Bruno Levrier Expertises

Consulting in Reliability Science and Scientific Computing

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BLE

May 2021

EXPERIENCE

Bruno LEVRIER, 46 years old, Freelance consultant

Cursus

MsC in Reliability and Quality of electronic devices and systems (DESS QFiab - University of Bordeaux, 2000)

Background

18 years of experience in microelectronic technologies – devices – Packaging & Assembly – Failure analysis – Multiphysics simulations.
15 R&D European programs

Enterprise

Company founded in May 2016

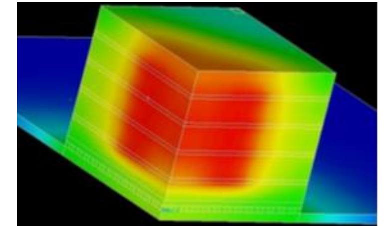
Network

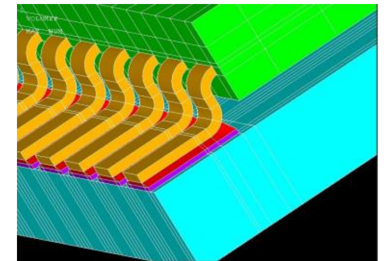
Alpha RLH (French cluster - Laser and RF technologies)
IMAPS France (General secretary since 2017)
IEEE CPMT
Aerospace Valley (French cluster - aerospace industry)

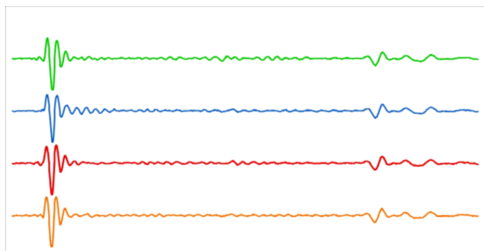
SCIENTIFIC COMPUTING & SIMULATIONS

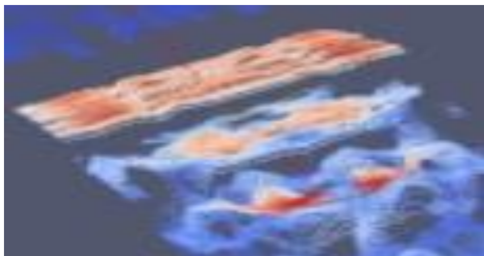
Multiphysics simulation of mechanical – thermal – thermomechanical – electric phenomena.

Modelling of damage mechanism (plasticity, creep, wear-out), determination of fatigue model and lifetime law for microelectronic assemblies and interconnections.







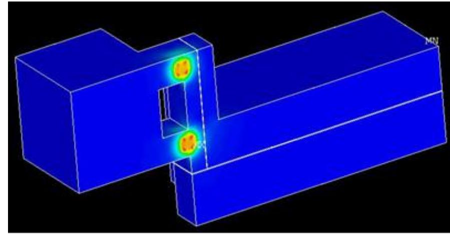


Signal and Image processing – Time Frequency methods (wavelet) for NDT analyses (Ultrasound and X-ray tomography).

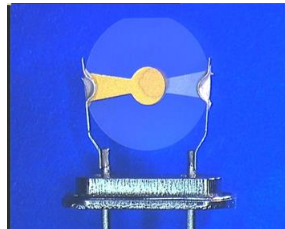
Statistical and mathematical methods for experimental data analysis.

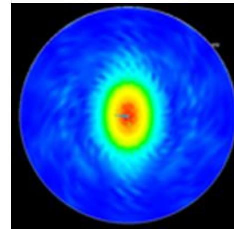
Simulations - Help for design & fabrication

