Berliner Nanotest und Design GmbH

Company Portfolio

@ 2023 Nanotest, All rights reserved

Origin

- Founded in 2004 as Fraunhofer spin-off
- Continuous refining of expertise from general reliability to focus on thermal management and thermal characterization
- Today partner of major European electronic industries and full-scale provider for thermal characterization and reliability analyses
- Creative, flexible and multidisciplinary team of physicists, mathematicians, programmers and engineers
- Member and co-founder of the Joint Lab Berlin for Thermal Management

Nanotest in numbers

- 19 years experience
- 30+ research projects
- 30 employees

© 2023 Nanotest. All rights reserved.

NANOTEST

Thermal Characterization

Failure Analysis

Material Level

System Level

TOCS®

Liquids and pastes
Slurries & resins

Thermal conductivity
Thermal diffusivity

Compact & versatile
Very quick testing

Features

- Quick measurement
- Curing and in-situ testing
- Multi-use test chips
- Integrated heating

TIMA®

Pastes to solids
TIM1 & TIM2

Thermal conductivity
Interface resistance

Automated testing
Aging investigation

Features

- ASTM D 5470 complete
- Curing and in-situ testing
- Customizable test heads

LaTIMA®

Solids
Substrates & metals

Thermal conductivity
Thermal diffusivity

Two-in-one system
Dog-bone samples

Features

- High conductivities
- Industrial sample compatibility
- Integrated sample integrity validation

TIMA® pulse

Active devices
FETs & IGBTs

Thermal impedance
Structure function

Compact & low-cost
Versatile software

Features

- Complete thermal path reconstruction
- Non-destructive
- Structural information
- Thermal modeling
- Thermal frequency spectrum

TIFAS®

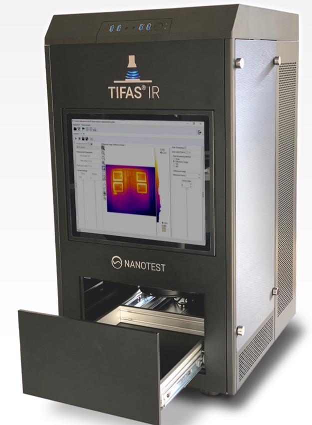
Systems & joints
Packages & modules

Buried defects
Thermal obstruction

Full-scale FA system
Compact & low-cost

Features

- Non-destructive & contactless
- Fast and thermovisual
- Heat flow-correct



© 2023 Nanotest. All rights reserved.

NANOTEST

Characterization

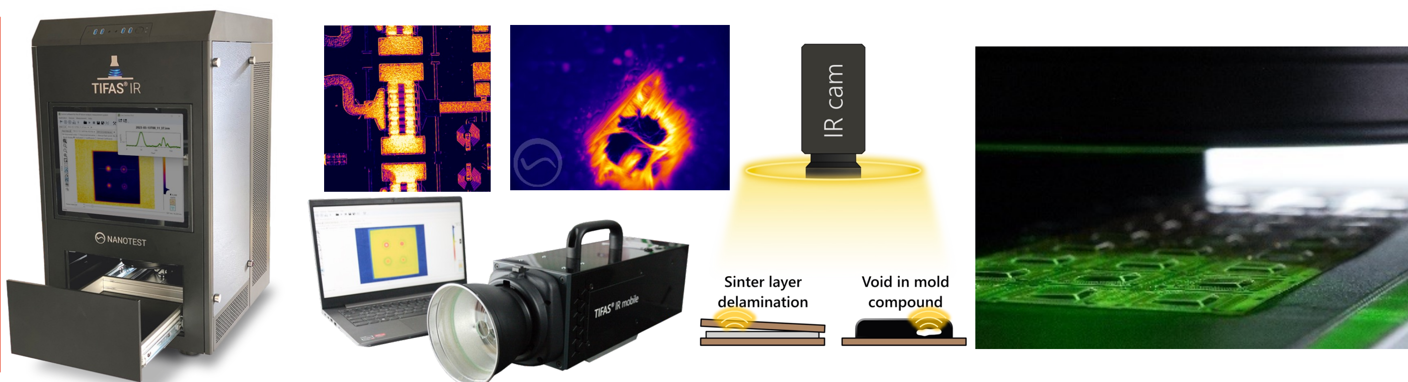
Lab-Scale Products & Services

- Thermal characterization of material, components and systems
- Fracture mechanical characterization of interfaces
- Material aging investigation
- Standalone benchtop solutions

Failure Analysis

Multi-Scale Solutions & Scientific Services

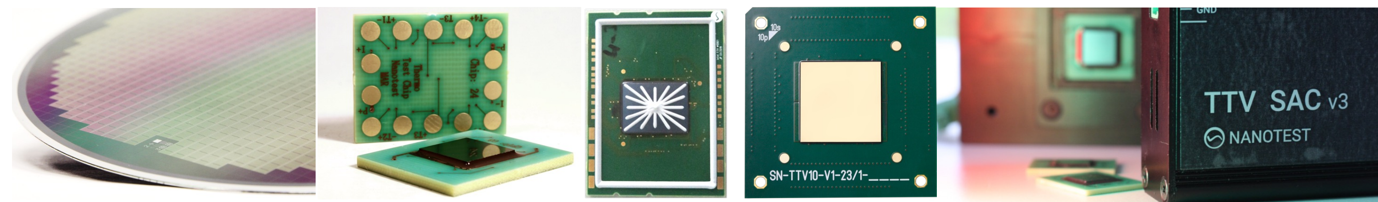
- Thermal imaging
- Failure detection and localization
- Quality management solutions
  - Contactless & non-destructive
  - Lab-scale to inline



TTV

All-round Thermal Test Vehicle Supply

- Thermal test chip wafers
- Thermal test vehicle design and assembly
- Measurement hard and software

