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Editorial corner – a personal view

Interleaving in structural composites: Adapting an old concept to new challenges

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Composite laminates possess excellent in-plane but moderate out-of-plane properties. For this reason, it is of primary importance to monitor the residual performance of composites after subcritical transverse impact by compression after impact or similar tests. Various approaches, including interleaving, were already introduced and adapted with limited success to enhance the resistance to delamination, being the most crucial failure type (https://doi.org/10.1080/15583724.2017.1309663). Most of them, however, were associated with considerable reduction in the in-plane properties.

The possibility to produce nano-engineered electrospun webs put the old interleaving concept under spotlight of research again recently. In fact, doping of the electrospinning solution or melt with anisometric nanoparticles, such as carbon nanotubes or graphene, and positioning the resulting nanoweb in interlaminar regions of structural composites may offer further functionalities, such as through-thickness electric conductivity, self-healing, sensing. To meet these requirements, the thermoplastic carrier of these carbonaceous nanofillers with a percolated structure should be (partly) soluble in the composite matrix.

An even more promising strategy towards functional interleaving can be achieved using additive manufacturing, for example fused deposition modeling (FDM). Here the local morphology can be tailored at a meso- or microscale instead of nanoscale, i.e. just above the typical critical fiber length in composites (https://doi.org/10.3144/expresspolymlett.2017.50). A further benefit is that the deposited pattern may retain its integrity after curing of the resin when suitable, i.e. less soluble, thermoplastics are selected. This feature may yield shape memory and self-healing performances, as well.

Via placement of the electrospun or FDM assemblies the interphase/interlaminar morphologies of the resin can be tailored through bypassing thermodynamics of the reaction-induced phase separation in thermosets. As a consequence, the local morphology may work for efficient toughening.

The interested reader may find some hints for the above mentioned concepts, though mostly implicitly, in the literature. So, why not to tackle such new interleaving concepts in detail?

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