

# **Degradation of Composite Adhesives**

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Meeting**

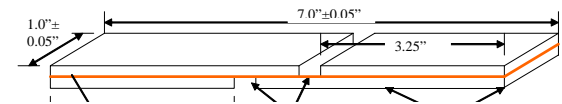
# Objectives

- **Characterization**
  - **Effect of adherend moisture content on adhesion of AF555**
  - **Effect of surface preparation on degradation**
- **Methodology**
  - **Improve composite wedge crack coupon**
  - **Procedures to accelerate degradation**
  - **Test methods to accelerate degradation**

# Characterization Techniques

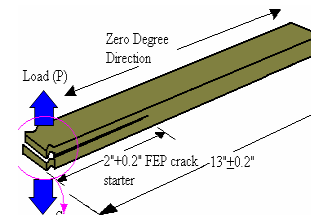
- **Wide Area Lap Shear (WALS)**

- No load
- Constant load



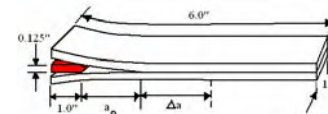
- **Double Cantilever Beam (DCB)**

- No load
- Constant Load
- Fluctuating Load



- **Wedge Crack (WC)**

- Compliant Adherends



- **In-Plane Shear (IPS)**

- No load
- Constant load



- **Compression Interlaminar Shear (CILS)**

- No load



# Materials

- **Prepreg**
  - Toray T800/3900-2B (Low cost BMS 8-276)
  - Standard BMS 8-276
- **Peel Ply**
  - Polyester, fine (Precision Fabrics 60001)
  - Nylon, texture (Precision Fabrics 52006)
  - SRB, coarse (Super Release Blue, siloxane coated polyester)
- **Adhesive**
  - 3M AF555
- **Surface Treatments**
  - Peel Ply (60001)
  - Sand (220)
  - Grit Blast (80)
  - Grit Blast (220)

# Accelerating Degradation

- **Concentration**
  - Immersed in water
- **Diffusion**
  - Scales with square of thickness
  - 40 plies at 140F requires 6k hrs to saturate
- **Temperature**
  - Accelerates diffusion
  - Limited to avoid phase changes
- **Load**
  - Accelerates diffusion, increases saturation
  - Can have synergistic effect with solvent
  - Limited to avoid coupon failure

## Summary: Characterization

- **AF555 is relatively insensitive to adherend moisture content prior to bonding**
- **Standard and low cost BMS 8-276 have similar reductions in interlaminar shear strength and shear modulus from moisture sorption**
- **Polyester peel ply provided superior strength, toughness, and immersed creep rupture**
- **Abrasive techniques did not improve bond strength over peel ply**
  - **Gritblasting tended to lower bond strength**

## Summary: Methodology

- **10 ply wedge crack coupon supported DCB and WALS findings**
  - **8 ply wedge crack coupon similar to 10 ply**
  - **12 ply wedge crack coupon lowered sensitivity**
- **Low cost immersed creep test fixtures are feasible**
  - **Oscillating load accelerated DCB crack growth**
  - **Results can depend on criteria for applied load**