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Editorial: Fiber-reinforced composites: design, characterization, analysis, and application

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Editorial on the Research Topic

[Fiber-reinforced composites: design, characterization, analysis, and
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To ensure the operation reliability, durability and safety of fiber-reinforced composite components in different application areas of aerospace, transportation, and nuclear industry, etc., it is necessary to perform experimental and theoretical investigations on the mechanical properties, defect/damage identification, and optimization design, etc. The Research Topic aimed to capture the recent developments of advancing new methods, experimental damage/defect identification technologies, optimization design methods in different fiber-reinforced composites, expecting to widen the knowledge in the research area and promote the applications. The Research Topic has currently collected five papers, including three original research articles and two reviews.

The three original research papers mainly focused on the investigations on the interfacial treatment, micro EDM drilling, and physiological and morphological properties of different fiber-reinforced composites.

Zhou et al. conducted experimental investigation on the effect of interfacial treatment on the static bending strength and elastic modulus of plant fiber/phenolic resin composites at room temperature. The mechanical properties of the strength and modulus have been improved after the pretreatment of the plant fibers by improving the compatibility between the plant fiber and the resin matrix. Compared with the untreated fiber reinforced phenolic resin (PF/SF) composites, the static bending strength and elastic modulus of the phenolic resin/lipase treatment rice straw fibers (PF/L-SF) composite increased by 32.9% and 30.5%, respectively.

Kaushik et al. performed experimental investigation on the process parameters (i.e., voltage, capacitance, and tool rotation speed) on the micro hole EDM drilling quality of CFRP composites using the response surface method. The result showed that the capacitance affected the hole quality of material removal rate, roundness error, and taper. Relationships between the optimum material removal rate, hole quality and process parameters have been established.

Zouari et al. analyzed the effect of biochar (BC) on the physiological and morphological properties of the hemp-poly(lactic acid) composites. Measurements of weight loss, color stability, microscopic observations, and water contact angle were conducted. Experimental results showed that the white and brown rots invaded the composites' surface at the initial stage of the incubation period and then accessed the interior of the composite materials due to the occurrence of microcracks which enabled the fungi to invade the internal structure of the composites.

The two review papers focused on the non-destructive testing and evaluation techniques, and intelligent methods for optimization design of lightweight composites.

Chen et al. performed the review on the nondestructive testing and evaluation (NDE&E) techniques of defects in fiber-reinforced polymer composites. Different NDT&E techniques were analyzed and divided into three categories based on the operation frequency and data processing means. Suitable NDT&E methods were identified for four types of defects/damage of great interest. The cost, inspection speed, benefits, limitations, and the development of the NDT&E technologies and their applications were compared and analyzed.

Chen et al. reviewed the intellectualization methods development for optimization design of lightweight fiber-reinforced composite structures, including prediction and optimization methods for composite properties. The trend of intelligent design technologies and intelligent composite structures were also discussed.

In conclusion, this Research Topic presented insightful and innovative investigation on the composites, promoting the development of this field. We sincerely thank all authors and reviewers for contributing to this Research Topic.

Author contributions

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