

7. FUNDAMENTALS OF RF DESIGN AND FABRICATION PROCESSES OF FAN-OUT WAFER/PANEL LEVEL PACKAGES AND INTERPOSERS

Course Leaders: Ivan Ndip and Markus Wöhrmann – Fraunhofer IZM

Course Objective:

Due to their myriad of advantages in system-integration, fan-out wafer/panel level packages (FO WLPs/PLPs) and interposers will play a key role in the development of emerging miniaturized electronic systems. The fabrication processes and RF performance of these advanced packages, especially their multi-layered redistribution layers (RDLs), required for the interconnection of the chips and other system components, will contribute significantly to the cost and performance of the entire system. The objective of this course is to provide and illustrate the fundamentals of the fabrication processes and RF design of FO WLPs/PLPs and interposers, including their multi-layered RDLs.

An overview of different types of wafer-level packages, fan-out technologies and interposers as well as the advantages of FO-WLPs/PLPs and glass/silicon interposers will first be given. This will be followed by a thorough discussion of the materials and fundamentals of the fabrication processes of FO-WLPs/PLPs, multilayered RDLs and glass/silicon interposers. The basics of efficient RF design and measurement of the fundamental building blocks of FO-WLPs/PLPs and glass/silicon interposers, considering their multi-layered RDLs, will be given for frequencies right up in the millimeter-wave range. Finally, examples of these advanced packages designed and fabricated at Fraunhofer IZM will be discussed.

Course Outline:

1. Overview: Different Types of Wafer-Level Packages, Fan-out Technologies and Interposers
2. Advantages: FO-WLPs/PLPs and Silicon/Glass Interposers
3. Materials and Fabrication Processes: FO-WLPs/PLPs, Multi-layered RDLs, and Silicon/Glass Interposers
4. Fundamentals of RF Design and Measurement: FO-WLPs/PLPs, RDLs, and Silicon/Glass interposers
5. Comparison of RF Performance of Interconnects in FO-WLPs/PLPs and Silicon/Glass Interposers
6. Examples of Advanced Packages Designed and Fabricated at Fraunhofer IZM

Who Should Attend:

Engineers, scientists, researchers, designers, managers and graduate students interested in the fundamentals of electronic packaging as well as those involved in the process of electrical design, layout, processing, fabrication and/or system-integration of electronic packages should attend.

Bio 1:

Ivan Ndip received his M.Sc. and Ph.D. degrees in electrical engineering from the Technische Universitaet (TU) Berlin, Germany. In 2002, he joined Fraunhofer-IZM as a Research Engineer. From 2005 to 2015 he was a Group Manager. Since 2014, he has been Head of the Department of RF & Smart Sensor Systems at IZM.

Ivan has also been a Lecturer at TU Berlin since 2008. He taught PDCs at the 43rd, 44th, 45th, 46th and 48th International Symposiums on Microelectronics in USA. He has also been teaching PDCs at ECTC since 2012.

Ivan has more than 130 publications in referred journals and conference proceedings, and has won 6 best-paper awards. He is a recipient of the Tiburtius-Prize, awarded yearly for outstanding Ph.D. dissertations in the State of Berlin, and also the recipient of the 2012 Fraunhofer-IZM Research-Award. He chairs the Signal/Power Integrity Committee at IMAPS. Ivan was Technical Co-chair of the 44th and 45th, the Technical Chair of the 46th, and the General Chair of the 47th International Symposium on Microelectronics. Ivan also served as the Chair of the 19th IEEE Workshop on Signal and Power Integrity. He is a Senior Member of IEEE and Fellow of IMAPS.

Bio 2:

Markus Wöhrmann (born 1984) did graduate work on the material properties of polymers in packaging at the Technische Universität Berlin and received the M.Sc. electrical engineering in 2010. Since 2010 he is working on electrical and mechanical property estimation of thin film layers at the Technische Universität Berlin in cooperation with the Fraunhofer Institute for Reliability and Microintegration (IZM). He is leading the glass interposer technology development at the Fraunhofer IZM since 2012 and he works in the group "Lithography and Thin Film Polymers" at the Fraunhofer IZM on the process development of RDL processing for Fan-Out Wafer Level Packaging.