

An Introduction to Electronics Systems Packaging

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NPTEL Video Course

Course Instructor:

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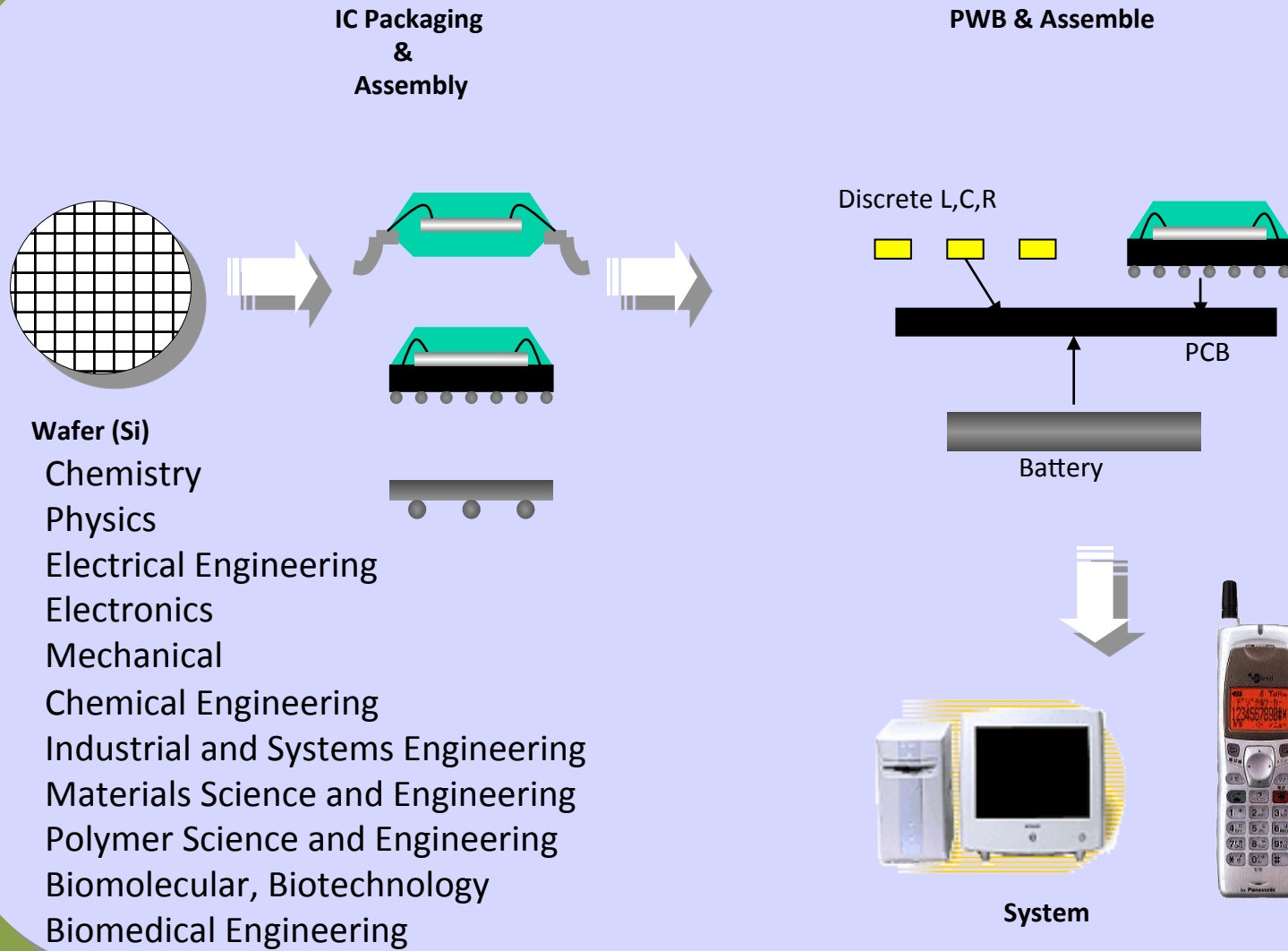
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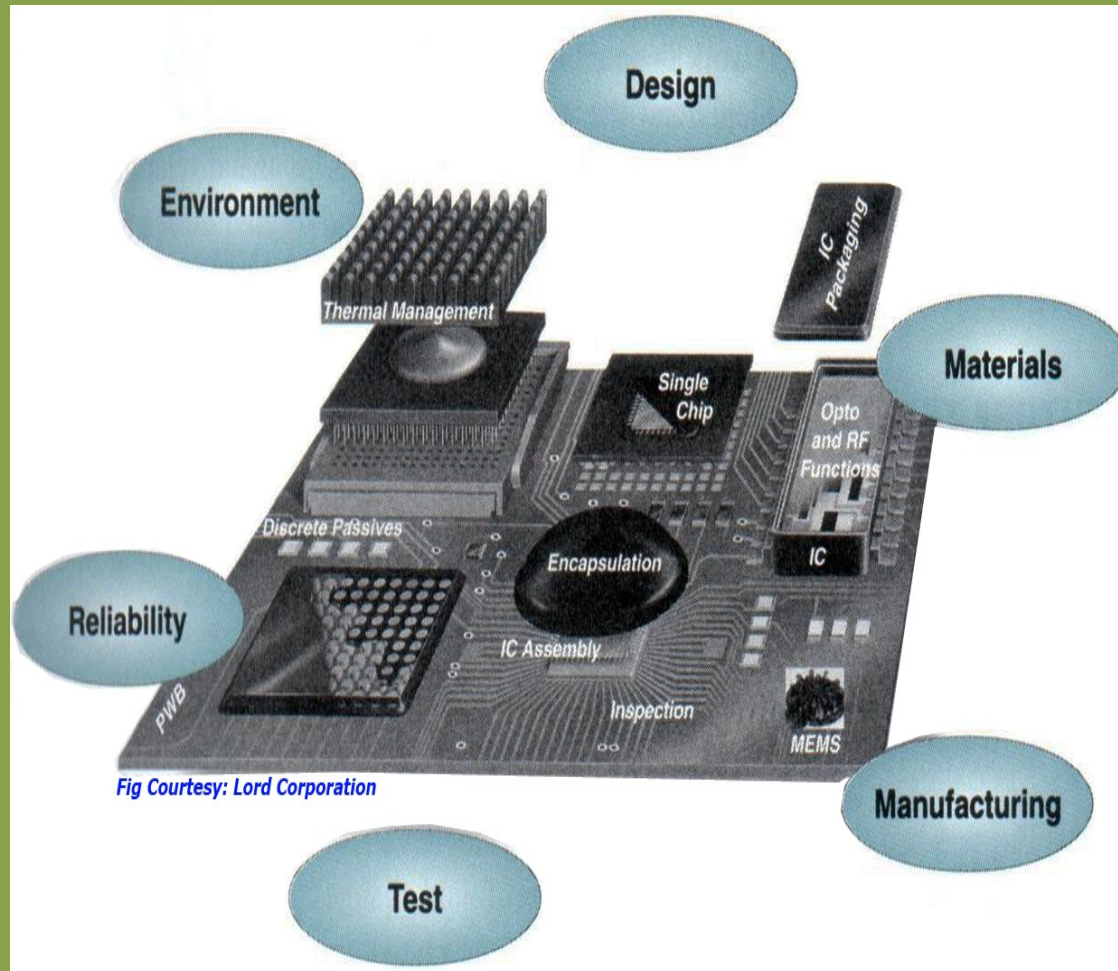
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From Wafer to a Complete System



