

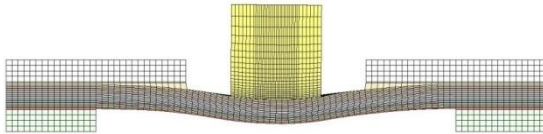
RESPONSE OF THE ADHESIVE INTERLAYER UNDER DYNAMIC LOADING

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OBJECTIVES

- ◆ Design a test method which subjects the adhesive interlayer to a large strain at a high strain rate and is capable of characterizing this dynamic deformation behavior while using actual components and dimensions similar to a realistic impact scenario
- ◆ Use the test method to examine the role of interlayer and measure properties related to strain, strain rate, and crack propagation
- ◆ Take findings from the test results to quantify the optimum properties needed for the interlayer



DYNAMIC BEAM TEST DESIGN

- ◆ The beam test design was developed using FE modeling and adapted to be used with the gas gun
- ◆ A projectile is fired from the gas gun impacting a punch which loads the composite backing plate therefore deforming the adhesive interlayer
- ◆ High-speed camera captures deformation

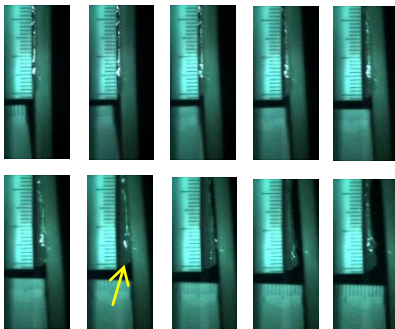


SPECIMEN DESIGN & FABRICATION

- ◆ Specimen was designed to allow for maximum strain of the interlayer under a high realistic strain (~26,000/sec) before fiber or ceramic damage
- ◆ The specimens are 2.0-in x 10.25-in with 2.25-in tile cavity in center
- ◆ The composite is 6 layers thick composed of S2-glass and SC-15 resin
- ◆ Aluminum tiles are used initially to replace ceramic tiles
- ◆ A silicon mold was made to fabricate specimens
- ◆ Pre-treated tiles are first placed in the mold, de-gassed resin is then poured, the composite placed on top and specimen placed in oven to cure

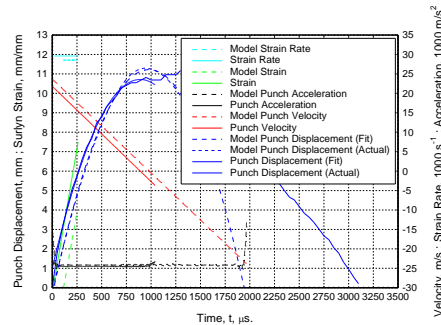


INITIAL RESULTS



Max Strain: ~800%

COMPARISON OF FE AND EXPERIMENTAL RESULTS



PATH FORWARD

- ◆ Replace aluminum tiles with ceramic
- ◆ Continue testing a variety of potential interlayer materials:
 - Air Products VPS Resins
 - Structural Adhesives
 - Surlyn
- ◆ Fully develop and further understand analysis parameters
- ◆ Consider complete analysis and make conclusions regarding the optimal interlayer properties needed.

CONCLUSIONS

- ◆ Experimental testing shows good congruence with FE models
- ◆ The dynamic beam test method is an adequate way to study adhesive interlayers under dynamic loading

ACKNOWLEDGEMENTS

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