MSE 4320 - Electronic Packaging Material Design
Course Outline

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Learning Objectives:

Through the application of fundamental and principles of chemistry, physics and materials, this course will provide a concise, yet comprehensive overview of the intimate relationships between materials in electronic packaging. The students will be introduced to the latest advances in the semiconductor technology and an appreciation of the importance of material design in advancing the modern microelectronics.

Catalog Description:

MATE 4320
Credit (3-0-3)
Prerequisites: Basic foundations in chemistry, physics and electronics is preferred. Introduction to Materials Engineering or similar course would be helpful.

This course will review the fundamentals and principles of materials used in electronics packaging. The relationships between the advances of semiconductor technology and the importance of electronic packaging.
Proposed Syllabus:

Textbooks &: References

1. C. P. Wong, Ed., "Polymers for Electronic and Photonic Applications," Academic Press (1993).

2. R. Tummala, Ed., "Fundamental of Microsystem Packaging", McGraw Hill, New York, New York (2001).

3. J. Lau, C. P. Wong, J. Prince and W. Nakayama,"Electronic Packaging :Design, Materials, Process and Reliability' McGraw Hill (1998).
4. J. Lau, C. P. Wong, R. Lee, N. C. Lee, "Electronics Manufacturing: With Lead-Free, Halogen-Free, and Conductive-Adhesive Materials," McGraw Hill, NY, NY (2002).

Topics **#of Lectures**

Introduction & Overview of Semiconductor Packaging Technology (3-4 Lectures)
Past, Present and Future Technological and Economic Trends

Overview: Purpose of Electronic Packaging, Interconnects, and Materials Needs

Fundamental of Organic and Polymer Chemistry(2 Lectures)

Fundamental and Principle of Materials(2 Lectures)

IC Passivation and Interlayer Materials and Design(1-2 Lectures)
Thermal CVD, Plasma and PECVD Processes

Design of High Performance Organic Polymers for Electronic Coating and Passivation (6-8 Lectures)
Silicones, Epoxies, Polyimides, Silicone-Polyimides, Parylenes, BCB, Silicon-carbons, Polyesters, Low K polymers: SiLK, FLARE, MSS,. High performance thermoplastics and Liquid-crystal Polymers

Electrically Conductive Adhesives(ECAs):(2 lectures)
Isotropic, Anistropic and Intrinsic ECAs

Prepackaging Cleaning and Control Methods(2 lectures)
Fundamental of cleaning, Fluxing Materials, Interfacial Adhesion

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), flip-chip and DCA, Thin-die, 3D Packaging,.. etc.

Microelectronic Encapsulation Techniques and Thermal Stress Analyses of Packaging(3 Lectures)
Coating, Moldings, Potting, Chip-on-Board, Glob-tops, Flip Chip, Underfills, Over-molded, BGA, CSP.

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

Design and Fabrications Technology of Microvias, HDI Printed Wiring Board:(3 Lectures)

Optoelectronic Packaging, Optical Fiber Coating and Manufacturing: Materials and Processes(2lectures)