MSE 4754: Electrical Packaging Assembly

Credit hours and contact hours: 3-0-0-3

Instructor: CP Wong

Textbook: No textbook required. Instructor notes used.

Specific course information

Catalog description: The course provides hands-on instruction in electronics packaging, including assembly, reliability, thermal management, and test of next-generation microsystems.

Prerequisites: ECE 3040 – Microelectronic Circuits or ECE 3710 – Circuits & Electronics

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

1. Understand why and how any semiconductor device is packaged and assembled
2. Understand interdisciplinarity of packaging involving electrical, mechanical, thermal, materials and processes
3. Understand the role of interconnection and assembly materials to meet electrical, mechanical and thermal requirements
4. Understand the need for thermal management and various heat transfer mechanisms
5. Understand the need for modeling and experimental assessment of package reliability
6. Understand the electrical failure mechanisms due to the fatigue behavior of metals or other material and interface degradation
7. Understand characterization methods used in packaging to extract the physical properties of materials or monitor the package integrity
8. Understand chemical safety in handling a variety of chemicals

Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Topics covered:

1. Introduction to System-On-Package
2. Introduction to Packaging and Assembly and its interdisciplinarity
   a. Electrical
   b. Mechanical
   c. Thermal
   d. Materials
   e. Chemical processes
3. Thermo-mechanical modeling and design for reliability of interconnections
4. Flip-chip assembly materials and processes
5. Heat transfer and thermal management
6. Non-destructive inspection
7. Failure analysis
8. Laboratory safety

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	**Student Outcomes**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. Understand why and how any semiconductor device is packaged and assembled	X	X					
2. Understand interdisciplinarity of packaging involving electrical, mechanical, thermal, materials and processes	X	X			X	X	
3. Understand the role of interconnection and assembly materials to meet electrical, mechanical and thermal requirements	X	X					
4. Understand the need for thermal management and various heat transfer mechanisms	X	X				X	
5. Understand the need for modeling and experimental assessment of package reliability	X	X					
6. Understand the electrical failure mechanisms due to the fatigue behavior of metals or other material and interface degradation (polymer delamination, voiding, etc)		X		X			
7. Understand characterization methods used in packaging to extract the physical properties of materials or monitor the package integrity	X					X	
8. Understand chemical safety in handling a variety of chemicals		X		X			

School of Materials Science and Engineering Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.