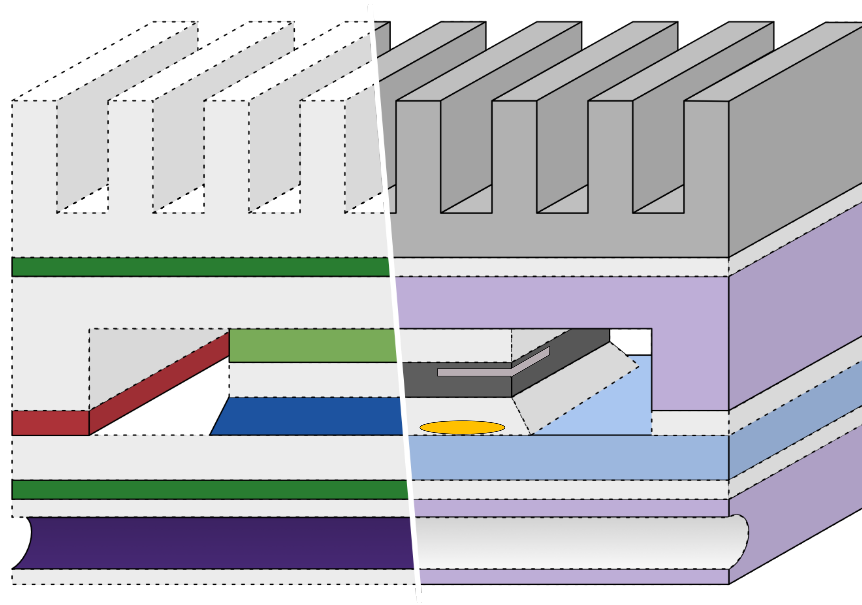


© 2023 Nanotest. All rights reserved.

Comprehensiveness by Design

TIMA®

- TIMs
- Sealant
- Underfill
- Die attach
- Substrate



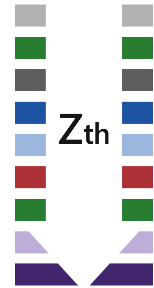
LaTIMA®

- Metals
- Alloys
- Die material
- Substrate
- Die attach

TOCS®

- TIMs
- Sealant
- Underfill
- Coolant

TIMA®pulse



TIFAS® IR

- Delamination
- Buried defects

© 2023 Nanotest. All rights reserved.

Fast-paced thermal material characterization

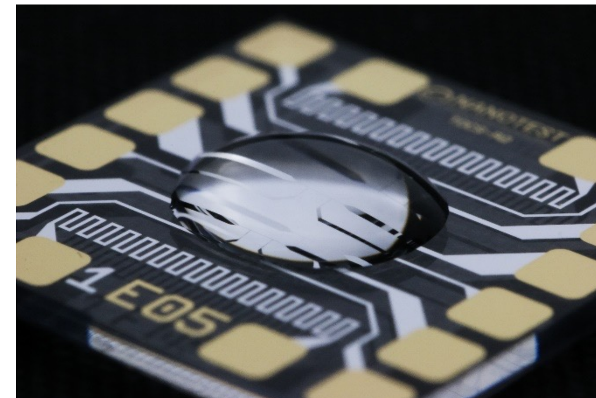
Material parameters

- Bulk thermal conductivity
- Thermal diffusivity

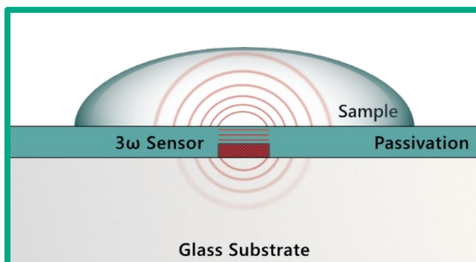
Feasible samples

- Liquids
- Gels
- Pastes
- Soft solids

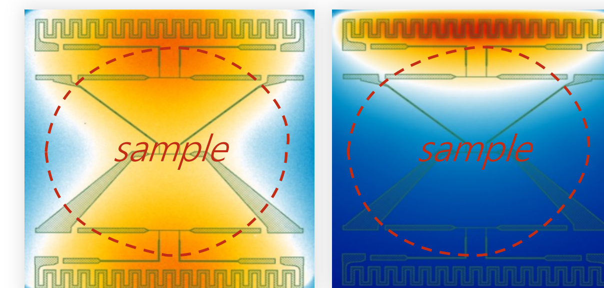
Sample material is ***simply applied*** *on the test chip and tested with a* ***mere buttonpress****.*



Measurement x-section



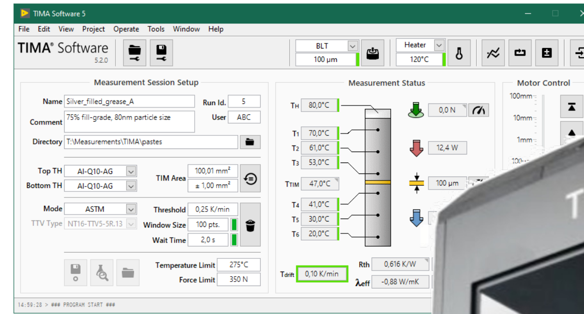
Custom temperature profiles

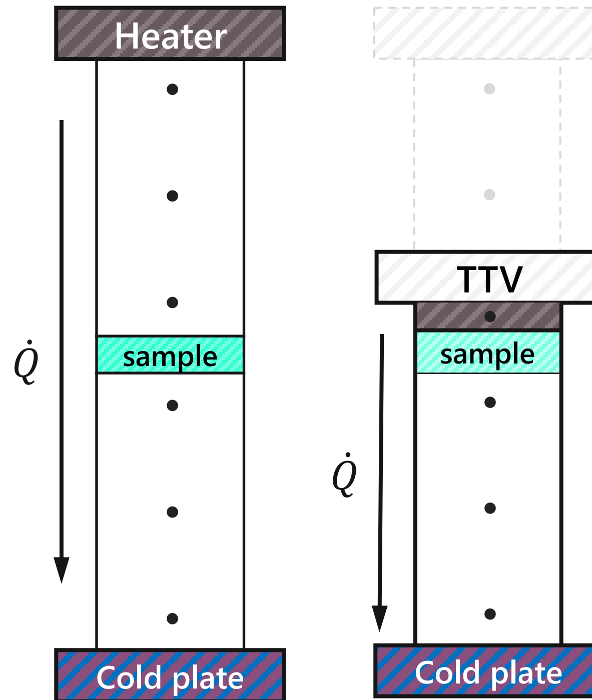


© 2023 Nanotest. All rights reserved.

