

PROCEEDINGS

Enhancement of Fracture Toughness and Self-Healing Property of Fiber Reinforced Composite

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ABSTRACT

Over the past several decades, fiber-reinforced composites have been widely used in many industrial fields, including aerospace, automotive, wind energy, sports equipment, and beyond. This widespread adoption is primarily due to their excellent combination of properties, such as high specific strength and stiffness, good fatigue resistance, and strong anticorrosion performance. However, during actual service conditions, composite materials are often subjected to various types of impact loadings, such as hail impact, bird strikes, or accidental drops of maintenance tools. These impact events can generate tiny internal cracks within the material. Such damage is usually very difficult to detect using conventional inspection methods, yet it can significantly degrade the structural integrity and safety of the component over time. Therefore, introducing a self-healing function into composite materials would be highly beneficial to address this challenge. In this study, we systematically investigate the impact properties of different composite materials. To achieve self-healing capability, we develop and integrate several healing strategies into the composites, including microcapsules containing healing agents, thermoplastic films, and shear stiffening gel. These components serve as both extrinsic and intrinsic healing materials within the composite system. Our experimental results show that the embedded microcapsules, thermoplastic films, and shear stiffening gel exhibit excellent healing efficiency, effectively repairing impact-induced damage and restoring mechanical performance. Furthermore, we explore the association mechanism between the impact properties and the self-healing properties of the composite materials. This investigation provides a deeper understanding of how impact resistance and healing behavior interact, thereby opening a new window for the development of next-generation multifunctional composites.

KEYWORDS

Fiber reinforced composite; impact loading; self-healing; fracture toughness

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