

## FAILURE ANALYSIS

- ▷ Electrical and Optical Testing
- ▷ Defect Localization
- ▷ Defect Physical Analysis
- ▷ Advanced Technologies

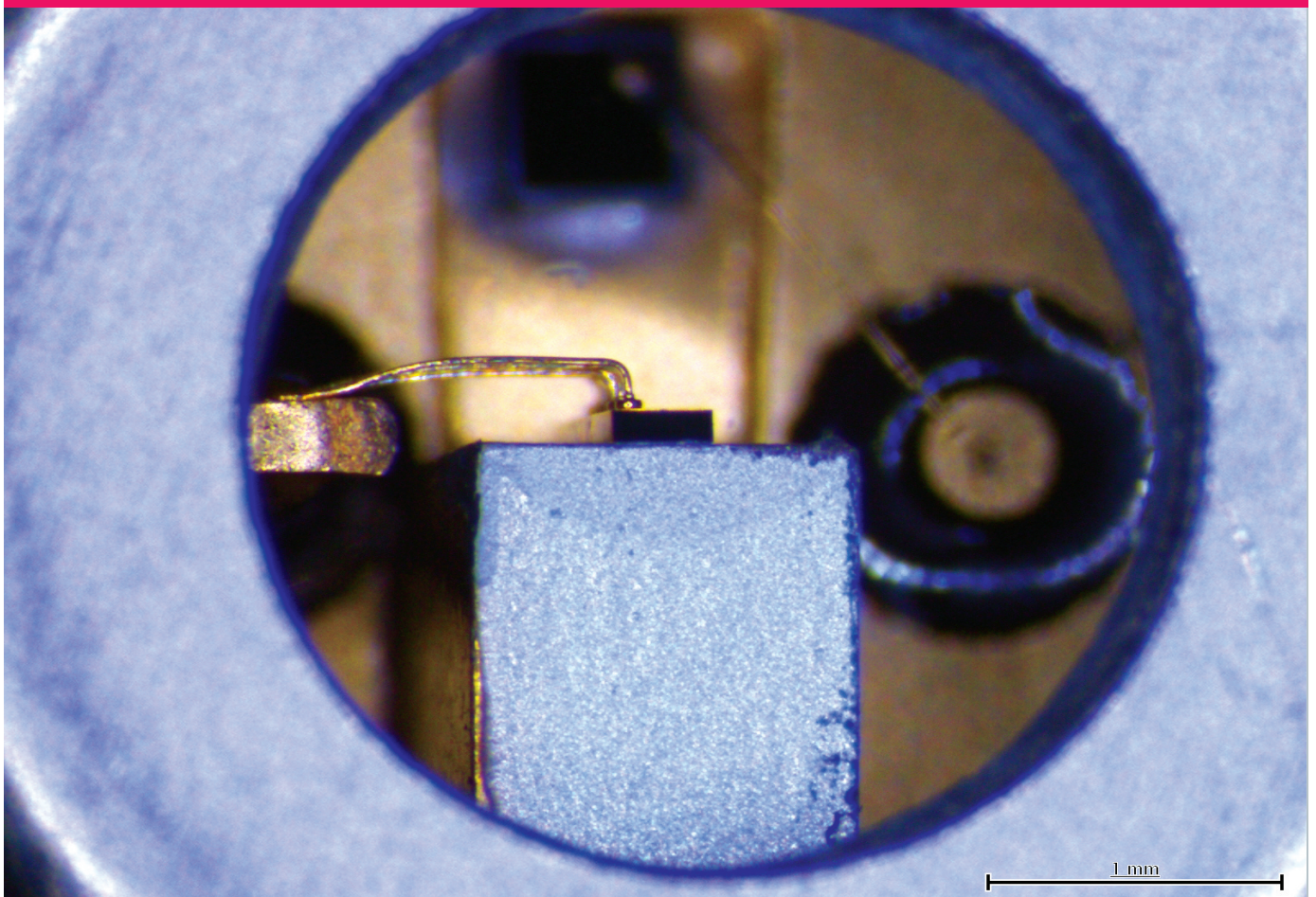
## CONSTRUCTION ANALYSIS

- ▷ Destructive Physical Analysis
- ▷ Technological Analysis
- ▷ Reverse Engineering

