CREST
COLLABORATIVE RESEARCH IN ENGINEERING, SCIENCE & TECHNOLOGY

ENGINEERING TALENT FOR SEMICONDUCTOR INDUSTRY PROGRAM

ETSI

Advanced Packaging Thermal Management for 2.5D and HPC Applications

COLLABORATIVE RESEARCH IN ENGINEERING SCIENCE AND TECHNOLOGY (CREST)
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Advanced Packaging Thermal Management for 2.5D and HPC Applications

INTRODUCTION

This course provides engineers with a focused understanding of thermal management in advanced semiconductor packaging, with particular emphasis on 2.5D package architectures and high-performance computing (HPC) applications.

As semiconductor devices continue to deliver higher compute density, greater bandwidth, and more compact system integration, thermal management has become a critical design and reliability consideration. In advanced packaging environments, especially for HPC systems, effective heat dissipation and thermal control are essential to maintaining device performance, preventing thermal hotspots, and ensuring long-term package reliability.

COURSE OVERVIEW

Through this course, participants will develop a structured understanding of the thermal fundamentals relevant to advanced packaging, including heat transfer principles, thermal resistance concepts, cooling strategies, hotspot management, package warpage, and reliability concerns under thermal loading. The programme also connects these concepts to practical engineering considerations through real-world industry case discussion involving thermal design approaches for advanced HPC packages.

This course is intended to strengthen participants' technical understanding of how thermal management influences package architecture, cooling solution selection, and system-level performance in modern 2.5D and HPC semiconductor applications..

COURSE OUTCOME

Upon successful completion this course, participants will be able to:

- Explain the role of thermal management in advanced packaging, particularly in 2.5D and HPC semiconductor applications.
- Describe the basic principles of heat transfer, heat flow, and thermal resistance as they relate to package-level thermal behaviour.
- Evaluate major industry cooling strategies used in advanced semiconductor systems, including air cooling, liquid cooling, heat spreaders, heat pipes, vapor chambers, and thermal interface materials.
- Identify key thermal challenges in HPC packages, including high power density, hotspots, thermal runaway risk, and system-level cooling demands.
- Recognize major thermal reliability concerns such as thermal stress, package warpage, and reliability degradation under thermal cycling conditions.
- Relate thermal management concepts to practical engineering challenges through case-based understanding of thermal modelling and cooling optimization in 2.5D package environments.

TARGET PARTICIPANT

This course is designed for technical professionals seeking intermediate-level knowledge of Advanced Packaging.

- Semiconductor Process Engineers
- Packaging Engineers
- Product and Test Engineers
- R&D Engineers in advanced packaging
- Quality and Reliability Engineers
- Design Engineers
- Yield Engineers
- Integration Engineers
- Project or Programme Leads supporting advanced packaging or HPC-related initiatives
- Technical professionals seeking stronger understanding of thermal management challenges in 2.5D and high-performance semiconductor packages

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Day	Training Outline
Day 1 9am - 5pm	1.Fundamentals of 2.5D Packaging • Evolution of semiconductor and chip packaging • Advantage of advance packaging for High-Performance Computing (HPC)
	2.Fundamentals of heat transfer and thermal management • Basic heat transfer • Heat flow analysis • Thermal resistance model • Core principle of thermal management
	3. Industry Cooling Strategies •Air cooling vs liquid cooling • Heat spreaders, heat pipes and vapor chambers • Thermal Interface Material (TIM) selection • Other cooling strategies (ThermalTSV, Direct Liquid cooling, immerse cooling etc)
	4. Thermal Management in HPC Systems • High-Performance Chips Thermal Challenges • Power density of HPC • The Importance of Thermal Management for HPC
	5. Managing Hotspots and Thermal Reliability • Managing hot spots and thermal runaway • Thermal stress and package warpage • Reliability concerns under thermal cycling
	6. Case study

TRAINERS PROFILE

	Dr. Nor Atiqah binti Zolpakar is a lecturer and researcher at Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), and she obtained her PhD in Mechanical Engineering from Universiti Teknologi Malaysia (UTM). Her expertise focuses on thermal engineering and advanced electronic cooling, particularly in the design, optimization, and thermal performance improvement of microchannel heat sinks (MCHS) for high heat flux microelectronics applications. She has demonstrated strong research achievements through publications in reputable WoS- and SCOPUS-indexed journals, and has actively presented her research outcomes at both international and national conferences. Dr. Nor Atiqah is also involved in international collaboration with the Synchrotron Light Research Institute (SLRI) in the fabrication and development of microchannel heat sinks for electronics cooling. Her training approach emphasizes practical and industry-relevant thermal management solutions, integrating simulation-based analysis, experimental insights, and real engineering applications.

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RELATED ADVANCED PACKAGING TRAINING COURSES

To continue their professional development, participants may progress to the following training programs upon completion of this course.

BEGINNER LEVEL

- Introduction to Advanced Packaging Techniques: 2.5D, 3D, Chiplets and Integration Technologies (2 days)

INTERMEDIATE LEVEL

- CoWoS Technology for AI Systems and HPC Packaging Integration (1 day)
- Advanced Packaging Reliability and Failure Mode (1 day)

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TRAINING PROVIDER

ABOUT CREST

Launched in 2012, CREST was formed to address Malaysia's E&E needs to grow the Research, Development and Commercialisation (R&D&C) ecosystem through market driven collaborative R&D and Talent Development. While CREST is industry-led, its member representation is the triple helix of Government, Industry and Academia. As of July 2023, CREST is officially an agency of Ministry of Trade, Investment and Industry (MITI).

ABOUT ETSI

In alignment with the National Semiconductor Strategic Plan (NSS), the development of local talent is a key pillar in driving the growth of the Electrical & Electronics (E&E) industry, with a particular focus on semiconductor technology. To meet the projected industry demand, the NSS targets the training of 60,000 engineers. In support of this objective, the Engineering Talent for Semiconductor Industry (ETSI) program has been established by CREST as a strategic talent development initiative to facilitate the effective implementation of the NSS.

CONTACT US

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