Beyond ASTM D5470

- » Effective and bulk thermal conductivity
- » Thermal effective and interface resistance
- » Temperature and pressure dependency
- » Aging and reliability testing
- » Compact all-in-one system

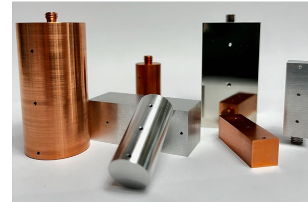




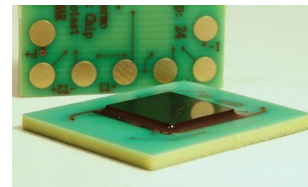
Feasible samples

- » Thermal interface material
- » Die attach materials
- » Underfill materials
- » Molding compound
- » Substrates
- » Multilayer samples

examples of feasible material samples


selection of available test heads

Assembly and curing tool adhesive

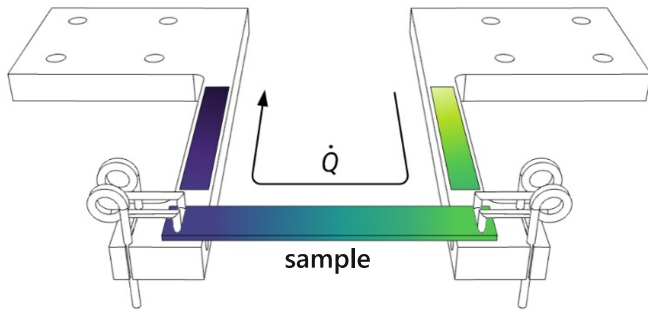

Thermal test chip

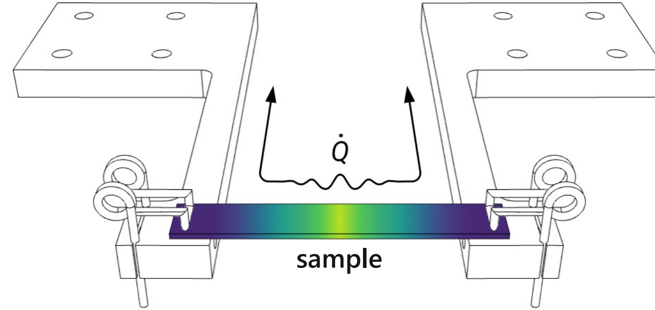
© 2023 Nanotest. All rights reserved.

LaTIMA base | TIMA*wave* add-on

» Thermal conductivity

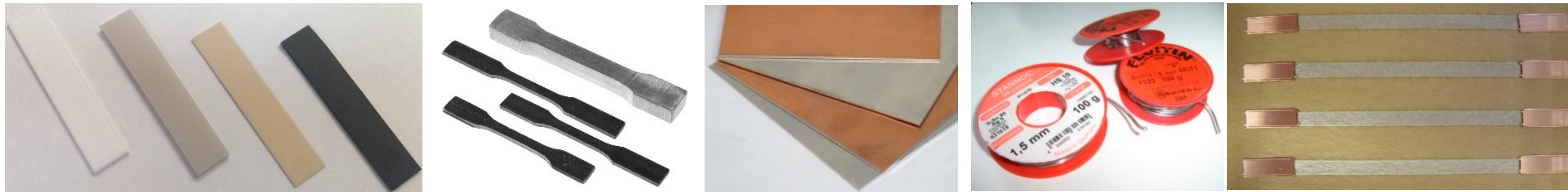
» Thermal diffusivity





For highly conductive materials

Feasible samples | Metals | Alloys | Substrates | Ceramics | | Solder | Sintered material | Semiconductors | FRP |



© 2023 Nanotest. All rights reserved.

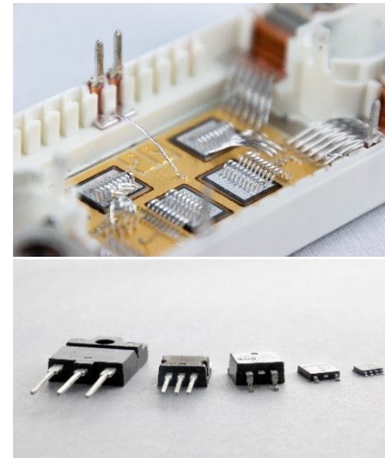
TIMA®pulse Transient Thermal System Analyzer

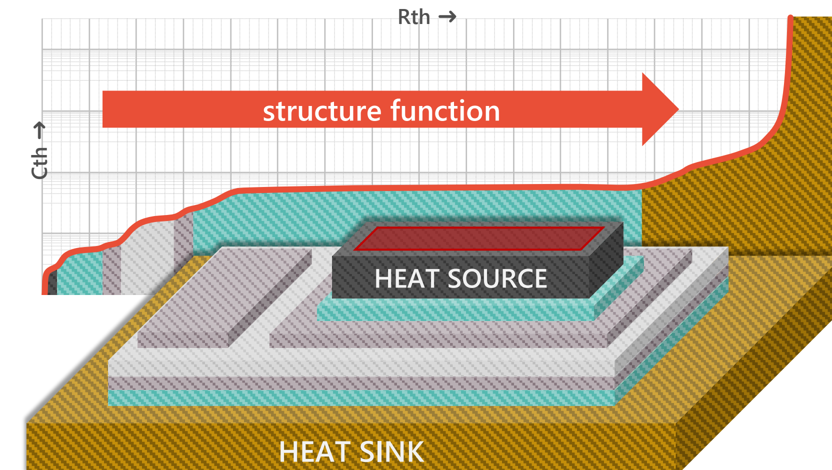
Lightweight transient thermal testing

Feasible samples | Electronic packages & modules | | Thermoelectric systems | Custom thermal setups |

Output

- Thermal impedance curve
- Thermal junction-to-case resistance
- Time constant spectrum
- Structure function
- Thermal equivalent RC networks



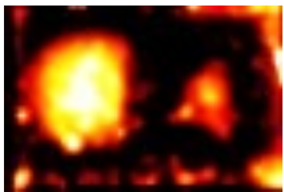


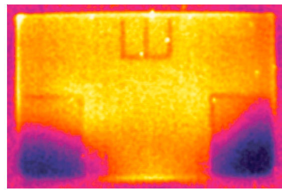
© 2023 Nanotest. All rights reserved.