COMMUNICATIONS & SECURITY

# OPTOELECTRONIC DEVICES ANALYSIS

**Failure and Construction Analysis**





COMMUNICATIONS & SECURITY

# OPTOELECTRONIC DEVICES ANALYSIS

## Failure and Construction Analysis

For optoelectronics quality and reliability assessment, the Thales High-Reliability Laboratory has more than 10 years of failure and construction analysis experience (specially for space and military applications). Our lab transposed successfully analysis techniques and methodologies originally from microelectronics to optoelectronics and also uses specific techniques adapted to the optical characteristic of this type of components.

Our unique skills developed for a broad-spectrum of optoelectronic devices, materials and packages give us the capability to meet any kind of component evaluation needs.

For all its services, Thales has designed a standard of quality with the aim of giving client complete confidence. These standards are based on:

- > a certified and accredited laboratory (CESTI, ISO9001, etc.),
- > technologies watch,
- > high-tech material,
- > a contractual engagement on our services,
- > traceability of the actions executed by our experts.

### Failure Analysis

#### Methodology

Our methodology for any failure analysis has always been organised in accordance with the three following steps:

- > electrical & optical characterization,
- > defect localization,
- > defect physical analysis.

Optoelectronic devices failure analysis are often lead with the use of:

- > electrical & optical testing techniques like I(V) characteristics, P(I) characteristics, C(V) characteristics, gummel plots, thermal resistance, D2Scan,...
- > defect localization techniques such as Electroluminescence, Thermal Laser Stimulation (OBIC, OBIRCH), SEM techniques, (monochromatic cathodoluminescence, EBIC), nanoprobng.
- > defect physical analysis techniques like EDX Nanoanalysis, cleavage, microsections, FIB-TEM, plasma RIE delayering, AFM (electrical modes like SCM, EFM) ...
- > more advanced techniques such as ToF-SIMS, D-SIMS, RAMAN, Auger, FTIR, RBS, ERDA, NRA...

From the smallest crystal defect such as dislocations to open-circuit, from optical thin layers inclusions to radiation effect, from ESD defects to surface contamination, whatever your optoelectronic device defect is, our laboratory can help you to find the root cause of it.



Laser diode cathodoluminescence analysis

### Construction Analysis

Our laboratory has developed unique technological analysis skills on a broad-spectrum of:

- > optoelectronics devices (Laser Diode, LED, photodiode, phototransistor, CCD, APS, microbolometer, solar cells, photoresistors / photovoltaics sensors, optical thin layers, passive components...),
- > materials & packages (IV semiconductors, III-V semiconductors, II-VI semiconductors, specific packages, window (BAK50, BK7...) / filter / lens / optical attach...).

#### Methodology

DPA aim is to evaluate the quality of devices lot, sort the bad samples, and if needed and possible impulse corrective actions in the process before operating devices selection.

In accordance with different standards (military, space, etc), we can lead any evaluation such as external & internal inspections, X-Ray inspections, seal testing, particle impact noise detection testing and particle extraction, residual gas analysis, bond pull testing, ball shear testing, stud pull testing, die shear testing, microsections...

#### Technological analysis

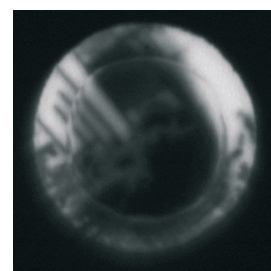
The target of a technological analysis is to evaluate the maturity of a process by analyzing some technological points: back-end and front-end, specific packages, optical microsystems and nano-technologies, optical coating, window attach...

We use non destructive techniques as optical observations or SEM or X-Ray imaging and destructives techniques as FIB-TEM or D-SIMS to get the sharpest evaluation of your optoelectronic devices technology.

#### Reverse engineering

The goal of reverse engineering is to get the full design of an entire device or one technological step.

The most advanced techniques are commonly used in our lab to get all the information needed to identify any technological and electrical layout in your optoelectronic device.



Electroluminescence of a failing LED