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Vascular self-healing within carbon fibre reinforced polymer stringer run-out configurations

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Abstract

Stringer debonding within stiffened, assembled aerospace structures is one of the most critical damage scenarios that can occur in such structures. As a result, a degree of redundancy is inherently built-in to the design process of skin-stringer configurations to mitigate against premature and in-service failure. Introducing a "self-healing" solution for stringer run-out configurations has the benefit of mitigating and controlling damage initiation, and by introducing this concept there is great potential to reduce excessive conservative safety margins that could ultimately lead to more lightweight designs. Vascular self-healing technology has been successfully implemented into a simplified strap lap specimen, showing that the introduction of a vascular microchannel reduces the strength by 15% but has little effect on the stiffness. Upon delivery and cure of epoxy-based self-healing agents full recovery of the mechanical properties was observed. This self-healing approach has been further implemented into industrially relevant, larger stringer run-out panels as a feasibility study, in which no knockdown to mechanical properties caused by the embedded vascular microchannels has been observed, this study has also shown similar promising results in terms of performance recovery.