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Improving Adhesion Properties in CF/PEKK Composites: Effects of HNT-Modified PEI Adhesive on Surface Energy and polarity

Abstract: Recently in the aerospace industry, large structures are joined using mechanical engagement like bolt joints. However, the joining method of mechanical engagement has several weakness, such decreasing stability and safety due to stress concentration. Due to these problems, research on the bonding of Carbon Fiber/Poly-Ether-Ketone-Ketone(CF/PEKK) laminates without mechanical engagement has been actively conducted, such as fusion welding and adhesive welding. In chemical bonding, adsorption capacity acts as an important factor in increasing chemical bonding abilities. To improve the adsorption capacity, laminates and adhesive should have similar surface energy. And also, polarity of adhesive acts as quite important factor in improving the adsorption capacity. Halloysite nanotube (HNT) is a nano-particle gaining attention for its ability to enhance the interfacial bonding strength of composites. With hydrogen bonding groups in its molecular structure, it can provide higher polarity when incorporated into PEI adhesive.

In this study, CF/PEKK was welded using PEI adhesive film between each laminate. To improve the adhesion abilities, the laminate surface was treated with mechanical abrasion, and the PEI adhesive film was modified by adding HNT. The contacting angle test was conducted to measure the wettability and surface energy of the PEI adhesive film and CF/PEKK laminates. To estimate adhesion performance, sing lap shear test was conducted to analyze lap shear strength (LSS). In condition of HNT addition, LSS improved due to the increased surface energy of the adhesive film. Following fracture, adherend failure was predominant at the bonding interface, with partial occurrences of adhesive and cohesive failures. And in condition of HNT addition, the rough ductile drawing was observed, which is considered to be due to the hydrogen bonding groups of HNT.

Keywords: CF/PEKK, PEI adhesive, HNT, Adsorption capacity

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