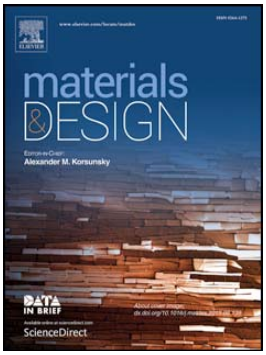

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Interlaminar Strengthening of Multidirectional Laminates using Polymer Additive Manufacturing

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Abstract

A novel approach for improving the inter laminar shear strength (ILSS) properties of multi-directional prepreg laminates using polymer additive manufacturing (PAM) technology is proposed in this paper. Fused deposition modeling (FDM) is the PAM technology used for imparting patterns onto carbon prepregs. These modified prepregs are further used for fabricating multi-directional laminates. Prior to manufacturing the laminates, interlaminar regions that are most susceptible to delamination type failure are identified using numerical simulations for selectively reinforcing these critical regions. Next, the influence of printed reinforcements on the ILSS of modified laminates is compared against pristine laminates by conducting short beam shear (SBS) tests. Significant improvement in the ILSS values of up to 28% is observed, which can be attributed to the resistance offered by the printed reinforcements that steered the delamination surfaces along undulated paths as opposed to smooth or straight paths in pristine laminates. Such behavior corroborates the resistance to delamination offered by these printed reinforcements. In summary, this is a pioneering study for exploring the feasibility of using PAM technology for imparting reinforcements at the interlaminar regions in multi-directional laminates with the intention of minimizing delamination.

Keywords: Polymer Additive manufacturing; Multi-directional Laminates; Interlaminar Shear Strength; Delamination; Finite element analysis

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