



*Journal of New Materials for Electrochemical Systems*

*Special issue, June 2027*

Journal homepage: <https://www.newmaterials.ca/>

## CALL FOR PAPERS

Advanced Metal and Composite Materials for Electrochemical Energy Systems:

Microstructural Design, Mechanical Performance and Durability

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## AIMS AND SCOPE

The main focus of the development of electrochemical energy systems is advanced metal and composite material products, in which electrochemical functionality should be enhanced by mechanical stability and long-term durability. Materials in fuel cells, sophisticated batteries, electrochemical supercapacitors and hydrogen production systems work under concurrent electrochemical reactions and mechanical strains which directly influence efficiency and life cycle. The microstructural design is thus important in regulating the grain size, phase distribution, crystallographic texture and interfacial bonding to assure stable charge transport, corrosion resistance and structural integrity. In addition, metal matrix composites and nano-engineered alloys offer enhanced electrical conductivity, controlled porosity and improved resistance to electrochemical degradation and could be used in electrodes, current collectors and structural elements of overall energy systems and high-performance electrochemical infrastructure.

Further, the correlation between microstructure and mechanical performance has a strong impact on electrochemical devices reliability. Precise control of the connectivity phase and distribution of defects through processing techniques such as powder metallurgy, spark plasma sintering, additive manufacturing and surface modification has a direct influence on ionic diffusion, electrical pathways and load-bearing capability. Additionally, microstructural stability dictates durability in electrochemical conditions, corrosion resistance, thermal stress, cyclic loading and interfacial degradation. The mechanical failure such as cracking, delamination or loss of interfacial adhesion may lower the electrochemical efficiency and system integration. However, to achieve a balanced control of the electrochemical activity and mechanical resilience, the coordination of the material design strategies is necessary with the help of the structural and electrochemical characterization. Emphasis is placed on the development and testing of high-performance metal and composite materials designed for utilization in fuel cells and advanced batteries, supercapacitors and hydrogen-based systems, with a guarantee of sustained operation, structural dependability and extended operational longevity in electrochemical energy systems and in practice systems integration applications.

In this special issue, we provide a forum for researchers working on advanced metal and composite materials for electrochemical energy systems to discuss challenges in microstructural design, mechanical performance and long-term durability under electrochemical operating conditions. Work exploring the effects of microstructural engineering on electrochemical stability, charge transport and mechanical reliability within fuel cells, batteries, supercapacitors and hydrogen production systems or work investigating degradation mechanisms and suggesting innovative material development, processing, characterization and durability enhancement solutions are particularly welcome.

**LIST OF TOPICS:**

- Additive Manufacturing of Conductive Metal Composites for Advanced Battery Current Collectors
- Spark Plasma Sintering of Nano-Engineered Alloys for Hydrogen Evolution Applications
- Interfacial Engineering Strategies to Enhance Mechanical Reliability in Electrochemical Electrodes
- Grain Boundary Tailoring in Metallic Composites for Improved Corrosion Resistance in Energy Systems
- Surface-Modified Metal Composites for Enhanced Ionic Transport in Supercapacitors
- Microstructure–Property Correlation in Lightweight Metal Alloys for Hydrogen Production Systems
- Nano-Structured Metallic Current Collectors for High-Efficiency Energy Storage Devices
- Multiscale Microstructural Design of Hybrid Metal Composites for Integrated Energy Systems
- Additive Surface Engineering for Enhanced Durability of Battery Structural Materials
- Mechanical Integrity of Porous Metal Composites for High-Performance Supercapacitors
- Defect Engineering in Metallic Composites for Long-Term Electrochemical Reliability
- Load-Bearing and Electrochemical Performance of Nano-Engineered Alloys in Energy Devices
- Integrated Structural and Electrochemical Characterization of Metal Composites for Sustainable Energy Applications

**INSTRUCTIONS TO AUTHORS ARE AT:**

Journal homepage: <https://www.newmaterials.ca/instructions-for-authors/>

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Or download the manuscript at: <https://www.newmaterials.ca/submit-your-article/>

by indicating the title of the Special issue.

The submitted manuscripts should not have been previously published, nor should they be currently under consideration for publication elsewhere.

**IMPORTANT DATES:**

- Manuscript submissions due: 05 November 2026
- First round of reviews completed: 15 January 2026
- Revised manuscripts due: 25 March 2027
- Final manuscripts due: 10 June 2027