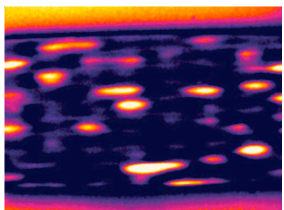
Contactless failure analysis in a nutshell

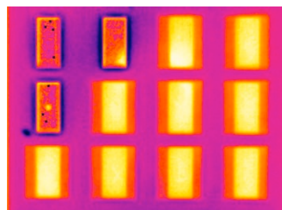
Features

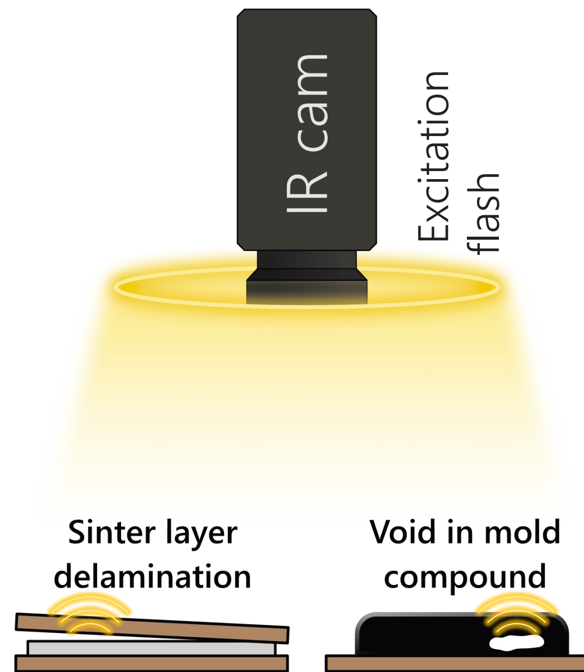
- » Complete infrared thermography-based failure analysis setup
- » Contactless and non-destructive
- » Short testing times, high throughput
- » Great variety of detectable defects
- » Comprehensive analysis software
- » Adaptable to special needs

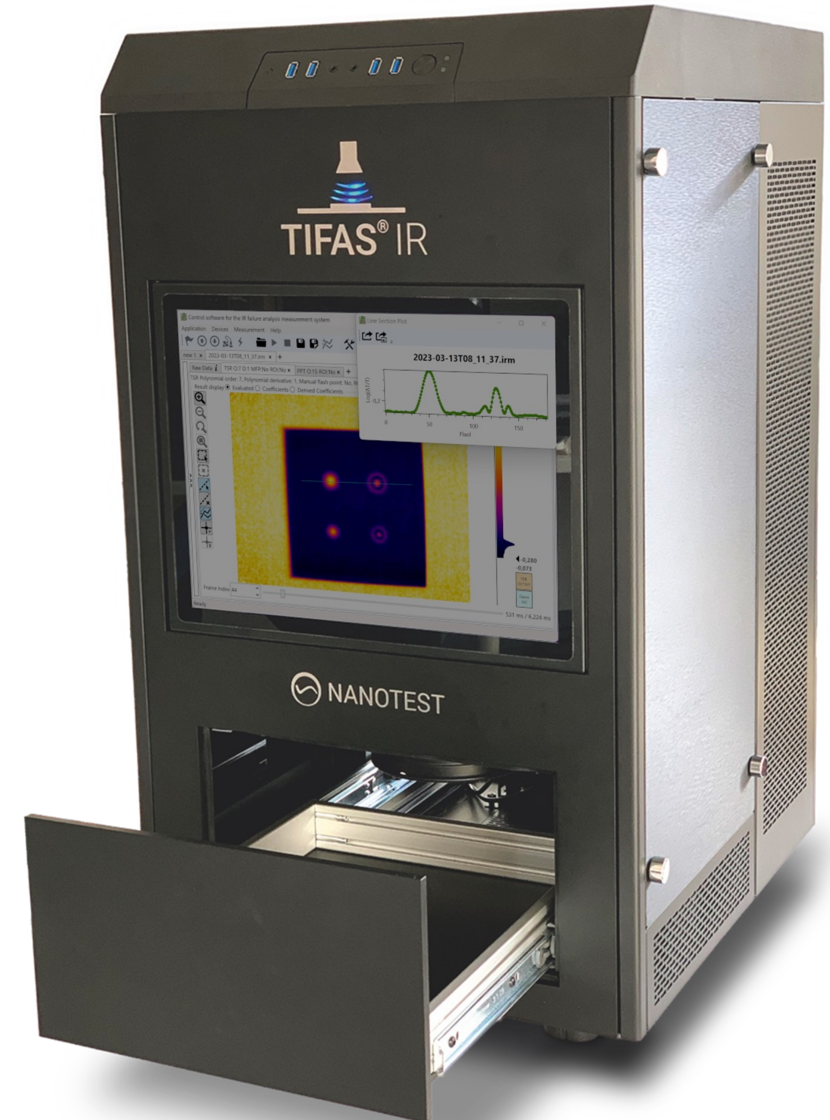

Voids in solder die attach layer


Delamination in sintered power module


Voids in carbon fiber reinforced polymer


Voids in molding compound



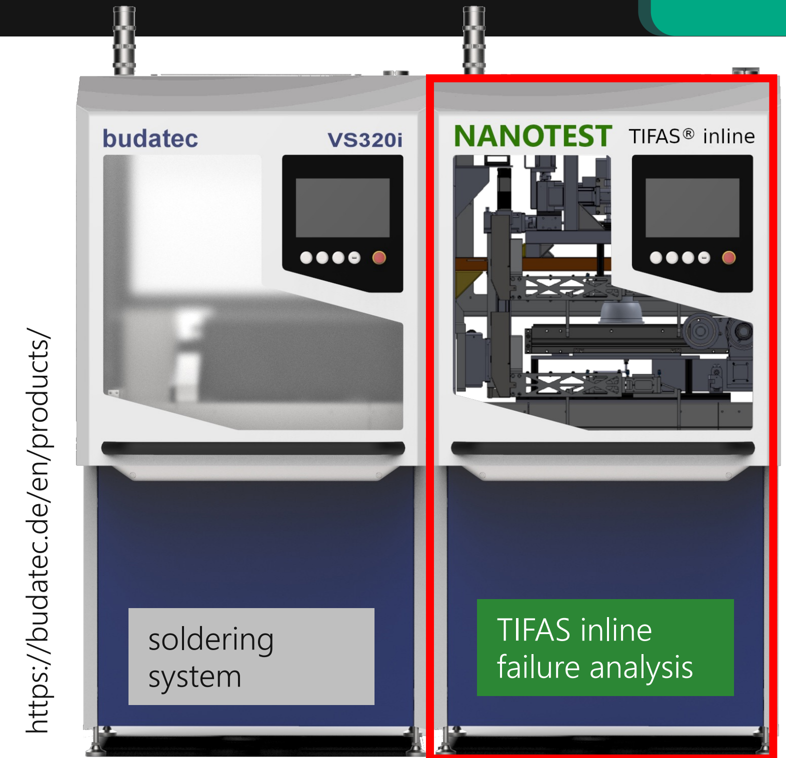


© 2023 Nanotest. All rights reserved.

