

Experimental Testing, Manufacturing and Numerical Modelling of Composite and Sandwich Structures (Second Edition)

Raul D. S. G. Campilho ^{1,2} 

¹ CIDEM, ISEP—School of Engineering, Polytechnic of Porto, R. Dr. António Bernardino de Almeida, 431, 4200-072 Porto, Portugal; raulcampilho@gmail.com

² INEGI—Institute of Science and Innovation in Mechanical and Industrial Engineering, Pólo FEUP, Rua Dr. Roberto Frias, 400, 4200-465 Porto, Portugal

Composite and sandwich structures are nowadays indispensable in engineering applications where lightweight, durability, and multifunctionality are critical [1]. Due to these requirements, aerospace, automotive, marine, energy, construction, and biomedical industries increasingly rely on these materials due to their superior strength-to-weight ratios, corrosion resistance, and geometric freedom [2,3]. The versatility of these materials arises from the combination of different reinforcements (fibers, nanoparticles, metallic foils) with diverse matrices, thus enabling customized properties for specific applications [4,5]. Despite this progress, several challenges in the design of composite and sandwich structures persist. The high production costs, complex reparability, and difficulties in accurately predicting failure constitute barriers to the wider application of these solutions [6,7]. Moreover, sandwich structures, while offering excellent stiffness and energy absorption, are still vulnerable to impact, delamination, and durability issues under environmental exposure [8]. Recent research has therefore focused on advanced manufacturing techniques (3D printing, digital manufacturing, friction stir processing) [9–11], bio-based and recyclable composites [12], multifunctional systems with embedded sensing or actuation, and robust numerical models capable of simulating damage initiation and propagation with high accuracy [13–15]. This Special Issue, entitled “Experimental Testing, Manufacturing and Numerical Modelling of Composite and Sandwich Structures (Second Edition)”, brings together 19 papers that explore these aspects from experimental, manufacturing, and numerical perspectives. The contributions are divided into five topics, described below, along with selected papers highlighting recent advances and future directions in this field.

Advanced Manufacturing and Processing of Composites

The development of advanced processing methods aims to make composites more accessible, sustainable, and customizable. Traditional techniques such as autoclave curing, resin transfer molding, and filament winding, while capable of producing high-quality components, are often limited by high costs, energy demands, and long cycle times [16]. Moreover, mass production remains a barrier for industries such as automotive and renewable energy, where cost competitiveness is critical [17]. On the other hand, emerging methods such as additive manufacturing (AM), friction stir processing (FSP), ultrasonic-assisted casting, and hybrid fabrication are being explored to surpass these limitations [18,19]. These processes enable complex geometries and graded architectures and enable embedding sensors or reinforcements during fabrication. At the same time, computational tools and artificial intelligence are increasingly used to optimize process parameters, microstructures, and resulting properties [20]. Sarmah and Gupta [21] present a systematic review of recent fabrication advancements in metal matrix composites (MMCs), by covering both traditional



Received: 2 September 2025

Accepted: 17 September 2025

Published: 19 September 2025

Citation: Campilho, R.D.S.G. Experimental Testing, Manufacturing and Numerical Modelling of Composite and Sandwich Structures (Second Edition). *Materials* **2025**, *18*, 4372. <https://doi.org/10.3390/ma18184372>

Copyright: © 2025 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

and advanced methods such as friction stir processing, ultrasonic-assisted casting, and additive manufacturing. Their work also discusses artificial intelligence applications in manufacturing optimization. Quinlan et al. [22] developed nanocrystalline cobalt–iron-substituted gadolinium-doped ceria (CoFe1-xGDC) powders as a novel solid oxide fuel cell (SOFC) anode, using a co-precipitation route with ammonium tartrate. The study combines extensive characterization techniques and demonstrates promising electrochemical performance.

