

Self-Healing Polymer Composites for Extended Fatigue Life

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A novel approach is explored for improving the fatigue life of thermosetting polymers through the addition of self-healing functionality. Thermosetting polymers are used in a wide variety of applications, but are susceptible to the initiation and propagation of small cracks deep within the structure where detection is difficult and repair is virtually impossible. The material under investigation is an epoxy matrix composite that utilizes embedded microcapsules to store a healing agent and an embedded catalyst. A propagating crack exposes particles of catalyst and ruptures the microcapsules, which release healing agent into the crack plane. Polymerization of the healing agent is triggered by contact with the catalyst. Fatigue crack retardation and arrest from self-healing functionality result from crack-tip shielding mechanisms, such as hydrodynamic pressure and artificial-crack closure. In situ healing is observed to significantly extend fatigue life or permanently arrested fatigue crack growth over a wide range of loading conditions.

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