Improving Adhesive Bonding of Composites Through Surface Characterization

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ABSTRACT
Adhesive bonds, especially those that are secondarily bonded, are sensitive to surface conditions, including chemical and mechanical considerations. Thus, the most important step in secondary bonding is surface preparation, which prevents or removes contaminants that can adversely affect bonding while also creating chemically active sites to maximize bond strength. The purpose of this research was to examine numerous composite surface preparation methods in terms of surface characteristics and bond quality. The materials examined were carbon fiber reinforced epoxy laminates prepared with various methods, including peel ply, abrasion, and atmospheric pressure plasma treatment. Surface analysis techniques utilized were XPS, FTIR and contact angle measurements. Bond quality was measured with the double cantilever beam test. Various adhesive systems were examined and ranged from room temperature cure paste adhesives to elevated cure (121 and 177 °C) film adhesives. Generally, abrasion and atmospheric pressure plasma create a surface independent of peel ply or release film material promoting high bond quality, while peel ply prepared surface characteristics (chemistry, energy, and bond quality) are materials system (peel ply, composite, and adhesive) dependent.