Mechanical Behavior, Damage and Impact Resistance

The application of composites in safety-critical industries such as aerospace and automotive highly depends on their mechanical performance and damage tolerance [23]. Failure in composites is far more complex than in isotropic materials, involving multiple interacting mechanisms: matrix cracking, fiber breakage, delamination, fiber–matrix debonding, and interlaminar shear [24]. The anisotropy and heterogeneity of composites add to the difficulty in predicting failure. Equally, sandwich structures often fail through skin–core debonding, core shear, or local buckling, which can initiate catastrophic collapse [25]. A particularly important issue is impact resistance, as both low-velocity (tool drops, runway debris) and high-velocity impacts (bird strikes, ballistic hits) may introduce hidden internal damage that drastically reduces the residual strength [26]. Research is therefore focused on hybridization strategies (e.g., fiber–metal laminates, cork cores, rubber interlayers), bio-based solutions, and advanced constitutive models to capture post-impact behavior [27]. Ursache et al. [28] studied carbon–aramid composites with and without rubber cores under low-velocity impact and water absorption. The results show how moisture severely reduces absorbed energy, especially for rubber-core systems. Zhang et al. [29] investigate hybrid fiber–metal laminates combining thermoplastic CFRP with aluminum alloy, subjected to high-velocity impacts. Both experiments and simulations confirm their superior energy absorption compared to conventional laminates.

Numerical Modelling and Simulation Advances

Numerical modelling of composites is traditionally limited by the difficulty of simultaneously capturing their heterogeneity, anisotropy, and multi-scale behavior [30]. Conventional FEM has been very successful but is limited due to mesh-dependence in crack propagation, difficulties with multi-scale homogenization, and high computational costs [31,32]. Recent efforts are directed toward meshless methods, multi-scale modelling, digital twins, and AI-enhanced simulations, which aim to balance accuracy and computational feasibility [33–36]. Modelling matrix cracking, delamination, and fiber breakage requires cohesive elements, continuum damage mechanics (CDM), or phase-field methods, each with its own limitations [37–39]. Equally, numerical methods are being linked to structural health monitoring by simulating acoustic emissions, Lamb waves, and vibrational signatures [40]. Rijal et al. [41] simulate acoustic emissions from composite failure modes (matrix cracking, delamination, fiber breakage) via finite element modelling of Lamb waves. Their work includes both experiments and modelling, enhancing structural health monitoring techniques. Cho [42] develops a natural element method (NEM) approach for coupled thermal and mechanical buckling in graphene platelet-reinforced composites. The study highlights the significance of thermo-mechanical interactions in design.

Sandwich Structures and Structural Dynamics

Sandwich structures are widely used due to their excellent stiffness-to-weight ratios and energy absorption capabilities [43]. Their mechanical behavior, however, is highly dependent on the interaction between skins, core, and adhesive interfaces [44,45]. Issues such as core shear failure, skin wrinkling, and debonding remain dominant failure modes [46,47].

With the trend toward functionally graded cores, 3D-printed honeycombs, and bio-inspired cellular structures, researchers are also investigating vibration behavior, damping, and adaptive functionalities [48]. Dynamic loading scenarios, such as vibration, acoustic excitation, and impact, are particularly critical in aerospace and automotive settings [49]. Structural health monitoring and active vibration control are therefore gaining importance by researching smart actuators and piezoelectric layers integrated into sandwich beams [50,51]. Raza et al. [52] present a combined numerical and experimental study of vibration control in thin-walled additively manufactured PLA and PLA-composite beams. Macro fiber composites are shown to effectively reduce vibration amplitudes. Bunoiu et al. [53] create magnetorheological suspensions based on lard, gelatin, and carbonyl iron particles, demonstrating tunable dielectric and rheological properties under magnetic fields. This approach points to adaptive structural materials with potential sandwich applications.

Sustainability, Multifunctionality, and Novel Applications

Designers of composite structures are increasingly adopting sustainability and multifunctionality as major design principles [54]. Scrapping composites is unsustainable due to the difficulty of recycling thermosets, the energy intensity of fiber production, and the need for petrochemical raw materials [55]. Solutions include using bio-based fibers and resins, recycling aerospace waste prepregs, and extending service life through repair and strengthening [56,57]. Parallel to sustainability, multifunctionality is being pursued by integrating composites with sensing, energy harvesting, or catalytic functions, which enables structures to contribute to functions other than load-bearing [58]. Chanchí-Golondrino et al. [59] apply computational methods to detect asbestos cement in hyperspectral images, proposing efficient algorithms (spectral differential similarity, SDS; Fourier phase similarity, FPS) that combine accuracy with acceptable computational cost. Zhou et al. [60] report the synthesis of Ce-doped α -MnO₂ catalysts via a hydrothermal method, where Ce incorporation refined the microstructure and enhanced defect formation. Detailed characterization confirmed strong Mn–Ce interactions and electron transfer, favoring Mn³⁺ species.

