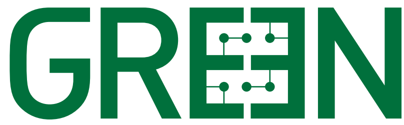

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PROCESS CERTIFICATION AND DEFECT RECOGNITION:
HYBRIDS, MICROCIRCUITS AND RF/MMIC MODULES
4 DAYS

Course Description

Most companies struggle to introduce new lines and waste countless manhours and resources resolving old problems on the manufacturing floor. Much of this waste is directly tied to the knowledge and training level of the responsible individuals. This course is designed teach the fundamental materials and processes used in microelectronics manufacturing and develop an understanding of the relevant visual inspection criteria. "Knowing what to do" is the first step towards lower costs, improved quality, and faster throughput. Multimedia PowerPoint presentations and video clips introduce the basics in a classroom setting over four days, and there is always plenty of time for questions and discussion as needed.

How you will benefit

- Advance your understanding of the basic materials and processing steps used in the assembly of Hybrids, Microcircuits and RF / MMIC Modules.
- Know what you're looking at and what constitutes a "reject" in the production flow along with the technical rationale to support the decision.
- Be able to explain to others visual defects that result from the basic manufacturing processes: i.e. wirebond, component attach, thick and thin film processing, etc.
- Learn how to interpret and apply the visual inspection criteria contained in the *Workmanship Standards for Hybrids, Microcircuits and RF/MMIC Modules manual, 2009 Edition.**

* © BAE Systems.

Who should attend:

This course is a must for process engineers, manufacturing engineers, and senior technicians and ideal for inspectors and line operators looking to broaden their knowledge base and understanding of visual inspection criteria. The course is also a must for newly assigned engineers and QA personnel looking to learn the basic terminology and key concepts vital to the manufacturing floor. Trained instructors with years of industry experience deliver the material in a straightforward and easy to understand format.

Seminar instructor:

Thomas J Green is an experienced process engineer and very knowledgeable instructor. Mr. Green designs curriculum and teaches industry short courses relating to advanced microelectronics manufacturing processes. He is a seasoned instructor with a B.S. in Metallurgy and Materials engineering from Lehigh University as well as a Master in Engineering. He has over twenty five years experience in the microelectronics industry at Lockheed Martin Astro Space and USAF Rome Laboratories. During that time period he was a Staff engineer responsible for the materials and manufacturing processes used in building custom high reliability space qualified microcircuits (Hybrids, MCMs and RF modules) for military and commercial communication satellites. Tom has demonstrated expertise in wirebonding, component attach, visual inspection and seam sealing processes. He has conducted and analyzed numerous statistically designed experiments which increased first past yield, reduced costs, and improved product quality. At Rome Labs he worked as a senior reliability engineer and analyzed component failures from AF avionic equipment along with providing technical support for a variety of Mil specs and standards (e.g. MIL-PRF-38534 and MIL-STD-883). Tom is a Society Fellow and active member of the IMAPS (International Microelectronics and Packaging Society) at both the regional and national levels.

Course Outline

DAY 1

Introduction to Manufacturing Processes
- Terminology and product definitions
- Hybrids . . . MCMs . . . RF/MMIC modules

Manufacturing Assembly Process Overview
- Basic manufacturing process flows

Visual Inspection Source Requirements
Semiconductor Processing Overview
GaAs MMIC Wafer Fab Overview
Wafer Saw and Probing
Foreign Material Identification and Control
- What is acceptable?

Cleanroom Requirements and Industry Protocols
Commercial vs. Military Visual Inspection Requirements
Incoming High Power Wafer/Chip Inspection

Workmanship Standards Semiconductor Fab related defects
(Incoming Visual Inspection)
High Powered Inspection
- *Monolithic silicon die*
- *Air bridges, mask defects, voids, metal defects*
- *Probe defects, scribing defects, edge cracks and chipouts*

DAY 2

Thick Film Processes
- Substrate fabrication and materials overview
- Screen printing machine variables and controls
- The drying and firing process
- Thickness measuring techniques
- Photo defined thick film processes
- Cofired ceramics

Thin Film Processes
- Sputtering vs vapor deposition
- Photolithography, coat, and etch

Plating Operations
- Electrolytic vs. electroless plating

Laser Trimming Processes
- Thick and thin film resistors

Review of Workmanship Standards Substrate Related Defects
- *Cracks and chip outs*
- *Scratches, voids and other defects*
- *Defects related to laser trimming*
- *Plating defects and metal lift*

Processing Fundamentals for Component Attach
- Automated handling and assembly of bare die

Material Properties Overview
Critical Processing Parameters
Die and Substrate Attach
Solder Attach of GaAs Chips

DAY 3

Overview of Common Cleaning Processes
- Wet chemicals, plasma, UV ozone

Review of Workmanship Standards related to component attach
- *Looking for the proper fillet*
- *Component to pad alignment issues*
- *Epoxy bleed and runout*
- *Flux contamination*
- *Excessive solder*
- *F/M resulting from the cure process and their effect on wirebonding*

Wirebonding Process Overview
- Ultrasonic/thermosonic bonding
- Thermocompression bonding
- Ribbon bonding

Material Properties of Bonding Wire
Wire Bonding Tools
Factor that Affect the Wirebond Process
Wire Bonding Reliability and Yield Problems

Review of Workmanship Standards Interconnects
(Pre Cap Visual Inspection)
- *Overdeformed bonds*
- *Underdeformed bonds*
- *Bond placement issues*
- *Intermetallic growth and what to look for*
- *Defective bond pad metal and platings*
- *Misplaced bonds*
- *Lifted bonds*

DAY 4 (Class ends 2:00 PM on Friday)

Hermetic Packaging Process Overview
- Seam sealing, laser welding, solder sealing
- Gross and fine leak testing

*Review of Workmanship Standards**
(External Visual Inspection)
- *Cracked seals*
- *Poor welds*
- *Plastic delamination*
- *Marking Defects*

Course Summary
Student Examination Test and Review
Student Feedback

Course Fee: $2,300

(Includes comprehensive student workbook and Workmanship Standards manual)