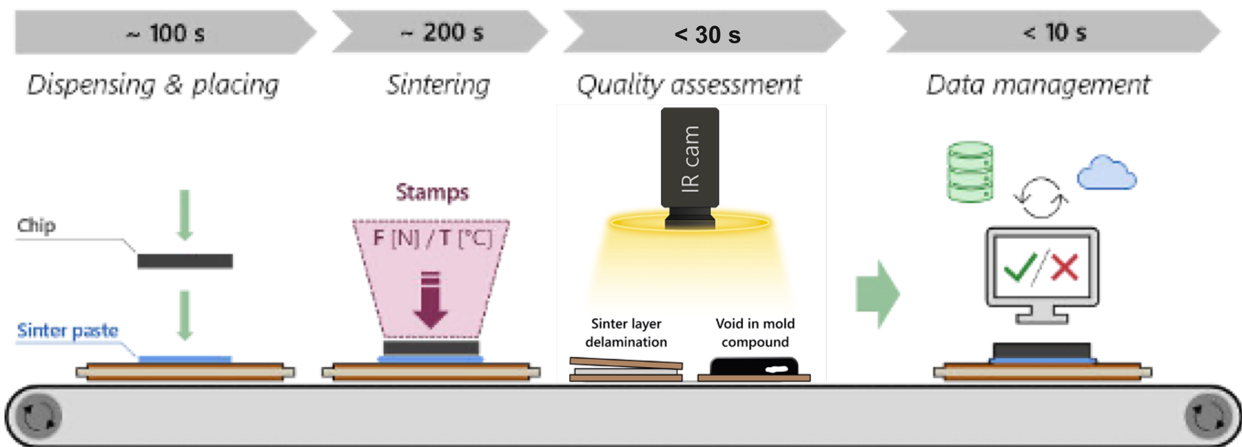
Intelligent non-destructive 100% inline failure analysis

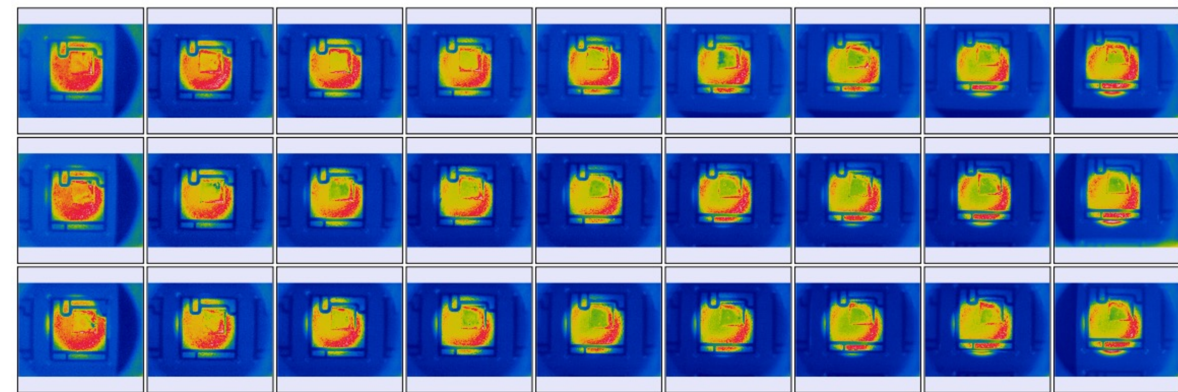
Features

- » 100% inspection in production lines, full automation
- » Short testing times, high throughput
- » Complete infrared thermography-based failure analysis setup
- » Contactless and non-destructive
- » Great variety of detectable defects



https://budatec.de/en/products/





3x9 Measurements in a system tray

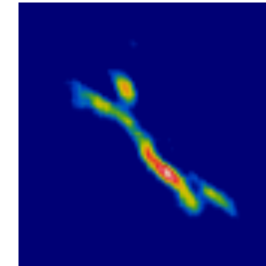
© 2023 Nanotest. All rights reserved.
NANOTEST

Contactless failure analysis in a nutshell for mobile applications

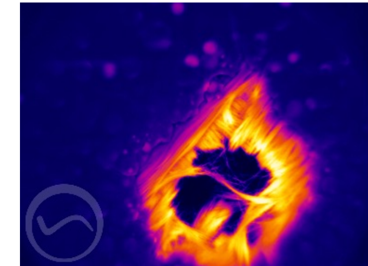
Features

- Mobile infrared thermography-based failure analysis setup
- Contactless and non-destructive maintenance of components
- Great variety of detectable defects
- Comprehensive analysis software
- Example: non-destructive testing of fiber composites and bonded joints

Impact defect



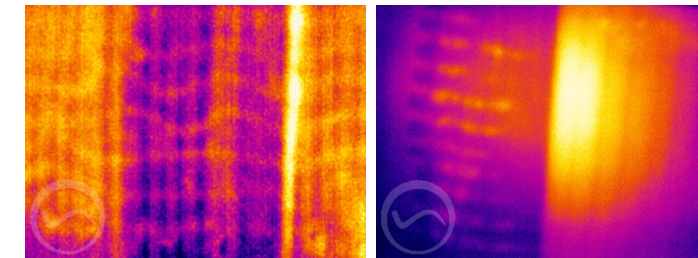
Lightning strike defect



© Bladecare-academy.de

© Deutsche Bahn AG

ZfP heute | Berlin 2020 p 54-55
M. Kaczmarek, M. Müller, Zerstörungsfreie Bauteilprüfung von großflächigen, glasfaserverstärkten Schienenfahrzeug-Komponenten



Inner structure of a wind turbine blade

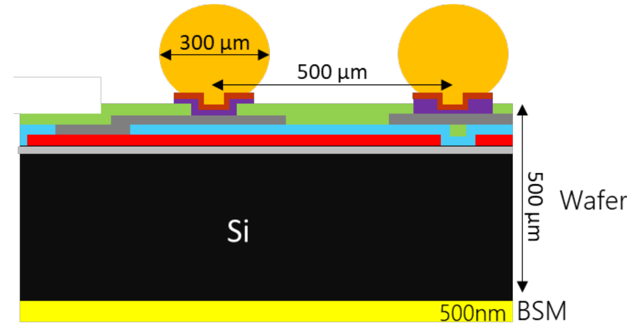
© 2023 Nanotest. All rights reserved.

