Numerical Approach to Predict the Thermal Expansion Coefficients of Honeycomb Core Validated by Experimental Test Results

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Honeycomb cores are typically produced in the form of flat sheets and are heat formed to the desired shapes for use in sandwich structures with curvatures. Understanding of the high temperature behavior of honeycomb core is fundamental to the process of forming honeycomb core. A 3D non-linear finite element model (FEM) of the repetitive unit cell of hexagonal honeycomb core is employed to predict the CTE of Fiberglass/Phenolic honeycomb core. It is shown that the CTE of the honeycomb core is highly dependent on node bond adhesive layer and its fillet region. Inclusion of the node bond adhesive layer and its fillet region in FEM leads to orthotropic thermal expansions. The wedge action created by the adhesive fillet contributes to the higher magnitudes of CTE's as well as a negative CTE along the ribbon direction. Good agreement is observed between numerical model predictions and test results.