Self-Healing Fiber-Reinforced Composites

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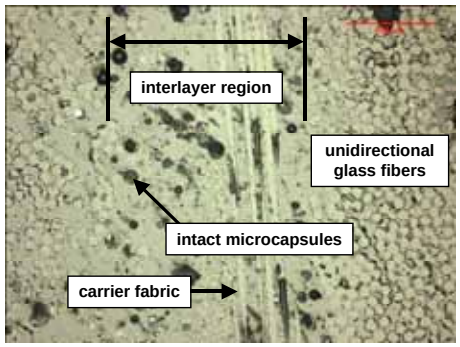
Abstract

Self-healing polymers have been continuously refined and optimized since their emergence in 2001. Several conceptual approaches have been pursued using either one or two component chemistries, operating over a range of size scales, and in a variety of polymer matrices. Transitioning these impressive results to fiber-reinforced composite systems requires advancements in a number of technical areas. Incorporating component phases such that virgin properties are not severely impacted, integrating a multiscale system in one matrix, and ensuring that healing functionality is maintained are all critical challenges that are currently being addressed. In this paper we report on recent research focused on fiber-reinforced self-healing epoxy composites for structural applications. The materials systems consist of glass or graphite continuous structural fibers embedded in an epoxy matrix that contains microcapsules of a healing agent and a solid catalyst phase. We report on the development of a prepreg form of the material suitable for lamination of structural panels, as well as wet lay-up of woven glass composite laminates. Healing functionality is assessed for static fracture and impact damage conditions.



Self-healing glass/epoxy composite.

A microencapsulated healing agent is embedded in a glass/epoxy structural composite in the interlayer regions (O. Armagan, Univ. of Illinois, 2005).