Journal of
Composites Science

MDPI

Editorial

Editorial for the Special Issue: Multifunctional Composites in the *Journal of Composites Science*

Phuong Nguyen-Tri

Department of Chemistry, Biochemistry and Physics, Université du Québec à Trois-Rivieres, Local 3170, CIPP, 3351, boul. des Forges, C.P. 500, Trois-Rivières, QC G9A 5H7, Canada; Phuong.Nguyen-Tri@uqtr.ca

With the progress in nanotechnology and production methods, composite materials are becoming lighter, cheaper, more durable, and more versatile. At present, great progress has been made in the design, preparation, and characterization of composite materials, making them smarter and more versatile [1–3]. By creating new properties using suitable fillers and matrixes [3–5], the functional composites can meet the most difficult demands of users, especially in high-tech industries. Advanced composites reinforced by high-performance carbon fibers and nanofillers are popular in the automotive and aerospace industries thanks to their significant advantages, such as high specific strength to weight ratio and non-corrosion properties. In addition to the improvement of the mechanical performance, composite materials today are designed to provide new functions dealing with antibacterial, self-cleaning, self-healing, super-hard, and solar reflective activities for desired end-use applications [6–9]. On the other hand, composite materials can contribute to reducing environmental issues by providing renewable energy technologies in conjunction with multifunctional, lightweight energy storage systems with high performance and noncorrosive properties. They are also used to prepare a new generation of batteries and directly contribute to H_2 production or CO_2 reduction in fuels and chemicals.

In this Special Issue, we have collected a total of 12 excellent articles reporting on recent developments dealing with preparative methods, design, properties, structure, and characterization methods, as well as promising applications of multifunctional composites from internationally recognized researchers worldwide. These papers come from a total of 44 authors from 14 different countries, including the USA (2), the UK (1), Canada (4), Germany (4), China (3), Italy (1), Pakistan (1), Vietnam (11), Iran (3), Ethiopia (4), Bangladesh (4), Russia (4), Romania (1) and Poland (2). These articles cover potential applications in various areas, such as anticorrosion, photocatalyst, absorbers, superhydrophobic, self-cleaning, antifouling/antibacterial, renewable energy, energy storage systems, construction, electronics, and modeling and simulating processes involving the design and preparation of functional and multifunctional composites.

Various multifunctional materials based on biodegradable polymers are reported in this collection. Kong D. et al. reported on the preparation of composites that contain chitosan and pectin biopolymers with tunable adsorption properties. Binary biopolymer composites were prepared at variable pectin–chitosan composition in a solvent directed synthesis, dimethyl sulfoxide (DMSO) versus water [10], while Nguyen et al. published an article on the preparation of biodegradable composites based on polylactide acid reinforced by pulp fiber (PF) and epoxidized tung-oil (ETO). The effect of these components on mechanical properties are deeply discussed [11]. In another article, the influence of layer thickness (LT), infill percentage (IP), and extruder temperature (ET) on the maximum failure load, thickness, and build time of bronze polylactic acid (Br-PLA) composites 3D-printed by the fused deposition modeling (FDM) was investigated via an optimization method [12].

Some articles reported on the recent developments in smart coatings in terms of their mechanical properties, while the oxidative and weather resistance of come smart composite

check for updates

Citation: Nguyen-Tri, P. Editorial for the Special Issue: Multifunctional Composites in the *Journal of Composites Science*. *J. Compos. Sci.* **2021**, *5*, 15. https://doi.org/10.3390/jcs5010015

Received: 4 January 2021
Accepted: 6 January 2021
Published: 7 January 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Copyright: © 2021 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/).

coatings are also reported [13–16]. Regarding the applications of multifunctional composites to the environmental field, N-doped Cu_2O/ZnO nanocomposite on the degradation of methyl red is reported by Raim et al. [17], while the phototodegradation of CuO/ZnO to textile dyes is also investigated [18]. Computer simulation has also been used to predict the behavior of composite materials at the nanoscale [19]. A critical review on the complex multiphase polydisperse system is also reported in this collection [20].

The guest editor would like to thank the Editor in chief of the Journal of composites Science for accepting his proposal related to this Special Issue. Many thanks to the assistant editors for their kind help during the review process and for all steps relating to the production of the selected articles. I hope the high-quality articles published in this SI may provide helpful information to students, engineers, and researchers working on multifunctional composites.

