

2014 POSTER SESSION WINNER – ENTRY #58378

ABSTRACT

The purpose of this research was to determine the effect of atmospheric pressure plasma treatment on Mode I strain energy release rate (GIC) and failure mode of bonded peel ply prepared carbon fiber reinforced polymer composites. Previous research showed that Toray T800/3900-2 carbon fiber reinforced epoxy composites prepared with Precision Fabrics Group 52006 nylon peel ply and bonded with MetlBond 1515-3M structural film adhesive failed in adhesion at low fracture energies when tested in the double cantilever beam (DCB) configuration. Other research suggested that plasma treatment may be able to activate these “un-bondable” surfaces and result in good adhesive bonds. Nylon peel ply prepared 177 °C cure carbon fiber reinforced epoxy laminates were treated with atmospheric pressure plasma after peel ply removal prior to bonding. Surface characterization methods, including contact angle and Fourier transform infrared (FTIR) spectroscopy, were used to determine how plasma treatment changed nylon peel ply prepared surfaces. DCB specimens were bonded with MetlBond 1515-3M and tested to determine failure mode and GIC. Plasma treated samples had acceptable failure modes and fracture energies that were triple that of peel ply only samples. It was demonstrated that atmospheric pressure plasma reversed the curse of this nylon peel ply. Fracture data was correlated to surface characterization results to understand the effect of plasma treatment on the surface and resultant bond quality.

PRIMARY AUTHOR

Ashley C. Tracey
Graduate Student
University of Washington

ADDITIONAL INFORMATION

I started graduate school at the University of Washington in June of 2009 with Dr. Brian Flinn. Our research has focused on the development of quality assurance methods for prebond surface preparation for adhesive bonding, with an emphasis on relating surface characteristics to bond quality. Surface preparations have included peel ply, abrasion, and atmospheric pressure plasma treatment. Characterization methods have included contact angle measurements, Fourier transform infrared (FTIR) spectroscopy, and X-ray photoelectron spectroscopy. Bond quality measurements have included the double cantilever beam test, the climbing drum peel test, and the rapid adhesion test.

100 WORD DESCRIPTION

The purpose of this research was to determine the effect of atmospheric pressure plasma treatment on Mode I strain energy release rate (GIC) and failure mode of nylon peel ply prepared carbon fiber reinforced polymer composites bonded with MetlBond 1515-3M adhesive. Fracture data was correlated to surface characterization results to understand the effect of plasma treatment on the surface and resultant bond quality.

Focus Area(s)

Materials