Physics-Based Prediction of Interlayer Delamination Initiation and Propagation

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OBJECTIVES:

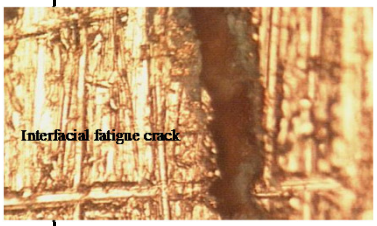
- Establish a framework for thermo-mechanical evaluation of interfacial integrity in multilayered structures
- Create a model for interfacial stress analysis for unsymmetric, anisotropic multilayered structures
- Develop an innovative technique for measuring the critical free-edge Stress-Intensity Factor
- Develop a test method for calibrating the interfacial fracture resistance
- Investigate interfacial delamination under monotonic and cyclic loading
- Develop models for predicting fatigue life of interfacial cracks
- Develop design guidelines, base substrate material properties, interlayer dielectric material properties to enhance interfacial integrity

APPROACH

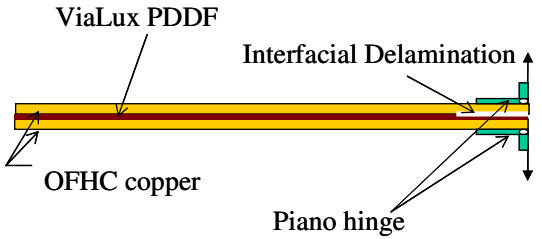
1. Develop Models for Interfacial Stress Estimation:
   - •Identify potential failure sites
   - •Reduce design window
   - •Select suitable materials
   - •Stress control in reliability design
   - •Optimum design
3. Delamination Propagation Models:
   - •Predict possible failure during process.
   - •Calibrate interfacial fracture resistance.
   - •Study delamination under thermal cycling
2. Predict Delamination onset
   - •Identify ability against delamination initiation
   - •Design against interlayer debonding
4. Interface Integrity of SOP
   - •Use the developed modeling mthodology for thermo-mechanical reliability assessment and interfacial integrity of of SOP substrates
   - •Validated the methodology using test vehicles

ACCOMPLISHMENTS:

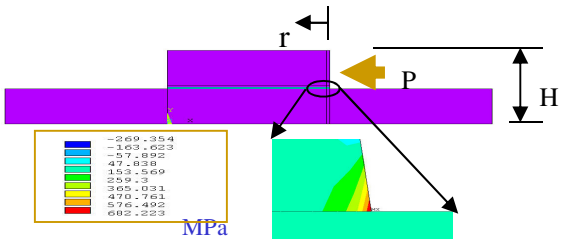
- Created a model for interfacial stress analysis for unsymmetric, anisotropic multilayered
- •Developed an innovative technique for measuring the critical free-edge Stress-Intensity Factor.
- •Developed a test method for calibrating the interfacial fracture resistance.
- •Performed design of simulations for SOP substrate

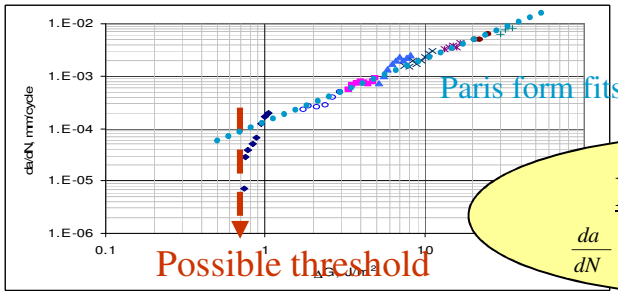


Fatigue crack propagation



Interface Calibration





Paris equation

$$\frac{da}{dN} = 1.14286 \times 10^{-4} (\Delta G)^{1.1902}$$