The contributions in this Special Issue highlight the vitality of composite and sandwich structure research and its interdisciplinary nature. They range from innovations in advanced manufacturing and novel hybrid material systems to new modelling strategies and sustainability-oriented solutions, showing the rapid evolution of the field and its growing relevance across diverse engineering domains. Looking ahead, several promising research topics have been identified:

- Artificial intelligence and machine learning are expected to accelerate the discovery of new composite formulations and predict damage and failure at different scales. Coupled with large experimental datasets, these tools will transform design and reduce development time [61].
- Circular economy strategies will gain importance, especially in aerospace, automotive, and transport, where the reuse of high-grade fibers, recycling of thermoplastic matrices, and upcycling of aerospace prepregs could drastically reduce environmental impact [62].
- The development of multifunctional and smart composites, capable of self-sensing, self-healing, or energy harvesting, will expand the functionality of materials, enable real-time health monitoring, and extend service life [63].
- The integration of digital twins and Industry 4.0 technologies will facilitate real-time monitoring and adaptive performance optimization to ensure safety, efficiency, and predictive maintenance [64].

- Hybrid material systems that combine composites with metals, ceramics, or nano-functional fillers will open up design possibilities for extreme-condition applications, particularly in aerospace, marine, defense, and renewable energy, where materials must withstand complex loading and harsh environments [65].
- Bio-inspired and bio-based composites are expected to grow in relevance, both for sustainability and for their ability to mimic the hierarchical structures and toughening mechanisms found in natural materials such as bone, seashells, or plant fibers [66].

These directions point towards a future where composites and sandwich structures will be lighter and stronger, and also smarter, greener, and more adaptive. As Guest Editor, I would like to express my sincere gratitude to all the authors for their high-quality contributions, which have greatly enriched this Special Issue. I hope that this Special Issue serves as a valuable reference for both researchers and engineers, by providing an insight into the latest advances in experimental testing, manufacturing, and numerical modelling of composites and sandwich structures.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Irisarri, F.-X.; Julien, C.; Bettebghor, D.; Lavelle, F.; Guerin, Y.; Mathis, K. A general optimization strategy for composite sandwich structures. *Struct. Multidiscip. Optim.* **2021**, *63*, 3027–3044. [\[CrossRef\]](#)
2. Mustapha, S.; Saad, D.M.; Fakih, M.A.; Yuan, F.-G. Composite sandwich structures: Damage detection and assessment using ultrasonic guided waves. In *Structural Health Monitoring/Management (SHM) in Aerospace Structures*; Elsevier: Amsterdam, The Netherlands, 2024; pp. 55–99.
3. Sreejith, M.; Rajeev, R. Fiber reinforced composites for aerospace and sports applications. In *Fiber Reinforced Composites: Constituents, Compatibility, Perspectives, and Applications*; Elsevier: Amsterdam, The Netherlands, 2021; pp. 821–859.
4. Kötter, B.; Yamada, K.; Körbelin, J.; Kawabe, K.; Nishikawa, M.; Hojo, M.; Fiedler, B. Steel foil reinforcement for high performance bearing strength in Thin-Ply composites. *Compos. Part C Open Access* **2021**, *4*, 100085. [\[CrossRef\]](#)
5. Wang, Y.; Tan, Z.; Li, Y.; He, L.; Zhang, Y.; Hu, X.; Chen, J.; Yi, M.; Yi, G. Preparation, properties, and application exploration of electrolytic Cu-CNTs composite foils. *Mater. Charact.* **2025**, *222*, 114855. [\[CrossRef\]](#)
6. Makhlof, M.H.; Abdel-kareem, A.H.; Mohamed, M.T.; El-Gamal, A. Experimental and numerical study of shear strengthening of reinforced concrete beams using jute fiber reinforced polymers (JFRP). *J. Build. Eng.* **2024**, *86*, 108732. [\[CrossRef\]](#)
7. Wang, L.-S.; Huang, Z.-M. On strength prediction of laminated composites. *Compos. Sci. Technol.* **2022**, *219*, 109206. [\[CrossRef\]](#)
8. Viotti, I.D.; Gomes, G.F. Delamination identification in sandwich composite structures using machine learning techniques. *Comput. Struct.* **2023**, *280*, 106990. [\[CrossRef\]](#)
9. Wang, J.; Liu, Y.; Wang, K.; Yao, S.; Peng, Y.; Rao, Y.; Ahzi, S. Progressive collapse behaviors and mechanisms of 3D printed thin-walled composite structures under multi-conditional loading. *Thin-Walled Struct.* **2022**, *171*, 108810. [\[CrossRef\]](#)
10. Dwivedi, S.P.; Sharma, S. Development and characterization of Cu-Ni-Al₂O₃ surface composite developed by friction stir process technique. *Mater. Today Commun.* **2023**, *37*, 107399. [\[CrossRef\]](#)
11. Ulu, F.; Tomar, R.P.S.; Mohan, R. Processing and mechanical behavior of rigid and flexible material composite systems formed via voxel digital design in polyjet additive manufacturing. *Rapid Prototyp. J.* **2021**, *27*, 617–626. [\[CrossRef\]](#)
12. Selvaraj, V.K.; Subramanian, J. Optimized bio-based epoxy composites with recycled fillers for sustainable noise mitigation. *Constr. Build. Mater.* **2025**, *492*, 143014. [\[CrossRef\]](#)
13. Faria, A.; Campilho, R. Parametric analysis of composite tubular adhesive joints bonded by the bi-adhesive technique. *Acad. Mater. Sci.* **2024**, *1*, 1–10. [\[CrossRef\]](#)
14. Ramalho, L.D.C.; Sánchez-Arce, I.J.; Campilho, R.D.S.G.; Belinha, J. Strength prediction of composite single lap joints using the critical longitudinal strain criterion and a meshless method. *Int. J. Adhes. Adhes.* **2021**, *108*, 102884. [\[CrossRef\]](#)
15. Ren, F.; Giannakeas, I.N.; Khodaei, Z.S.; Aliabadi, M.F. The temperature effects on embedded PZT signals in structural health monitoring for composite structures with different thicknesses. *NDT&E Int.* **2024**, *141*, 102988.
16. Alimirzaei, S.; Ahmadi Najafabadi, M.; Nikbakht, A. Investigation of mechanical properties and failure behavior of CFRP filament-wound composites using an acoustic emission-based methodology and numerical simulation. *Fibers Polym.* **2023**, *24*, 693–707.
17. Nadezhdin, V.; Gruzdev, A.; Titov, O. Prospects for the use of composite and polymer materials in transport construction. In *IOP Conference Series: Materials Science and Engineering*; IOP Publishing: Bristol, UK, 2021; p. 012032.