PACKAGING IS MULTI-DISCIPLINARY IN NATURE

ESP Group Activities at DESE, IISc



ESP Group Activities at DESE, IISC...

- ❖ Only Packaging course to offer hands-on curriculum
- ❖ Dust-free lab for photolithography; analysis lab
- ❖ Chemical process lab and SMD lab
- ❖ Research focus on microvias and embedded passives
- ❖ Organic substrate sequential build-up technology

WHAT IS ELECTRONICS SYSTEMS PACKAGING?

- ❖ Packaging is ‘every technology’ required between the IC and the system.
- ❖ Packaging is just not a study of ‘interconnections’. It is a lot more than that.
- ❖ Without a proper packaging methodology a manufactured die/IC is no good.
- ❖ Packaging is basically done at three levels- chip level, board level and system level.



INFORMATION

Methodology

- ❖ This video course will try to cover all the fundamental aspects of electronic systems packaging- namely, chip level, board level and system level packaging.
- ❖ This course is currently not available at any undergraduate university
- ❖ Parts of it or a few individual topics may be taught by professors at universities and IITs/IISc

Methodology...

- ❖ Will sensitize the student to electronics packaging work at the graduate level
- ❖ The course will have lectures, short video clips enhancing the presentation and some tutorial work to make a better understanding of the topic(s).

INFORMATION

Benefits from this course

- ❖ CAD design capability,
- ❖ Understand Design for Manufacturing,
Design for Testing,
Design for Reliability,
- ❖ Holistic view of packaging

OBJECTIVES OF THIS COURSE

- ❖ Student masters the fundamental knowledge of electronic packaging including package styles, hierarchy and methods of package necessary for various environments.
- ❖ Sensitize students to the multi-disciplinary areas and appreciate the role of packaging in electronic products.
- ❖ Provide pathway for further studies in packaging if the student is inclined to do so.

