MSE 6510 - Polymers for Electronic and Photonic Applications I
Course Outline

Lecturer: C.P. Wong, Regents' Professor

Learning Objectives:

Through the application of fundamental and principles of polymers, this course will provides a concise, yet comprehensive overview of the intimate relationships between polymers in electronic applications. The students will be introduced to the latest advances in the semiconductor technology and an appreciation of the importance of polymers in advancing the modern microelectronics.

Catalog Description:

Credit (3-0-3)
Prerequisites: Basic foundation in chemistry, physics and electronics is preferred. Introduction to Polymer Engineering or similar course would be helpful.

This course will review the fundamentals and principles of polymers used in electronic and photonic applications. The relationships between the advances of semiconductor technology and the importance of polymers and their applications will be discussed.

Proposed Syllabus:

Textbooks &: References

1. C. P. Wong, Ed., "Polymers for Electronic and Photonic Applications," Academic Press (1993).
2. J. Lau, C.P. Wong, S.W. R. Lee, N.C. Lee, "Electronics Manufacturing: With Lead-Free, Halogen-Free, and Conductive-Adhesive Materials," McGraw Hill, New York, NY, (ISBN 0-07-138624-6, (2002).
3. J. Lau, C. P. Wong, J. Prince, W. Nakayama," Electronic Packaging: Design, Materials, Process and Reliability", McGraw Hill, NY, (1998).
4. R. Tummala, Ed., "Fundamentals of Microsystems Packaging", McGraw Hill (2001).

Course Contents:

Introduction & Overview of Semiconductor Packaging Technology
Past, Present and Future Technological and Economic Trends(2-3 Lectures)

Overview: Fundamentals and Principles of Organic Chemistry and Polymers (2-3 Lectures)

Purpose of Electronic Packaging, Interconnects and Materials Needs(1 lecture)

Inorganic Polymers as IC Passivation and Interlayer Dielectric Materials(2 Lectures)
Thermal CVD, Plasma Processes and Plasma Enhanced CVD

High Performance Organic Polymers for Electronic Coating, Passivation and Interconnects (6-7 Lectures)
Silicones, Epoxies, Polyimides, Silicone-Polyimides, Parylenes, BCB, Silicon-carbons, Polyesters, Low K, High performance thermoplastics and Liquid-crystal Polymers, Conductive Adhesives(ICA, ACA/F for lead-free Interconnects)and Embedded Passiv Materialss(ultra (high k and high Q)

Electronic Interconnects Levels and Process Techniques (3-4 Lectures)
Wire-bonding, Flip-chip, Tap Automated Bonding (TAB), Beam-leaded, Polymer Interconnects, Ball Grid Array (BGA), Chip Size/Scale Packaging (CSP),FC, etc.

Prepackaging Cleaning and Control Methods (2 lectures)
Interfacial Surface Analyses, Contact Angle, XPS, Electronic Corrosion Mechanism and Lotus Effect Materials

Reliability Testing of Polymers: (2-3 lectures)
Fundamental of the Reliability Physics, Test Setup and Data Interpretation

Microelectronic Encapsulation Techniques (2-3 Lectures)
Coatings, Moldings, Potting, Chip-on-Board, Glob-tops, BGA, CSP, Flip-chip Underfills. and Recent Advances in Low-cost Flip-chip packaging

Photonic Packaging(1 lectures)
The fundamentals and Recent Advances

Guest Lectures(2- 4 lectures on Liquid Crystal Polymers, Conductive Adhesives, Microvias HDI, SOP and Embedded Passives)