References

1. Nguyen-Tri, P.; Tran, H.N.; Plamondon, C.O.; Tuduri, L.; Vo, D.-V.N.; Nanda, S.; Mishra, A.; Chao, H.-P.; Bajpai, A.K. Recent progress in the preparation, properties and applications of superhydrophobic nano-based coatings and surfaces: A review. *Progr. Organ. Coat.* **2019**, *132*, 235–256. [CrossRef]
2. Nguyen-Tri, P.; Nguyen, T.A.; Carriere, P.; Ngo Xuan, C. Nanocomposite Coatings: Preparation, Characterization, Properties, and Applications. *Int. J. Corros.* **2018**, *2018*, 4749501. [CrossRef]
3. Nguyen-Tri, P.; Sollogoub, C.; Guinault, A. Relationship between fiber chemical treatment and properties of recycled pp/bamboo fiber composites. *J. Reinf. Plast. Compos.* **2010**, *29*, 3244–3256. [CrossRef]
4. Tri, P.N.; Domenek, S.; Guinault, A.; Sollogoub, C. Crystallization behavior of poly(lactide)/poly(β-hydroxybutyrate)/talc composites. *J. Appl. Polym. Sci.* **2013**, *129*, 3355–3365. [CrossRef]
5. Azizi, S.; David, E.; Fréchette, M.F.; Nguyen-Tri, P.; Ouellet-Plamondon, C.M. Electrical and thermal phenomena in low-density polyethylene/carbon black composites near the percolation threshold. *J. Appl. Polym. Sci.* **2019**, *136*, 47043. [CrossRef]
6. Nguyen-Tri, P.; Altiparmak, F.; Nguyen, N.; Tuduri, L.; Ouellet-Plamondon, C.M.; Prud'homme, R.E. Robust Superhydrophobic Cotton Fibers Prepared by Simple Dip-Coating Approach Using Chemical and Plasma-Etching Pretreatments. *ACS Omeg.* **2019**, *4*, 7829–7837. [CrossRef]
7. Tri, P.N.; Prud'homme, R.E. Nanoscale Lamellar Assembly and Segregation Mechanism of Poly(3-hydroxybutyrate)/Poly(ethylene glycol) Blends. *Macromolecules* **2018**, *51*, 181–188. [CrossRef]
8. Nguyen-Tri, P.; Gilbert, V. Non-isothermal Crystallization Kinetics of Short Bamboo Fiber-reinforced Recycled Polypropylene Composites. *J. Reinf. Plast. Compos.* **2010**, *29*, 2576–2591. [CrossRef]
9. Azizi, S.; Ouellet-Plamondon, C.M.; Nguyen-Tri, P.; Fréchette, M.; David, E. Electrical, thermal and rheological properties of low-density polyethylene/ethylene vinyl acetate/graphene-like composite. *Compos. Part B Eng.* **2019**, *177*, 107288. [CrossRef]
10. Kong, D.; Wilson, L.D. Uptake of Methylene Blue from Aqueous Solution by Pectin–Chitosan Binary Composites. *J. Compos. Sci.* **2020**, *4*, 95. [CrossRef]
11. Nguyen, V.K.; Nguyen, T.T.; Pham Thi, T.H.; Pham, T.T. Effects of Pulp Fiber and Epoxidized Tung Oil Content on the Properties of Biocomposites Based on Polylactic Acid. *J. Compos. Sci.* **2020**, *4*, 56. [CrossRef]
12. Moradi, M.; Karami Moghadam, M.; Shamsborhan, M.; Bodaghi, M. The Synergic Effects of FDM 3D Printing Parameters on Mechanical Behaviors of Bronze Poly Lactic Acid Composites. *J. Compos. Sci.* **2020**, *4*, 17. [CrossRef]
13. Nguyen, T.V.; Nguyen, T.A.; Nguyen, T.H. The Synergistic Effects of Sio2 Nanoparticles and Organic Photostabilizers for Enhanced Weathering Resistance of Acrylic Polyurethane Coating. *J. Compos. Sci.* **2020**, *4*, 23. [CrossRef]
14. Alharaty, G.; Ramaswamy, H.S. The Effect of Sodium Alginate-Calcium Chloride Coating on the Quality Parameters and Shelf Life of Strawberry Cut Fruits. *J. Compos. Sci.* **2020**, *4*, 123. [CrossRef]
15. Abbas, I.; Wang, Y.; Elahi, H.; Siddiqui, M.A.; Ullah, M.; Qayyum, F. Effect of $MoSi_2$-Si_3N_4/SiC Multi-Layer Coating on the Oxidation Resistance of Carbon/Carbon Composites above 1770 K. *J. Compos. Sci.* **2020**, *4*, 86. [CrossRef]
16. Afshar, A.; Wood, R. Development of Weather-Resistant 3D Printed Structures by Multi-Material Additive Manufacturing. *J. Compos. Sci.* **2020**, *4*, 94. [CrossRef]
17. Gaim, Y.T.; Tesfamariam, G.M.; Nigussie, G.Y.; Ashebir, M.E. Synthesis, Characterization and Photocatalytic Activity of N-doped Cu2O/ZnO Nanocomposite on Degradation of Methyl Red. *J. Compos. Sci.* **2019**, *3*, 93. [CrossRef]
18. Sakib, A.A.M.; Masum, S.M.; Hoinkis, J.; Islam, R.; Molla, M.A.I. Synthesis of CuO/ZnO Nanocomposites and Their Application in Photodegradation of Toxic Textile Dye. *J. Compos. Sci.* **2019**, *3*, 91. [CrossRef]
19. Van Tham, V.; Huu Quoc, T.; Minh Tu, T. Free Vibration Analysis of Laminated Functionally Graded Carbon Nanotube-Reinforced Composite Doubly Curved Shallow Shell Panels Using a New Four-Variable Refined Theory. *J. Compos. Sci.* **2019**, *3*, 104. [CrossRef]
20. Smirnova, A.; Konoplev, G.; Mukhin, N.; Stepanova, O.; Steinmann, U. Milk as a Complex Multiphase Polydisperse System: Approaches for the Quantitative and Qualitative Analysis. *J. Compos. Sci.* **2020**, *4*, 151. [CrossRef]