3. 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 electronic systems, especially for 5G applications. 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 will first be given. This will be followed by a presentation of new fan-out-packaging and interposer-based concepts for emerging applications (e.g., 5G) as well as 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 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:

- Overview of Different Types of Wafer-Level Packages, Fan-Out Technologies, and Interposers
- Requirements of 5G Packaging
- New Fan-out Packaging and Interposer-Based Concepts for 5G Applications
- Materials and Fabrication Processes: FO-WLPs/PLPs, Multi-layered RDLs, and Silicon/Glass Interposers
- Fundamentals of RF Design and Measurement: FO-WLPs/PLPs, RDLs, and Silicon/Glass Interposers
- Comparison of RF Performance of Interconnects in FO-WLPs/PLPs and Silicon/Glass Interposers
- 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 for emerging applications (e.g., 5G) should attend.

BIO:

Ivan Ndip received the Dipl.-Ing. (M.Sc.) and Dr.-Ing. (Ph.D.) degrees in electrical engineering from the Technical University (TU) of Berlin, Germany, in 2002 and 2006, respectively, and the Dr.-Ing. habil. degree also in electrical engineering from the Brandenburg University of Technology, Cottbus-Senftenberg, Germany, in 2017. 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 has been teaching PDCs at ECTC since 2012.

Ivan has more than 175 publications in referred journals and conference proceedings and has won numerous best-paper awards. He is a recipient of the Tiburtius-Prize, awarded yearly for outstanding Ph.D. dissertations in the State of Berlin, and the recipient of the 2012 Fraunhofer-IZM Research-Award. He received the 2016 John A. Wagnon Technical Achievement Award from the International Microelectronics Assembly and Packaging Society (IMAPS) for his outstanding technical contributions to the microelectronic industry.
Since October 2016 he has been serving in the Executive Council of IMAPS as Director.
He is a Senior Member of IEEE, and Fellow of IMAPS.

Markus Wöhrmann did graduate work on the material properties of polymers in packaging at the Technische Universität Berlin and received the M.Sc. in 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.