18. Zou, X.; Yan, H.; TuLiuXiong, K.Z.J. Heat treatment behavior, microstructure and mechanical properties of TiO₂@CNTs/7075 Al composites fabricated by ultrasonic-assisted casting. *Trans. Indian Inst. Met.* **2022**, *75*, 2875–2882. [\[CrossRef\]](#)
19. Li, Y.; Ojo, O.O.; Salman, S.; Paidar, M.; Refaai, M.R.A.; Zain, A.M.; Nasution, M.K.; Xin, D. Fabrication of the novel hybridized AZ31B Mg/CeO₂ + ZrO₂ composites via multiple pass friction stir processing. *J. Res. Technol.* **2023**, *24*, 9984–10004.
20. Fonseca, J.H.; Jang, W.; Han, D.; Kim, N.; Lee, H. Strength and manufacturability enhancement of a composite automotive component via an integrated finite element/artificial neural network multi-objective optimization approach. *Compos. Struct.* **2024**, *327*, 117694. [\[CrossRef\]](#)
21. Sarmah, P.; Gupta, K. Recent advancements in fabrication of metal matrix composites: A systematic review. *Materials* **2024**, *17*, 4635. [\[CrossRef\]](#)
22. Quinlan, L.; Brooks, T.; Ghaemi, N.; Arellano-Garcia, H.; Irandoost, M.; Sharifianjazi, F.; Amini Horri, B. Synthesis and characterisation of nanocrystalline CoFe_{1-x}GDC powders as a functional anode material for the solid oxide fuel cell. *Materials* **2024**, *17*, 3864. [\[PubMed\]](#)
23. Malik, K.; Ahmad, F.; Dawood, M.S.; Islam, M.S.; Ali, S.; Raza, A.; Shahed, C.A. Mechanical property enhancement of graphene-kenaf-epoxy multiphase composites for automotive applications. *Compos. A Appl. Sci.* **2024**, *177*, 107916.
24. Huang, W.; Li, Y.; Zhang, Y.; Xiao, Z.; Li, W. Experimental and numerical investigations of interlaminar shear behaviors of CFRP composites at cryogenic and high temperatures. *Compos. Struct.* **2025**, *352*, 118681. [\[CrossRef\]](#)
25. Nazari, A.; Taheri, F. On the pacifying influence of an elastomeric foam core on the failure mechanism of sandwich composites with various skin layups. *Int. J. Crashworthiness* **2023**, *28*, 402–417. [\[CrossRef\]](#)
26. Ren, J.; Zhou, Y.; Qiang, L.; Gao, W.; Meng, H.; Zhao, Z. Enhancing impact resistance of metallic foam core sandwich constructions through encasing high-strength fibrous composites. *Thin-Walled Struct.* **2024**, *196*, 111546. [\[CrossRef\]](#)
27. Zhang, R.; Han, B.; Zhou, Y.; Qiang, L.-S.; Zhang, Q.; Zhang, Q.-C.; Lu, T.J. Ballistic performance of ultralight multifunctional cellular sandwich plates with UHMWPE fiber metal laminate skins. *Compos. Struct.* **2023**, *304*, 116390. [\[CrossRef\]](#)
28. Ursache, S.; Cerbu, C.; Hadăr, A.; Petrescu, H.A. Effects of rubber core on the mechanical behaviour of the carbon–aramid composite materials subjected to low-velocity impact loading considering water absorption. *Materials* **2024**, *17*, 4055. [\[CrossRef\]](#)
29. Zhang, Z.; Guo, H.; Lan, Y.; Zhao, L. Impact resistance study of fiber-metal hybrid composite laminate structures: Experiment and simulation. *Materials* **2025**, *18*, 2906. [\[CrossRef\]](#)