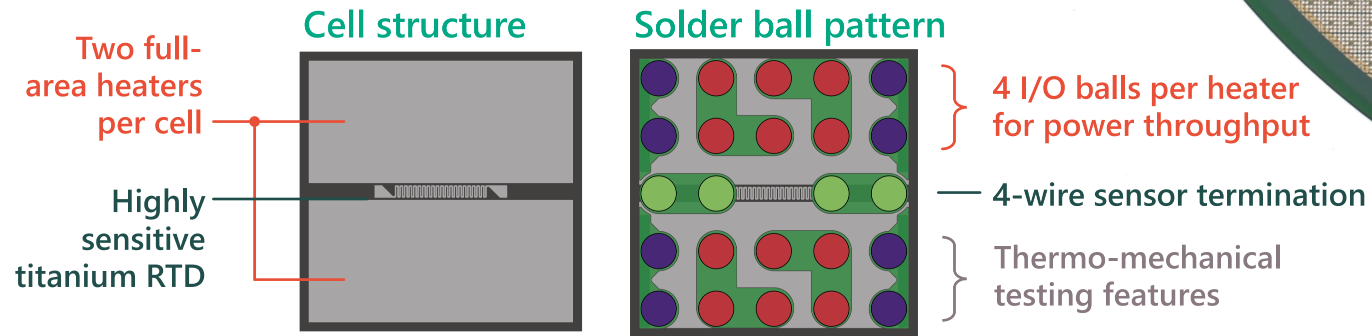
NANOTEST

NT20-3k thermal test chip

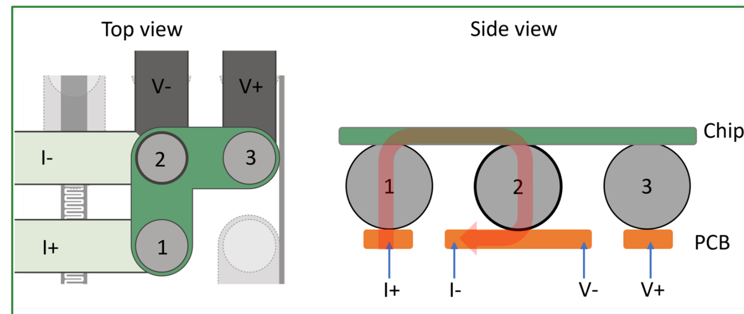
- 200 mm (8″) Si wafer
- Titanium thin-film structures
  - 1 × 3.3 kΩ RTD
  - 2 × 15 Ω heaters
  - 4 x Monitoring Bumps
- Versatile & customizable
- Different BSM
- Up to
  - 50 × 50 mm^2 die size
  - 200°C chip temperature
  - 10 W/mm^2

Ready for your custom TTV design

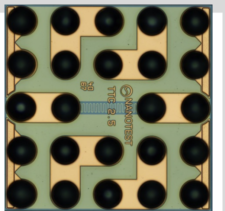




Resistive Bump Monitoring Structure



2.5×2.5 mm^2 unit cells



- 10 W/mm^2 heating
- 82% area coverage
- 300 µm solder bumps
- 500 µm pitch
- 4000+ cells per wafer

© 2023 Nanotest. All rights reserved.

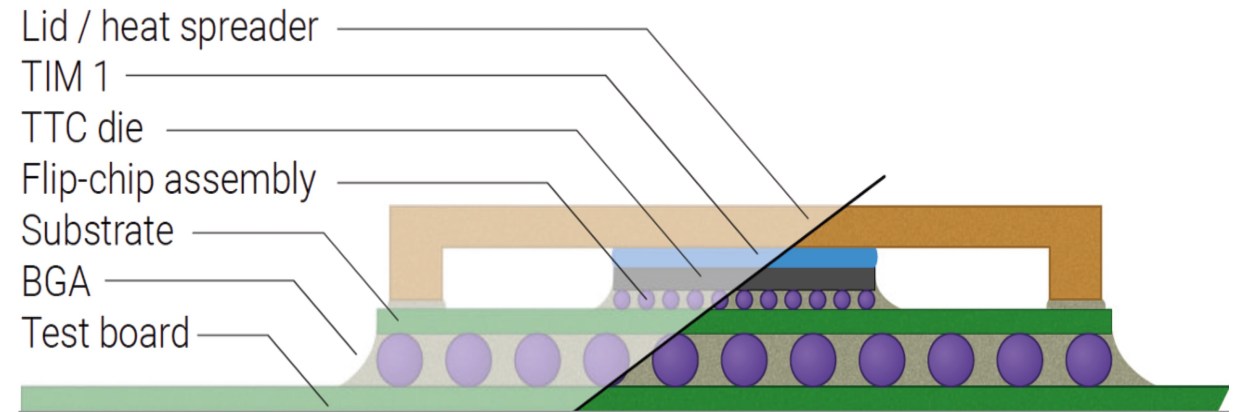
Thermal Test Vehicles (Thermal Twin)

Design the TTV you need. No Compromise

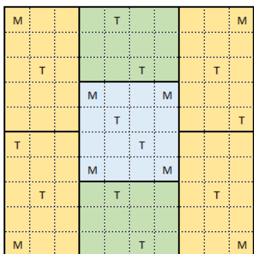
We support our customers to verify their prospective package, TIMs and cooling solutions by offering TTV solution

We offer:

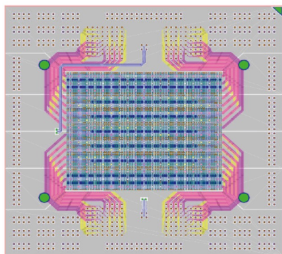
- Thermal test chips wafer
- Concept and feasibility
- Interposer and test board
- Assembly and quality assessment
- Measurement hardware
- Measurement and control software
- Calibration and test



