracking review system. All manuscripts will undergo the standard peer-review process (single-blind, at least two independent reviewers).

The deadline for submissions is April 10, 2026, but individual papers will be reviewed and published online on an ongoing basis. When the submission of individual papers is completed, the review process begins immediately.

IMPORTANT DATES

Submission of papers: April 10, 2026
Authors to be Notified by: June 11, 2026
Revised Paper Submission End Date: August 13, 2026
Last Decision Date: October 12, 2026

In case of any question please contact Joanna Kosińska,
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