

# Comprehensive Short Course

## TESTING AND 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 short course 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.

**Audience:** Scientists, technicians and professional staff in R&D, manufacturing, processing, quality control/reliability involved with bonding using adhesives, adhesion aspects of coatings and adhesion sensitive applications.

**Level:** Beginner- Intermediate introduction/overview

**Prerequisites:** Elementary background In chemistry, physics or materials science.

**Duration:** 1 day

**Course fee and materials:** \$695; Includes complete set of lecture notes plus copy of handbook and reference guide **ADHESION MEASUREMENT METHODS: THEORY AND PRACTICE**, (CRC PRESS, 2006)

**How You Will Benefit From This Course:**

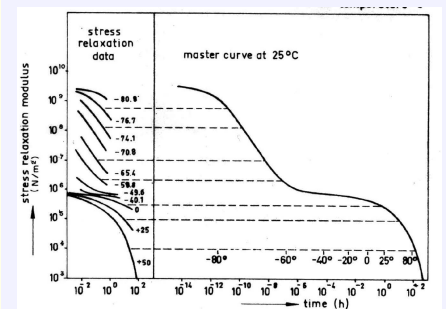
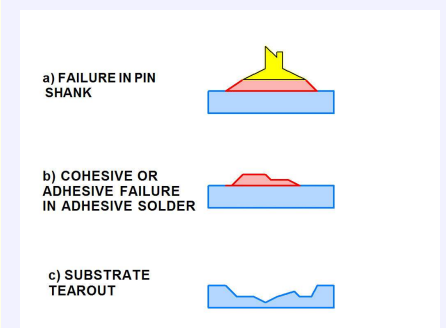
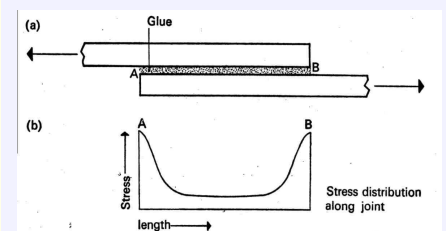
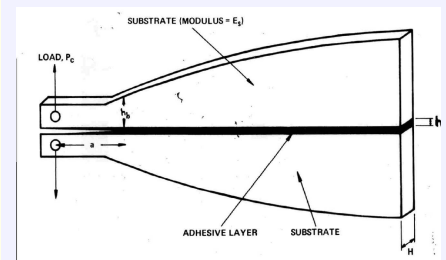
Understand advantages and disadvantages of a range of test methods for adhesive joints.

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.



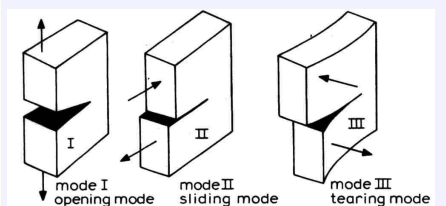
## CONTACT INFORMATION

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## 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

## DURABILITY OF ADHESIVE JOINTS

2. Stress and Deformation in Material Bodies, a quick overview:
  - a. Stress and deformation as primary engines driving failure
  - b. Continuum Theory (CT)
  - c. Strength of Materials Theory (SOM)
  - d. Fracture Mechanics
3. Direct Measurement of Joint strength
  - a. Lap shear test
  - b. Double cantilever beam test
  - c. Four point bend test
  - d. Wedge test
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
  - c. Creep behavior
  - d. Concept of time-temperature superposition

6. Role of Residual Stress

7. Nondestructive Inspection

## PART II: PUTTING IT ALL TOGETHER:

8. A Guide to the Evaluation and Prediction of Bond Durability
  - a. Stability maps:
  - b. virtual crack propagation
  - c. Creating a stability map
  - d. Case study

## COURSE INSTRUCTOR

Dr. Lacombe received his PhD. degree in Macromolecular Science from Case Western Reserve University and spent 3 years as a postdoctoral fellow at the University of Massachusetts working on problems of polymer solution thermodynamics. He was an IBM senior level engineer/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 and using the techniques of fracture mechanics in solving problems of delamination and cracking in composite devices. He has been a leader in the areas of materials characterization 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. He is credited with over 40 publications and patents.

Post IBM Dr. Lacombe worked for a small startup company doing contract work for the state of New York on diamond coatings in the energy industry and for the US Navy on problems of subsurface nondestructive inspection of aircraft parts. He did innovative work in the field of subsurface inspection methods dealing with flaws in structural parts of aircraft, auto, marine and aerospace vehicles.

Since 1999 Dr. Lacombe has been Chairman of MST Conferences and has collaborated in the organization of over 50 international symposia. The course material reflects the integration of over 40 years experience with materials science and design engineering focusing on practical product development.

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