30. Belhouari, M.; Benkheira, A.; Madani, K.; Campilho, R.; Gong, X. Effect of temperature on the energy release rate variation in repaired laminate composites. *J. Fail. Anal. Prev.* **2023**, *23*, 420–435. [\[CrossRef\]](#)
31. Van Der Meer, F.; Sluys, L. Continuum models for the analysis of progressive failure in composite laminates. *J. Compos. Mater.* **2009**, *43*, 2131–2156. [\[CrossRef\]](#)
32. Fuga, F.R.; Donadon, M.V. A progressive damage model for composite laminates based on non-linear continuum mechanics—Static and fatigue loadings. *Theor. Appl. Fract. Mech.* **2022**, *122*, 103639. [\[CrossRef\]](#)
33. Gonçalves, D.C.; Ramalho, L.D.C.; Campilho, R.D.S.G.; Belinha, J. Predicting the mixed-mode fracture propagation in single-leg bending using a radial point interpolation meshless method. *Compos. Struct.* **2024**, *343*, 118270. [\[CrossRef\]](#)
34. Wang, Z.; Ye, J.; Lei, Z.; Gao, T.; Qu, H.; Liu, K.; Chen, Z.; Yuan, K. A multi-scale simulation strategy for cutting three-dimensional braided composite materials. *Compos. A Appl. Sci.* **2025**, *199*, 109216.
35. Xu, X.; Wang, G.; Yan, H.; Zhang, L.; Yao, X. Deep-learning-enhanced digital twinning of complex composite structures and real-time mechanical interaction. *Compos. Sci. Technol.* **2023**, *241*, 110139. [\[CrossRef\]](#)
36. Khatir, S.; Tiachacht, S.; Le Thanh, C.; Ghandourah, E.; Mirjalili, S.; Wahab, M.A. An improved artificial neural network using arithmetic optimization algorithm for damage assessment in FGM composite plates. *Compos. Struct.* **2021**, *273*, 114287. [\[CrossRef\]](#)
37. Benyettou, M.; Madani, K.; Djebbar, S.C.; Amin, H.; Belhouari, M.; Elajrami, M.; Feaugas, X.; Campilho, R.D.S.G. Analysis of load-displacement curves of an adhesive-reinforced composite patch repaired plate using the combination of XFEM and CZM techniques. *Int. J. Adhes. Adhes.* **2025**, *136*, 103885. [\[CrossRef\]](#)
38. Aminallah, S.; Madani, K.; Benyettou, M.; Boussahra, M.; Harmel, M.; Campilho, R.D. Numerical analysis of composite patch repairs on damaged plates with optimized geometric modifications for improved fracture strength. *Mech. Adv. Mater. Struct.* **2025**, 1–20. [\[CrossRef\]](#)
39. Fan, W.; Yang, H.; Taylor, A.C. Numerical analysis of fracture in interpenetrating phase composites based on crack phase field model. *Compos. Sci. Technol.* **2023**, *232*, 109873. [\[CrossRef\]](#)
40. Pan, T.; Shu, Z.; Liu, Y.; Aydin, B.B.; Li, Y.; Zhou, Y.; Zhou, Y. Acoustic emission based health monitoring of RC corroded beams strengthened by CFRP anchorage system under bending loads. *Compos. Struct.* **2025**, *372*, 119514. [\[CrossRef\]](#)
41. Rijal, M.; Amoateng-Mensah, D.; Sundaresan, M.J. Finite element simulation of acoustic emissions from different failure mechanisms in composite materials. *Materials* **2024**, *17*, 6085. [\[CrossRef\]](#) [\[PubMed\]](#)

