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Journal of Applied Engineering Science & Technology

An Interdisciplinary Journal in Sciences & Technology

Journal home page: https://journals.univ-biskra.dz/index.php/jaest

https://doi.org/10.69717/jaest.v6.i3.230 Editorial

Editorial: Special Issue on Mechanical, Energy and Material Engineering – CMEME 2025

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Graphical Abstract

Editorial

The *Journal of Applied Engineering Science & Technology (JAEST)* is pleased to present this Special Issue on **Mechanical, Energy and Material Engineering**, associated with the **2nd Conference on Mechanical, Energy and Material Engineering (CMEME 2025)**, held on **11–12 November 2025 in Biskra, Algeria**.

CMEME 2025 provided a scientific forum for researchers, academics, engineers, and students working across mechanical engineering, energy systems, materials science, computational engineering, sustainability, and related interdisciplinary fields. The conference created an opportunity to exchange recent scientific results, discuss emerging engineering challenges, and strengthen cooperation among researchers from different institutions and research laboratories.

This Special Issue reflects the interdisciplinary character of modern engineering research. Contemporary technological challenges increasingly require the integration of advanced materials, numerical modelling, energy conversion and storage, experimental characterization, reliability assessment, and sustainable use of natural and recycled resources. The papers collected in this issue address these themes at different scales, ranging from nanoscale electronic materials to engineering components, energy-storage technologies, electrical insulation, biomaterials, biocomposites, and sustainable construction materials.

The contributions selected for publication in JAEST were considered within the journal's editorial framework. Participation in CMEME 2025 did not in itself constitute acceptance for journal publication. The manuscripts were submitted to editorial assessment and peer review according to the journal's procedures before their final acceptance in this Special Issue.

The first research contribution, by Djabri et al. [1], investigates band-gap engineering in hydrogen-passivated planar silicene nanoribbons using first-principles density functional theory. Hydrogen termination was shown to stabilize the ribbon edges and significantly alter their electronic properties. Zigzag configurations exhibit metallic or semi-metallic characteristics, whereas armchair structures behave as direct-band-gap semiconductors whose energy gaps depend on ribbon width. The work demonstrates how edge configuration, width, and chemical passivation may be exploited to tailor silicene nanostructures for future nanoelectronic and field-effect transistor applications.

In the field of biomaterials, Sidane et al. [2] examine the influence of calcination conditions on the *in vitro* bioactivity of calcium-phosphate ceramic powders. Their study combines structural and compositional characterization with immersion in simulated body fluid. Particular attention is given to hydroxyapatite treated at 900 °C, for which changes in calcium and phosphorus content together with surface-particle deposition suggest the formation of a calcium-phosphate layer. These observations underline the importance of thermal processing in controlling the structural characteristics and biological response of ceramic materials intended for biomedical applications.

Energy engineering is represented at both the system and material levels. Houria et al. [3] present the preliminary design and modal analysis of a 9S4P lithium-ion battery pack for small-satellite applications. Using a three-dimensional finite-element model, the authors evaluate natural frequencies and mode shapes under launch-related mechanical conditions. The predicted frequencies remain well separated from the relevant launcher excitation range, indicating adequate structural stiffness and reduced resonance risk under the adopted modelling assumptions. The study illustrates the close relationship between energy-storage technology, mechanical design, and structural reliability in aerospace applications.

A complementary contribution to engineering reliability is provided by Satta et al. [4], who experimentally investigate the effects of creepage distance, pollution severity, and insulator geometry on AC flashover voltage and parallel-discharge mechanisms in glass insulation. Increasing creepage distance raises the flashover voltage, while high-speed observations reveal the role of multiple parallel arcs during discharge development. The identification of an effective-width threshold for steady partial-discharge propagation provides useful information for the design and optimization of high-voltage outdoor insulation exposed to polluted environments.