OBJECTIVES OF THIS COURSE...

- ❖ Provide industry perspective.
- ❖ Ability to distinguish between engineering performance and economic efficiency and develop cost-efficient high-performance packaging approaches.
- ❖ Student should be able to predict the reliability of electronic components and structures.

CONTENTS OF COURSE

- ❖ Overview of packaging; levels of packaging
- ❖ Semiconductor, board and system level packaging
Highlights
- ❖ Packages and interconnection choices; single chip
and multichip packages
- ❖ Electrical design; CAD for PWBs
- ❖ RF packaging; power delivery in systems

CONTENTS OF COURSE ...

- ❖ PWB Technologies
- ❖ Surface mount technology-design, fabrication and Assembly
- ❖ Soldering, lead-free and green electronics
- ❖ Design for reliability, thermo-mechanical reliability, thermal management on PWBs
- ❖ Materials and processes at board level

CONTENTS OF COURSE ...

- ❖ Embedded Passives for miniaturization
- ❖ some tutorials
- ❖ Short video clips describing the processes in detail (for some topics only)

TEXT BOOKS

Books recommended

- ❖ Fundamentals of Microsystems Packaging, Ed. Rao Tummala, McGraw Hill 2001
- ❖ Advanced MCM Handbook, Ed. William Brown
- ❖ Electronics Packaging Handbook-3 Vol series; Ed Rao Tummala
- ❖ 'Microvias' by Ricky Lee

Books recommended...

- ❖ ‘Solders’ by John Lau, J Huang
- ❖ ‘Packaging Handbook’ by Charles Harper
- ❖ ‘Printed Circuit Board Technology’ by R S Khandpur
- ❖ System on Package: Ed Rao Tummala, 2008
- ❖ Other books in PCB technology, design
- ❖ Web reading

ADDITIONAL READING

Online Magazines and General reading:

- ❖ Advanced Packaging
- ❖ Chip Scale Review
- ❖ Flipchips.com
- ❖ Electronics Packaging and Production
- ❖ IEEE Spectrum
- ❖ Circuit Assembly Asia
- ❖ CircuiTree Asia
- ❖ Transactions of IEEE-CPMT (refereed journal)

More links in ESP web page

❖ www.cedt.iisc.ernet.in/people/mahesh/links.htm

WEB READING

Useful Websites:

- ❖ For roadmaps and standards/documents published pertaining to semiconductor and PWB industry

www.ipc.org (Institute for interconnects and printed circuits)

www.sia.org (Semiconductor industry association)

www.itrs.org (international technology roadmap for semiconductors)

www.inemi.org (international electronics manufacturing initiative)

WEB READING...

- ❖ IEEE-CPMT (Components, Packaging and Manufacturing Technology) website
- ❖ ITRI- Industrial Technology Research Institute (globally- several places)
- ❖ Surface Mount Technology Association, SMTA IMAPS USA and IMAPS India
- ❖ Indian Printed Circuit Association, IPCA

Academic centers and Industries

Academic Centers worldwide for packaging research

- ❖ PRC, Georgia Tech, Atlanta
- ❖ CALCE, University of Maryland
- ❖ Cornell University Packaging Lab
- ❖ MIT and Stanford
- ❖ IME and NUS, Singapore

Academic centers and Industries...

- ❖ IMEC, Belgium; Chalmers University in Sweden
- ❖ University of Arkansas
- ❖ University of Colorado at Boulder and a few others

Industries pioneering packaging research

- ❖ GE
- ❖ IBM
- ❖ Intel
- ❖ Kyocera
- ❖ AT&T Bell Labs
- ❖ Delphi
- ❖ Samsung
- ❖ Motorola
- ❖ IMEGO (Sweden)
- ❖ Nokia ..and a few others

In India: a few companies research in some aspects of electronics packaging but there are many SMEs in the area of EMS for board assembly, test and repair/rework apart from quite a few PCB manufacturing houses.

“wanted packing engineers”

Safety and Right to Know (RTK) Issues in Lab

- ❖ Safety training and Quiz
- ❖ Awareness on right to know issues in lab
 - Very common practice in universities abroad
- ❖ Be aware when working in chemical lab and photolithography area
 - Wear safety goggles provided by the lab
 - Spillages
 - Prevent Fire and accidents in lab
 - Be ready to help in case of emergency
- ❖ There should be no compromise on SAFETY

It is hoped you will find the course beneficial.
We will now start with the topics..



Once again, I can be reached by email:
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