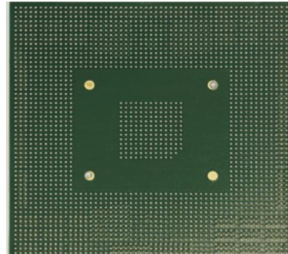
Chip configuration



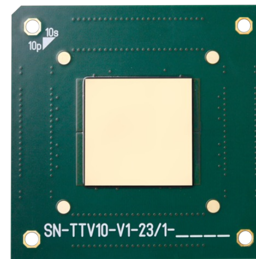
Substrate design



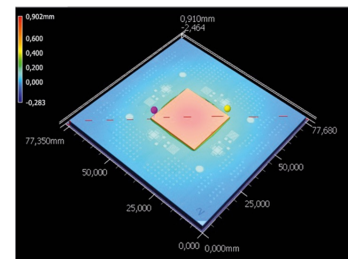
Substrate manufacturing



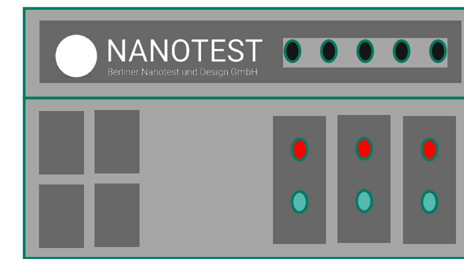
Chip and Board assembly



Quality control



Measurement hardware



Measurement Software

© 2023 Nanotest. All rights reserved.

Rapid, inexpensive and effective interfacial adhesion strength characterization

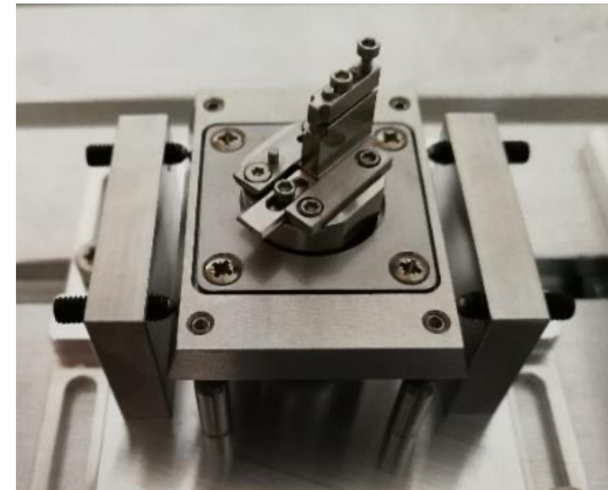
Material parameters

- Critical Energy Release Rate G_c vs. Mode-mixity ψ

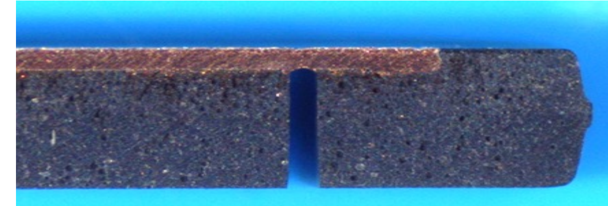
Feasible samples

- Artificially manufactured samples
- Bi- or multi-layered beams
- Package origin cut-outs

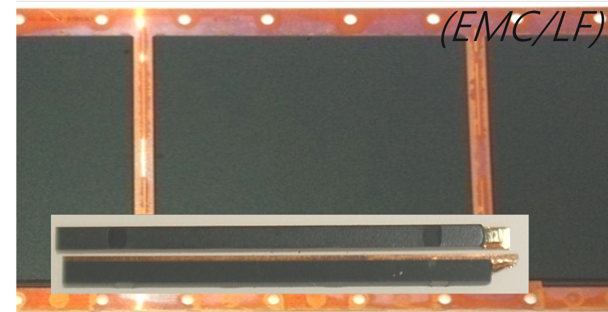
*Specimen is **simply fixated** in the detachable sample holder.*

