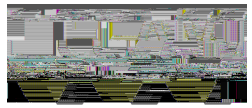
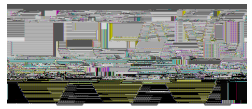
Improving Adhesive Bonding of Composites Through Surface Characterization



The Joint Advanced Materials and Structures Center of Excellence

Improving Adhesive Bonding of Composites



Motiv tion nd ey Issues

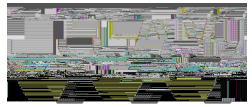
Effect of Surface Preparation Technique on Bond Quality of AGATE Composite Laminates

Brian Flinn

Curtis Hickott

University of Washington

Materials Science and Engineering



Effect of Surf ce Prep r tion Technique on

FAA Sponsored Project Infor tion

Princip l Investig tors Rese rchers

Bri n D Flinn PI

Curtis Hick ott BS new PhD student U MSE

Jeffery S terwhite MS U MSE

FAA Technic l Monitor

D vid estlund Curt D vies

Other FAA Personnel Involved

L rry Ilcewicz

Industry P rticip tion

Tor y Co posites

Henkel Intern tion l

Precision F rics Rich ond Aerosp ce Airtech Intern tion l

The Boeing Co p ny

Outline

- B ckground
  - AGATE teri ls
  - Bonding-Surf ce Prep r tion
- Processing nd Test Procedures
- Surf ce Ch r cteriz tion
  - Cont ct Angle Results
  - Surf ce Energy
  - SEM
- Bond Qu lity Tests
- Su ry

AGATE M teri ls

Three prepreg teri ls tested

Tor y AGATE teri ls Tor y resin.

- C r on T pe
- C r on F ric
- Fi ergl ss F ric

Surf ce Prep r tion

Cruci l for proper dhesion in co posites

Sever l ethods

- Peel ply s tooled
- A r sion S nding or grit l sting

Surf ce prep r tion influences surf ce energy nd the wett ility of surf ce lso prevents re oves

Procedures

Surf ce Prep r tion

Peel ply Precision F rics Group „l nylon or „l polyester

S nded H nd s nded with „l grit Al O

Cont ct ngle e sure ents t ken with si st nd rd fluids

Surf ce energy deter ined using Owens endt two p r eter odel

Bonding procedure

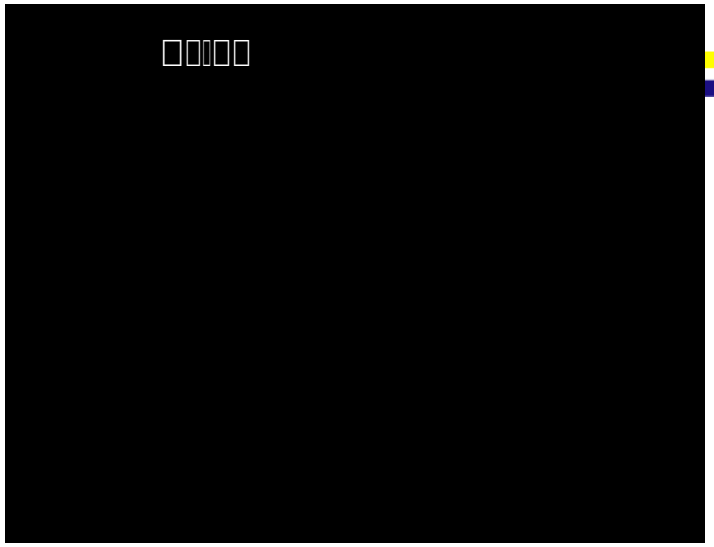
fil dhesive Henkel EA „l „l v cuu g cure C F