Modelling of YAG laser welding of Kovar laser lens holder

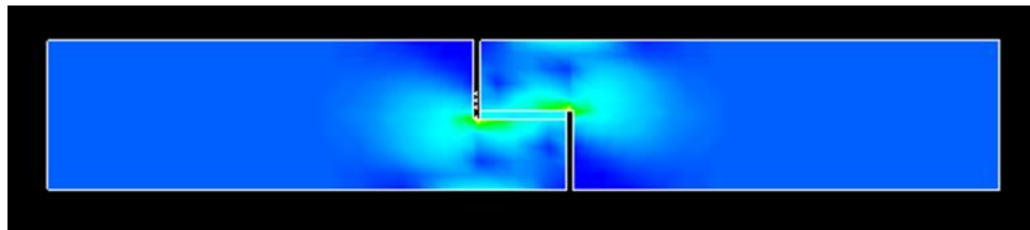


Modelling of AT-cut crystal piezoelectric resonance after assembly

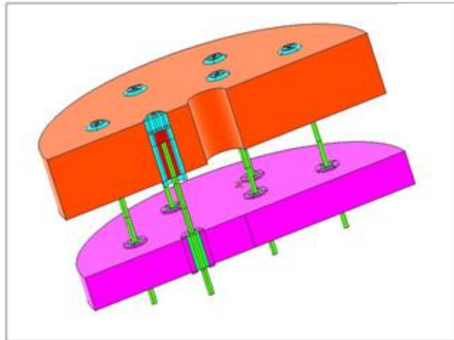




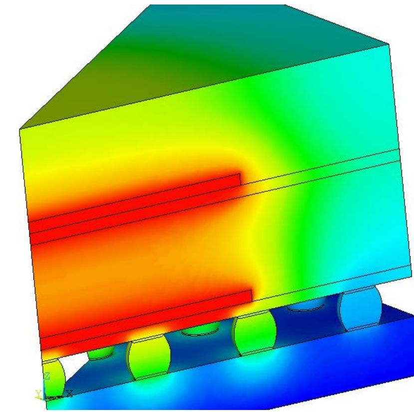
Modelling and scaling of tensile tests for adhesives in aeronautic domain

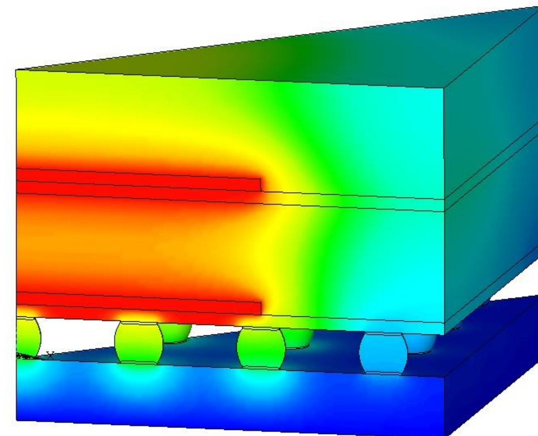


Simulations - Thermal and mechanical performances



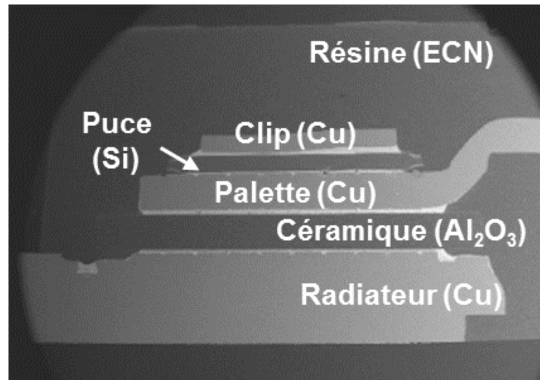
Modelling of modal response in sensor device during vibrations tests

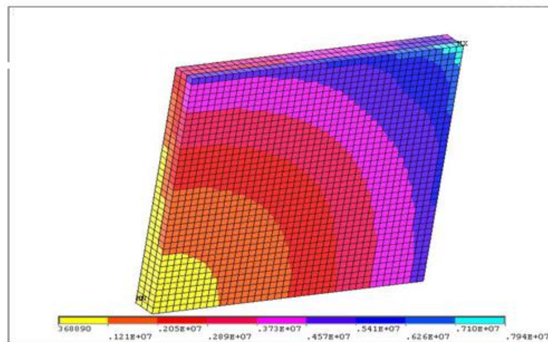




Thermal dissipation modelling in 3D memory module (1/8 symmetry)