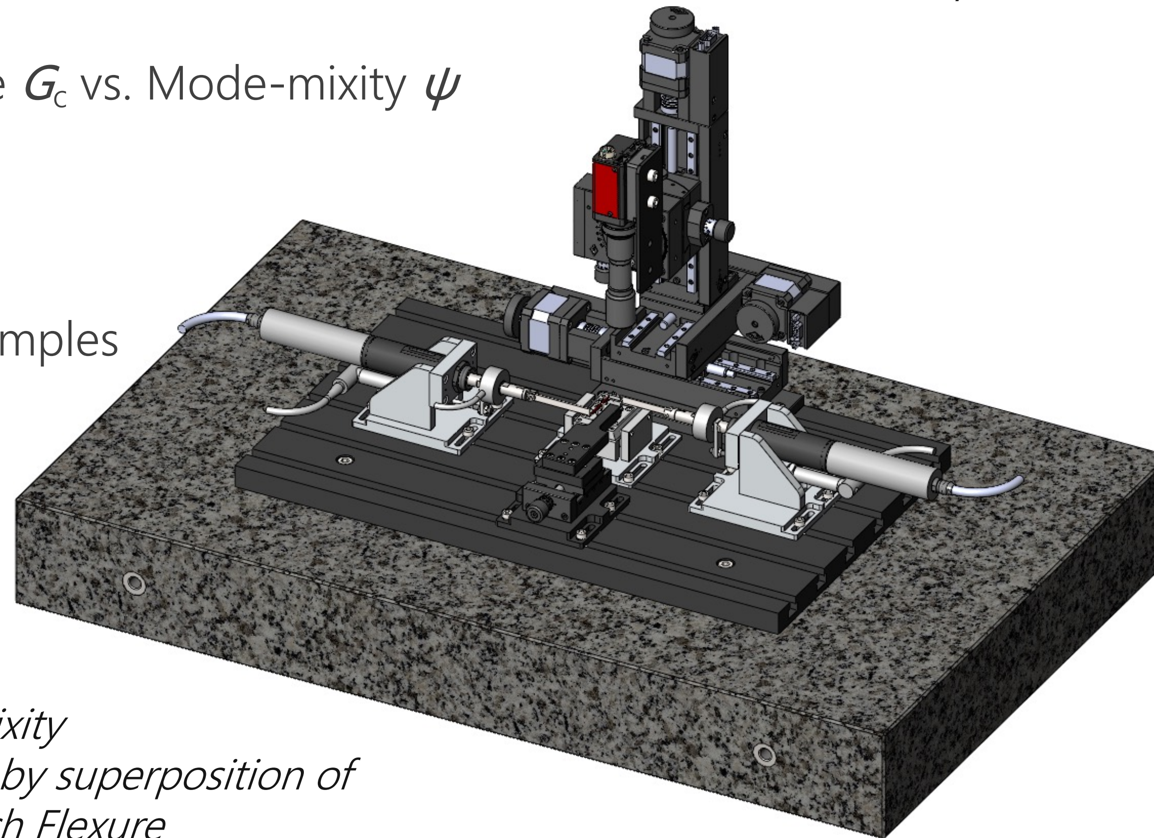


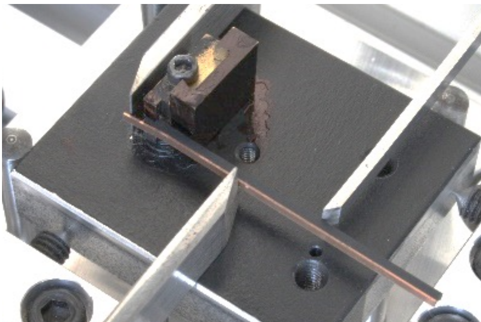
Package origin cut-out (No chip)



Artificial manufactured (EMC/LF)







Mode-mixity variation by superposition of End Notch Flexure and Double Cantilever Beam tests

© 2023 Nanotest. All rights reserved.

Why Nanotest

Our Offering

- Thermal expertise
  - 19 years of R&D experience
  - 100+ scientific publications
  - World-wide industrial network
- Holistic lab services
  - Material & package characterization
  - Aging and reliability testing
  - Failure detection and analysis
  - TTV design, manufacturing and testing
  - adhesion strength characterization
- High-end laboratory products
  - Focused on user-friendliness
  - At maximum versatility
  - Ensuring high scientific accuracy

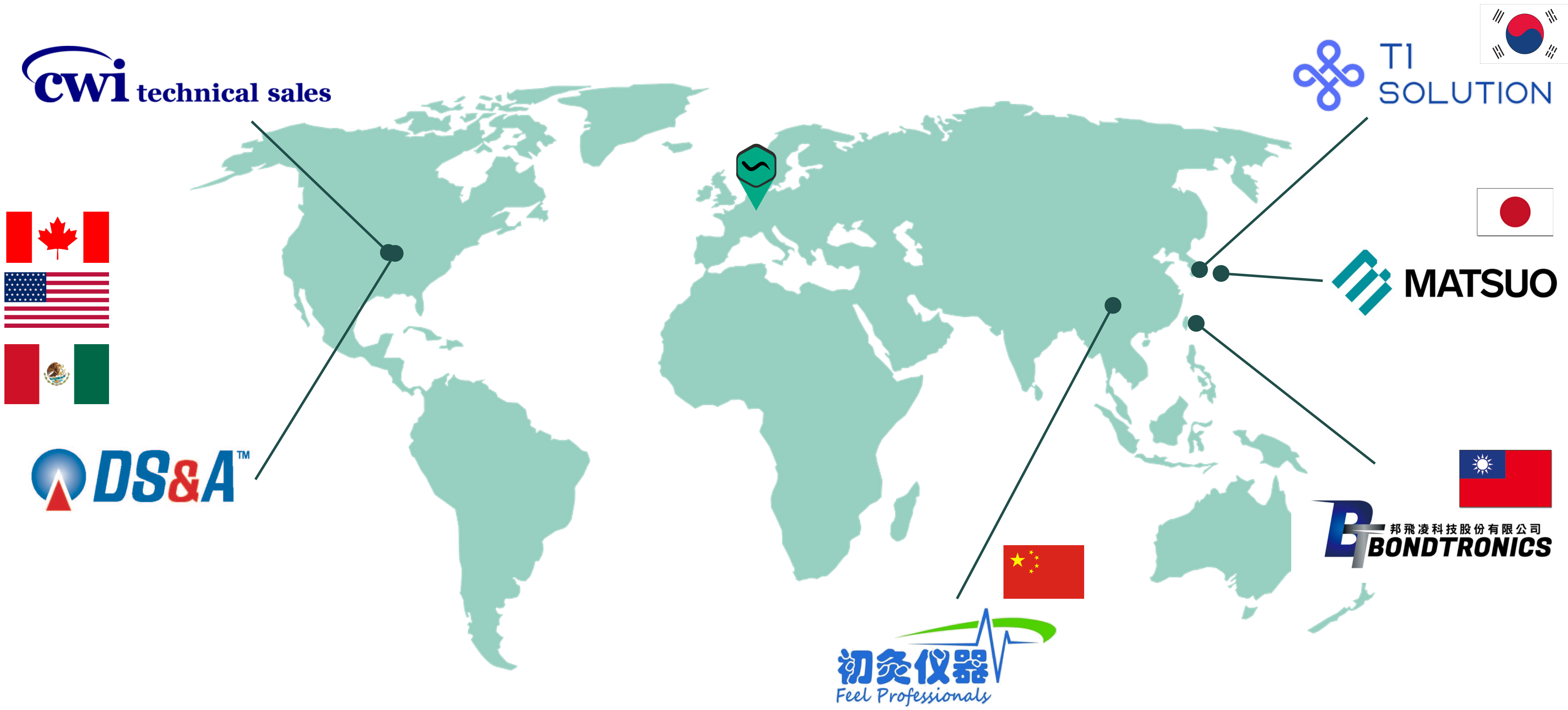
Our Promise

- Transparency
  - About our measurement results
- Fairness
  - In pricing and conditions
- Free technical and scientific services
  - Zero-cost requirements analysis
  - Zero-cost scientific discussion
  - Zero-cost remote technical support
- You learn - we learn.

© 2023 Nanotest. All rights reserved.

NANOTEST

Worldwide Distributors – Made in Germany to the World



© 2023 Nanotest. All rights reserved.

Thank you

nanotest.eu

Berliner Nanotest und Design GmbH
Volmerstr. 9 B, 12489 Berlin, Germany
info@nanotest.eu
+49 30 6392 3880