42. Cho, J.-R. Buckling analysis of functionally graded GPL-reinforced composite plates under combined thermal and mechanical loads. *Materials* **2025**, *18*, 567. [[CrossRef](#)] [[PubMed](#)]
43. Tablit, B.; Chellil, A.; Houari, A.; Lecheb, S.; Madani, K.; Mohamed, B.; Campilho, R.D.S.G.; Bey, M.; Djellab, A. Experimental study on failure detection of sandwich panels with different cores under bending, vibration and cyclic impact loading, use of piezoelectric technology. *Proc. Inst. Mech. Eng. Part L J. Mater. Des. Appl.* **2025**, *in press*. [[CrossRef](#)]
44. Bragagnolo, G.; Crocombe, A.; Ogin, S.; Mohagheghian, I.; Sordon, A.; Meeks, G.; Santoni, C. Investigation of skin-core debonding in sandwich structures with foam cores. *Mater. Des.* **2020**, *186*, 108312. [[CrossRef](#)]
45. Naik, R.; Das, A.; Mahale, P.; Panda, S.; Racherla, V. Design optimization of high interface strength metal–polymer–metal sandwich panels. *Compos. A Appl. Sci.* **2023**, *171*, 107544. [[CrossRef](#)]
46. Mansourinik, M.; Taheri-Behrooz, F. The effect of interface debonding on flexural behaviour of composite sandwich beams. *J. Sandw. Struct. Mater.* **2020**, *22*, 1132–1156. [[CrossRef](#)]
47. Jebadurai, D.S.; Kumar, A.A.J. Influence of different core configurations on the skin core bonding of sandwich composites. *J. Braz. Soc. Mech. Sci. Eng.* **2023**, *45*, 391. [[CrossRef](#)]
48. Atahan, M.G.; Erikli, M.; Ozipek, E.; Ozgun, F. Comparative study on bending behavior and damage analysis of 3D-printed sandwich core designs with bio-inspired reinforcements. *Eng. Fail. Anal.* **2024**, *163*, 108439. [[CrossRef](#)]
49. Sadiq, S.E.; Bakhy, S.H.; Jweeg, M.J. Optimum vibration characteristics for honey comb sandwich panel used in aircraft structure. *J. Eng. Sci. Technol.* **2021**, *16*, 1463–1479.
50. Chang, L. Stability improvement in different types of smart sandwich shells with piezoelectric sensor–actuator face sheets using feedback gain. *Int. J. Struct. Stab. Dyn.* **2025**, *25*, 2550104. [[CrossRef](#)]
51. Pehlivan, F. Thermo-mechanical vibration analysis of GPLs reinforced foam core smart sandwich nanosensor/actuator plates. *Mech. Based Des. Struct. Mach.* **2025**, *in press*. [[CrossRef](#)]
52. Raza, A.; Mieloszyk, M.; Rimašauskienė, R.; Jūrėnas, V. Dynamic analysis and vibration control of additively manufactured thin-walled polylactic acid polymer (PLAP) and PLAP composite beam structures: Numerical investigation and experimental validation. *Materials* **2024**, *17*, 5478. [[CrossRef](#)] [[PubMed](#)]
53. Bunoiu, O.M.; Bica, I.; Anitas, E.M.; Chirigiu, L.M.E. Magnetodielectric and rheological effects in magnetorheological suspensions based on lard, gelatin and carbonyl iron microparticles. *Materials* **2024**, *17*, 3941. [[CrossRef](#)] [[PubMed](#)]
54. Sasikumar, R.; Babu, B.R.; Subramanian, V.; Jayavel, R. Multifunctionality of MWCNT modified carbon fiber reinforced thermoplastic composite, and reclaiming composite in the pursuit of sustainable energy storage applications: An experimental and numerical analysis. *Compos. Sci. Technol.* **2024**, *248*, 110468. [[CrossRef](#)]