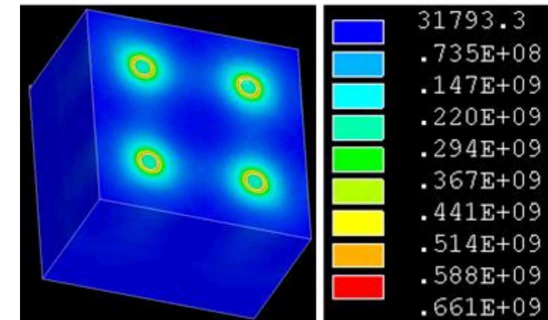
Simulations - Early failures and fatigue





Modelling of solder joint failure within TO-220 during thermal cycling and power cycling

Von Mises stress



Modelling and mapping of residual mechanical stress within 3D silicon dies at Cu Through Silicon Via level after annealing

RELIABILITY OF TECHNOLOGIES

Problem Solving, Methodologies for reliability assessment (Physic of Failure, MIL-HDBK, FIDES).

Technological survey and bibliographic analysis (devices, process, materials, Failure and wear-out mechanisms, technologies, harsh environments).

Reliability improvement (DfR Design for Reliability, DoE Design of Experiment - Taguchi)

Design of electronic benchs and measurement (electronic, mechanic, acoustic, optic).

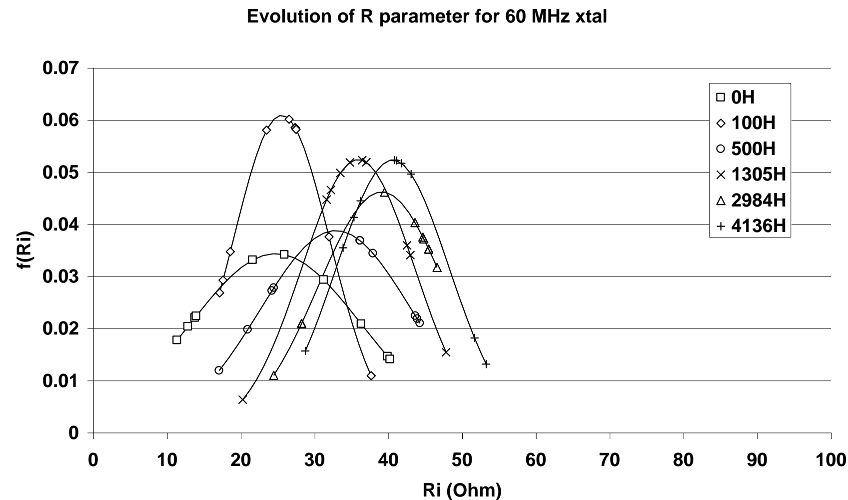
Machine Learning & Big Data techniques for data analysis in reliability domain and Prognostic & Health monitoring in avionics.

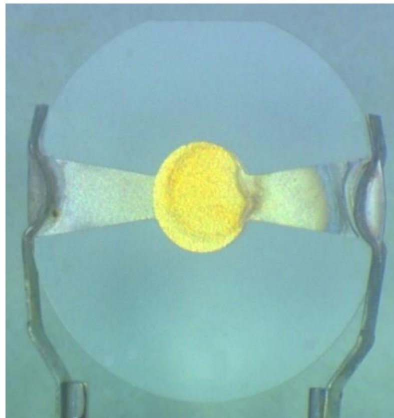
Quartz resonator – High temperature reliability

Impedance Spectroscopy for Failure Analysis – Ageing parameters

- Impact of wear-out of silver adhesive between kovar clip and crystal lens
- Correlation of Impedance signature (dispersion) with Optical and SEM inspection

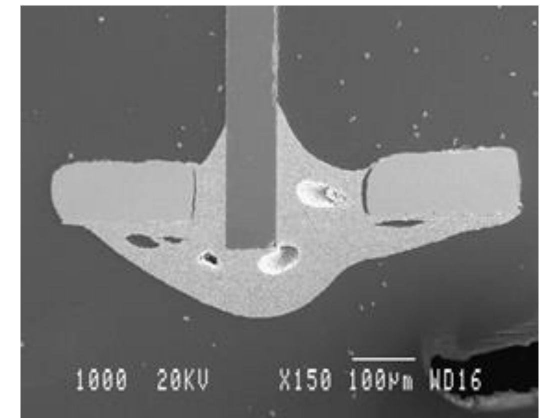
Dispersion of R parameter in motion branch





