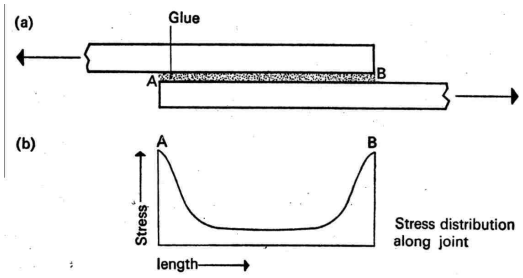

SHORT COURSE ON DURABILITY OF ADHESIVE JOINTS

When you make an adhesive joint as part of some device or product there is always the concern of joint durability whether the product is something as prosaic as a cereal box or as high tech as a jet aircraft. The consequences of joint failure can range anywhere from an annoying nuisance to the endangerment of lives. Thus this seminar series will give an overview of the technology and tools available for evaluating beforehand the expected performance of adhesive joints subjected to the environmental and load conditions under which they must survive.

PART ONE: OVERVIEW OF TEST METHODS

1. Two Aspects of Adhesive Action

- a. Interfacial bonding between adhesives and adherends
- b. Bulk thermal-mechanical performance of adhesives

2. Durability of Adhesive Joints

- a. Stress and Deformation in Material Bodies, a quick overview
- b. Strength of Materials Theory (SOM)
- c. Fracture Mechanics

3. **Direct Measurement of Joint strength**

- a. Lap shear test
- b. Double cantilever beam test
- c. Four point bend test
- d. ... etc

4. **Tests That Measure Practical Adhesion Between Adhesive and Adherend**

- a. Peel test
- b. Blister test
- c. Indentation debonding test
- d. Self loading tests

5. **Measuring Adhesive Thermal-Mechanical Properties**

- a. Elastic properties
- b. Viscoelastic properties
  - i. Creep behavior
  - ii. Concept of time-temperature superposition

6. **Role of Residual Stress**

- a. Cantilevered beam methods
- b. Ultrasonics
- c. Photoelasticity
- d. Strain relief methods

7. **Nondestructive Inspection**

- a. Xray
- b. Thermography
- c. Shearography
- d. Ultrasonics

PART TWO: DETAILED LOOK AT SPECIFIC TESTS AND CASE STUDIES

1. A Closer Look at Interfacial Adhesion Through the Peel Test

- a. Peel testing on a shoe string

2. **The Peel Test in the Development Lab and Manufacturing Line**

- a. Ranking effectiveness of adhesion promoters
- b. Evaluating the effect of manufacturing procedures on bond durability
- c. Developing improved process steps

3. **A Closer Look at The Thermal-Mechanical Properties of Polymers**

- a. Common Test methods
  - i. Dynamic mechanical experiments
  - ii. Determination of glass transition, T_g
  - iii. Relaxation processes below T_g
- b. Case Study on rubber modified epoxy structural adhesives
  - i. Time-temperature superposition for epoxies
  - ii. Variation of fracture toughness with loading rate and temperature

4. **Putting it All Together: A Guide to the Evaluation and Prediction of Bond Durability**

- a. Structures that survive in the long term are in a state of unconditional stability
- b. Stability maps: An engineering tool for putting it all together.
- c. Case study: Adhering pins to a multi-chip module:
  - i. Pathology of pin failure, outline of the problem
  - ii. Modeling virtual crack propagation
  - iii. Creating a stability map

Audience: Scientists, technicians and professional staff in R&D, manufacturing, processing, quality control/reliability involved with applying adhesives to a range of practical applications

Level: Introduction and technical overview

Suggested Prerequisites: General background In chemistry, physics or materials science.

Duration: 1 Day

COURSE FEE

$595 Which Includes complete set of lecture notes plus a copy of handbook and study guide **ADHESION MEASUREMENT METHODS: THEORY AND PRACTICE, (CRC PRESS, 2006)**

HOW YOU WILL BENEFIT FROM THESE LECTURES

Understand advantages and disadvantages of a range of test methods for adhesive joints

Gain insight into mechanics of adhesion testing and the role adhesive material properties

Explore the full range of phenomena affecting joint reliability including: adhesion to substrate, thermal-mechanical properties of adhesive and the effect of residual stress.

Review most important non-destructive inspection methods for discovering flaws in joint formation

Gain perspective from detailed discussion of actual case studies of product manufacturing and development problems

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www.mstconf.com/mstreg.htm

INSTRUCTOR

Dr. Lacombe received his PhD. degree in Macromolecular Science from Case Western Reserve University and was a postdoctoral fellow at the University of Massachusetts working on problems of polymer solution thermodynamics. He was an IBM senior level physicist for 17 years working on hybrid non-intrusive inspection and evaluation techniques, as well as problems of materials compatibility of both semiconductor and microelectronic packaging devices. He is an expert in the area of stress buildup in laminate structures using the techniques of fracture mechanics and in solving problems of delamination and cracking in composite devices. He has been a leader in the areas of materials characterization of thin films having published some of the first mechanical response data on monolayer nanostructures in the early 1980's. In addition, he has pioneered innovative uses of large scale computation using finite element methods and has applied this expertise directly to problems affecting product development and manufacturing. Upon leaving IBM he joined a consulting firm doing contract work for the U.S. Navy on nondestructive inspection of aircraft landing gear and development work on diamond coatings for the New York Energy Research and Development Agency (NYSERDA). Dr. Lacombe is currently Chairman of MST Conferences and has organized over 20 international symposia dealing with problems of surface science, adhesion, thin films, particle contamination and high temperature polymers. As part of his activities within MST he consults with companies both large and small on problems related to adhesion and publishes a quarterly newsletter dealing with all aspects of the symposia topics and distributed to over 5,500 scientists and engineers worldwide. Copies of the newsletter are available 24/7 on the world wide web at www.mstconf.com/Newsletters.htm . As part of his teaching activities he has authored a volume on ADHESION MEASUREMENT METHODS: THEORY AND PRACTICE, CRC Press (2006).