LIFE EXTENSION THROUGH AUTONOMIC HEALING OF FATIGUE CRACKS

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The resistance of thermosetting polymers to fatigue crack propagation is significantly improved with the use of autonomic crack healing technology. Current autonomic healing technology uses a combination of catalyst particles and microcapsules of healing agent embedded in the thermosetting polymer matrix[1]. As a fatigue crack propagates through the polymer matrix, catalyst particles are exposed and the microcapsules of healing agent are ruptured, releasing healing agent into the crack plane[2].

Polymerization of the healing agent is triggered by contact with the exposed catalyst particles. The fatigue crack growth rate is dependent on the mechanical loading (stress ranges, frequency etc.) and the in situ cure kinetics of the healing agent. As the cure kinetics are accelerated, the fatigue crack growth rate is reduced. The cure kinetics of the system depend on the availability and reactivity of the catalyst. Methods have been developed to protect the catalyst from deactivation during the fabrication of the self-healing polymer composite as well as improving the dissolution of the catalyst in the healing agent. These measures have significantly improved the fatigue performance of self-healing polymer composites. Further work is in progress to investigate autonomic healing material systems and to better understand the complex relationship between loading parameters, healing cure kinetics and crack growth rate.

References

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