Optical inspection

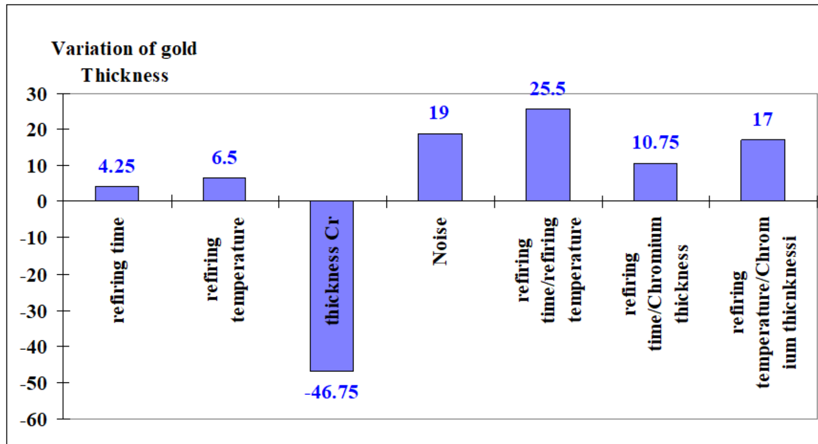
SEM analysis



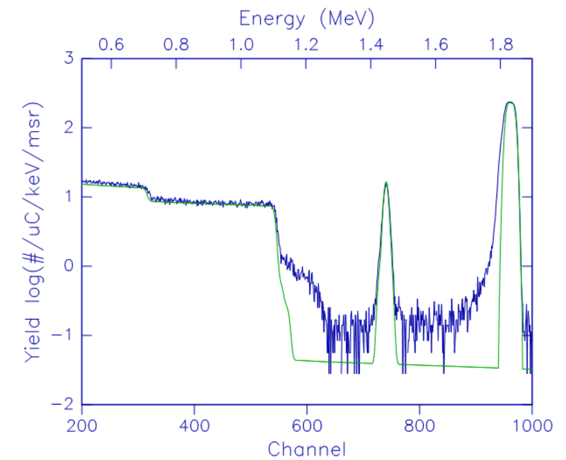
Quartz resonator – Process improvements

Methods

- Design of Experiment (Taguchi method)
- Physical analyses (RBS, Rutherford Backscattering Spectrometry) -> stabilisation of metallic layer
- Simulation with Finite Elements -> improvement of packaging robustness

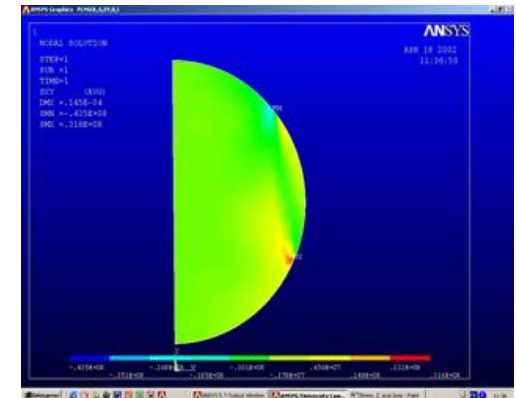


Taguchi analysis with RBS results



RBS of metallic layer

Quartz resonator without cover



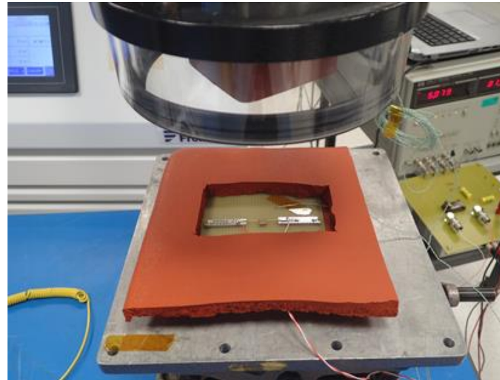
Finite Element Analysis of the half-lens