55. Sandá, A.; Ruiz, R.; Ángel Mafé, M.; Ander Sarasua, J.; González-Jiménez, A. Scrapping of PEKK-based thermoplastic composites retaining long fibers and their use for compression molded recycled parts. *AIMS Mater. Sci.* **2023**, *10*, 819–834. [[CrossRef](#)]
56. Kahla, H.B.; Völtz, L.R.; Agumba, D.O.; Varna, J.; Salmela, J.; Forsberg, F.; Lycksam, H.; Oksman, K. Mechanical performance and reinforcing potential of spun cellulose filaments in bio-based epoxy composites. *Compos. A Appl. Sci.* **2025**, *198*, 109153. [[CrossRef](#)]
57. Zouggar, K.; Guerraiche, D.; Rabouh, M.; Guerraiche, K.; Haddag, B.; Harmel, M.W.; Madani, K.; Campilho, R.D.S.G. Numerical damage assessment in T700/epoxy composite laminate under low and high velocity impacts using a modified hashin-puck criterion. *Compos. Struct.* **2025**, *372*, 119578. [[CrossRef](#)]
58. Maruyama, K.; Kawakami, Y.; Mori, K.; Kurita, H.; Shi, Y.; Jia, Y.; Narita, F. Electromechanical characterization and kinetic energy harvesting of piezoelectric nanocomposites reinforced with glass fibers. *Compos. Sci. Technol.* **2022**, *223*, 109408. [[CrossRef](#)]
59. Chanchí-Golondrino, G.E.; Saba, M.; Ospina-Alarcón, M.A. Comparative evaluation of the effectiveness and efficiency of computational methods in the detection of asbestos cement in hyperspectral images. *Materials* **2025**, *18*, 3456. [[CrossRef](#)] [[PubMed](#)]
60. Zhou, Z.; Wang, Y.; Cao, M.; He, Z.; Qiao, R.; Bi, F.; Wang, Y.; Zhang, X. Preparation of CeXMn1–XO2 catalysts with strong Mn-Ce synergistic effect for catalytic oxidation of toluene. *Materials* **2025**, *18*, 3809. [[CrossRef](#)]
61. Zhu, Z.; Kong, X.; Zhou, H.; Zheng, C.; Wu, W. A hybrid data-driven machine learning framework for predicting the impact resistance of composite armor. *Int. J. Impact Eng.* **2025**, *195*, 105125. [[CrossRef](#)]
62. Espinach, F.; Monzon, M.; Paz, R.; Ortega, R.; Fullana, P.; Bala, A.; Campos, C.; Delgado-Aguilar, M.; Tarrés, Q. Composites made of a blend of plastics recovered from bottle caps reinforced with fibers from banana rachis waste. A Circular Economy Strategy in the Canary Islands. *J. Clean. Prod.* **2024**, *483*, 144244. [[CrossRef](#)]
63. Mahmoud, H.A.; Lubineau, G. Advanced e-tattoo wireless strain sensors for smart structural health monitoring of composite structures. In Proceedings of the Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2025, Vancouver, BC, Canada, 17–20 March 2025; pp. 64–70.
64. Li, Q.; Zhao, G.; Li, J.; Li, S.; Yan, W.; Tian, X.; Ai, S. An in-situ predictive method for modulus degradation in composite structures with fatigue damage: Applications in digital twin technology. *Mech. Syst. Signal Process.* **2025**, *237*, 113090. [[CrossRef](#)]

65. Peng, S.; Li, P. Applications of nanomaterials and nanotechnology in military and aerospace fields. In *Nanomaterials and Nanotechnology: Basic, Preparation and Applications*; Springer: Berlin/Heidelberg, Germany, 2024; pp. 265–308.
66. Sansone, N.D.; Jung, J.; Serles, P.; Aguiar, R.; Razzaz, Z.; Leroux, M.; Filleter, T.; Ryu, S.; Lee, P.C. Synergy in bio-inspired hybrid composites with hierarchically structured fibrous reinforcements. *Chem. Eng. J.* **2024**, *487*, 150357. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.