At the materials level, Meziane et al. [5] investigate polyaniline/metal-oxide composites as pseudocapacitive electrode materials. Structural and spectroscopic characterization confirms the incorporation of different metal oxides into the polyaniline matrix, while cyclic-voltammetry measurements demonstrate substantial variations in charge-storage behavior. Among the studied composites, PANI/ZrO_2 exhibited the highest specific capacitance, reaching

563.5 F/g, whereas the PANI/TiO_2 system showed comparatively poorer electrochemical performance. These findings illustrate the importance of metal-oxide selection in optimizing hybrid electrode materials for supercapacitor applications.

Sustainable materials engineering is another important theme of this Special Issue. Djoudi et al. [6] investigate the effect of date-palm-fiber length on epoxy-based biocomposites. By comparing short and semi-long fibers obtained from the same natural source, the study demonstrates that fiber length strongly influences density, stiffness, tensile strength, and fiber–matrix interaction. Semi-long date-palm fibers produced lower apparent density together with significant improvements in modulus of elasticity and maximum stress, supporting the potential of locally available agricultural residues as reinforcing materials for lighter and more sustainable engineering composites.

The Special Issue is completed by the review contribution of Cherrallah and Abdelli [7], which examines the thermo-mechanical behavior of lightweight concrete containing recycled ethylene-vinyl-acetate (EVA) waste aggregates. The review highlights an important engineering compromise: increasing recycled EVA content generally reduces density and thermal conductivity, thereby improving thermal-insulation performance, but may simultaneously reduce compressive, flexural, and other mechanical properties. Nevertheless, the reuse of EVA waste offers significant environmental and economic opportunities and supports wider efforts toward circular-economy approaches in construction materials.

Taken together, the contributions of this Special Issue demonstrate the diversity of contemporary mechanical, energy, and materials engineering while also revealing several common scientific directions. Advanced numerical simulation is increasingly combined with experimental validation; material composition and processing are being tailored to obtain specific functional properties; energy technologies require simultaneous consideration of electrochemical and mechanical performance; and sustainability is becoming a central design criterion rather than an additional consideration.

The collection also illustrates the importance of connecting fundamental research with engineering applications. At the nanoscale, control of structure and surface chemistry enables the adjustment of electronic properties. At the material scale, thermal processing, constituent selection, and reinforcement geometry determine mechanical, biological, thermal, and electrochemical performance. At the component scale, numerical modelling and experimental analysis provide essential tools for assessing reliability under demanding operational conditions. At the same time, the valorization of agricultural and polymer wastes demonstrates how engineering research can contribute to resource efficiency and more sustainable material cycles.

Through this Special Issue, JAEST aims to provide a platform for disseminating high-quality research arising from scientific exchange while maintaining the independent editorial and peer-review standards of the journal. We hope that the contributions collected here will stimulate further research and collaboration among specialists in mechanical engineering, materials science, energy technologies, electrical engineering, sustainable construction, and related disciplines.

We also hope that the scientific interactions initiated through CMEME 2025 will continue to strengthen cooperation among Algerian universities, research centres, international partners, industry, and young researchers, thereby contributing to the development of innovative engineering solutions addressing current scientific, technological, and societal needs.

Acknowledgements

The Editors would like to express their sincere appreciation to the organizing and scientific committees of CMEME 2025, as well as to the Faculty of Sciences and Technology of the University of Biskra and the research laboratories involved in the organization of the conference.

We gratefully acknowledge all authors who contributed their research to this Special Issue. Particular thanks are extended to the reviewers for their time, expertise, and constructive evaluations, which contributed significantly to the scientific quality of the published papers.

The Editors also acknowledge the members of the JAEST editorial and production teams for their efforts throughout the editorial, revision, and publication process.

Conflict of Interest

The editors declare that they have no conflicts of interest regarding the publication of this Special Issue.

Author Contributions

Both editors contributed to the conception and preparation of this Editorial, participated in its revision, and approved the final version for publication.

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