Ceramic capacitors – Detection of early failures

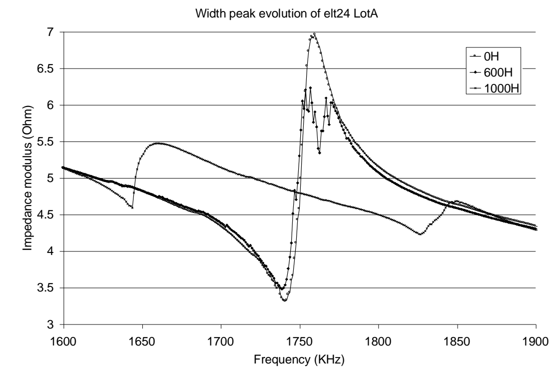
Methods

Measurement by piezoelectric Resonance in controlled climatic conditions

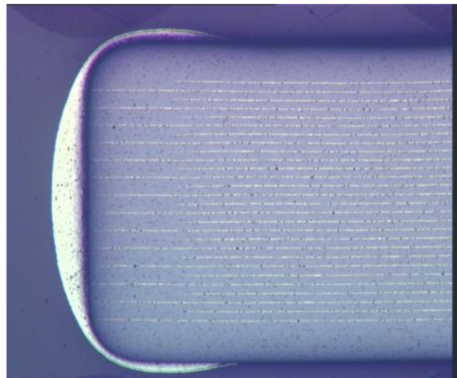
Non Destruction Detection of defects (localisation for Failure Analysis) or criticality estimation (screening, kinetic of failure, lifetime model) before and after mounting on PCB.



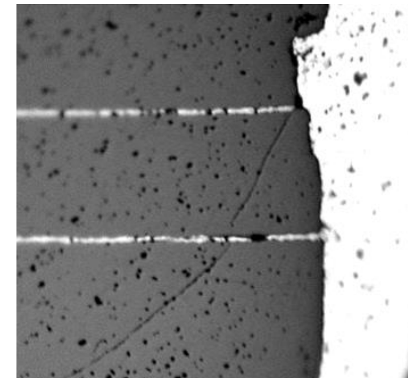
Impedance measurement and thermal systems



Impedance analysis



Microsection

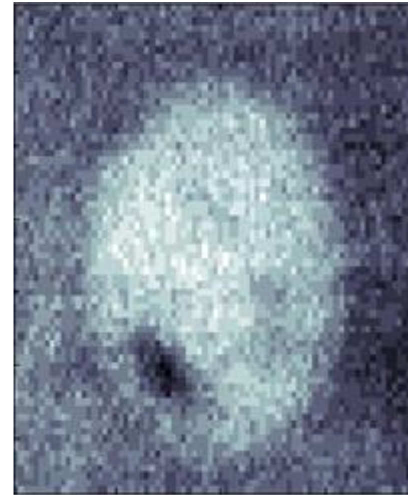


Crack at the termination

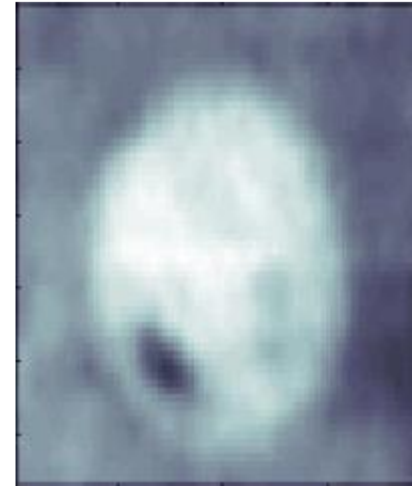
NDT – Computing for Reliability evaluation

Algorithms for NDT

- For Ultrasounds and X-rays
- Wavelet analysis
- Denoising / Extraction of transient
- Imaging (3D, Transformation of Radon)
- Machine Learning



Raw Image



Denoised image by Wavelet

Technological Survey for acoustic inspection systems (from MHz to GHz) and photo-acoustic systems (from GHz to THz) for Space Agency

PRESENT & FUTURE

Partnership BLE – ELEMCA (materials and failure analysis).

Transition of the expertise in simulation towards open-source solutions.

Build-up of business to Nouvelle Aquitaine Region and extension to international.

Machine Learning & Big Data techniques for data analysis in reliability domain and Prognostic & Health monitoring.

CONTACT

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