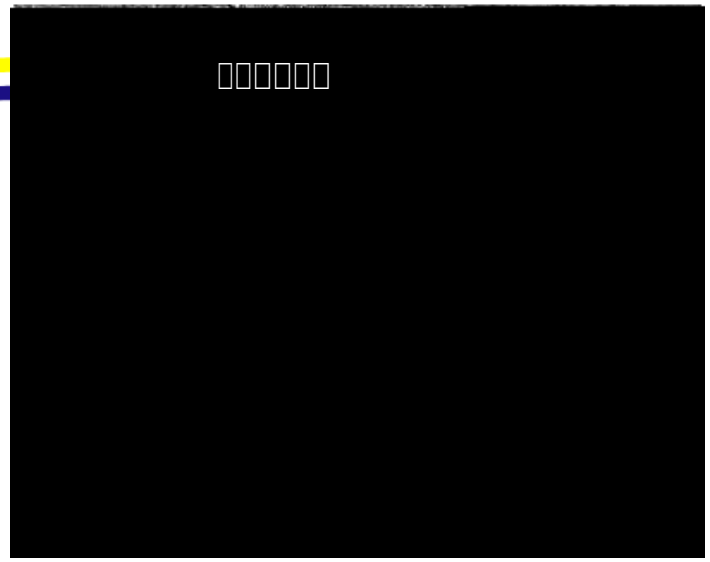
R pid Adhesion Tests RAT

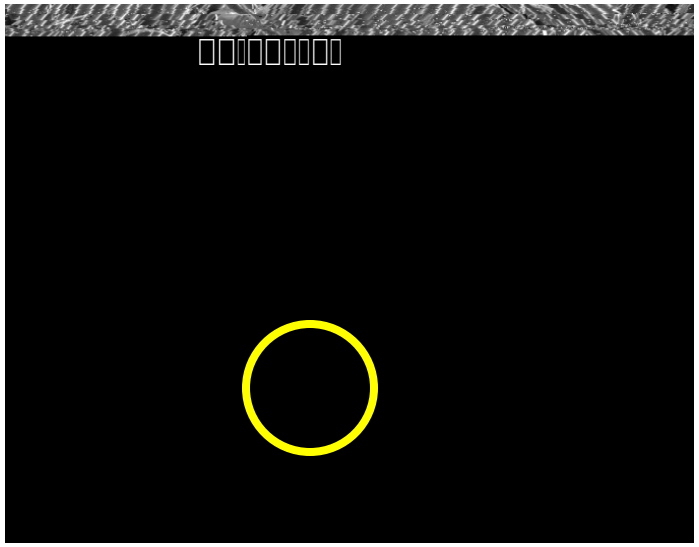
for ond qu lity ssess ent Mode I peel test

SEM i ges of the su str te nd the RAT ond fr cture surf ces

Su str tes fter Surf ce Prep r tion







Fi er reinforce ent did not h ve signific nt effect on surf ce ch r cteristics

Represent tive c r on f ric surf ces shown

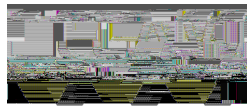
S nding re oved ny peel ply i print

Re n nts of polyester peel ply visi le

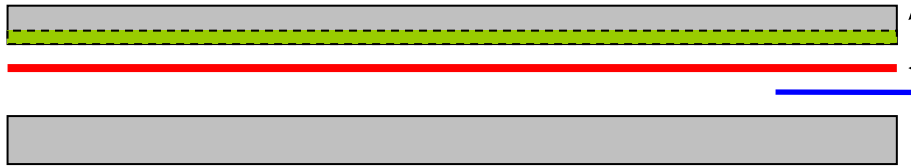
Surf ce Energy

- The pol r co ponent nd tot l surf ce energy were found to incre se fter s nding
- S nding decre sed dispersive co ponent of polyester surf ce

ett ility Envelopes C r on F ric



R pid Adhesion Test RAT



The RAT s ple is si ple nd ccur te ond test used to deter ine ode of f ilure

By e ining the surf ce nd deter ining the ode of f ilure the qu lity of the ond c n e ssessed

Types of Bond F ilures

F ilure of Adhesion B d

Cohesive epo y or dhesive Good

R pid Adhesion Test S ples

Surface Preparation

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
-

ork In Progress

Conclusions

Fi er type h d little effect on surf ce che istry surf ce prep r tion nd ond qu lity

Good onds were produced with the Tor y AGATE teri ls nd the Henkel EA „l „l dhesive with the proper surf ce prep r tion

ett ility envelopes illustr ted the different surf ce ch r cteristics produced y the surf ce prep r tions

ett ility envelopes y h ve role in ssessing surf ce prep r tion


AMTA

A Look Forw rd

Benefit to Avi v. iF d o.