Berliner Nanotest und Design GmbH

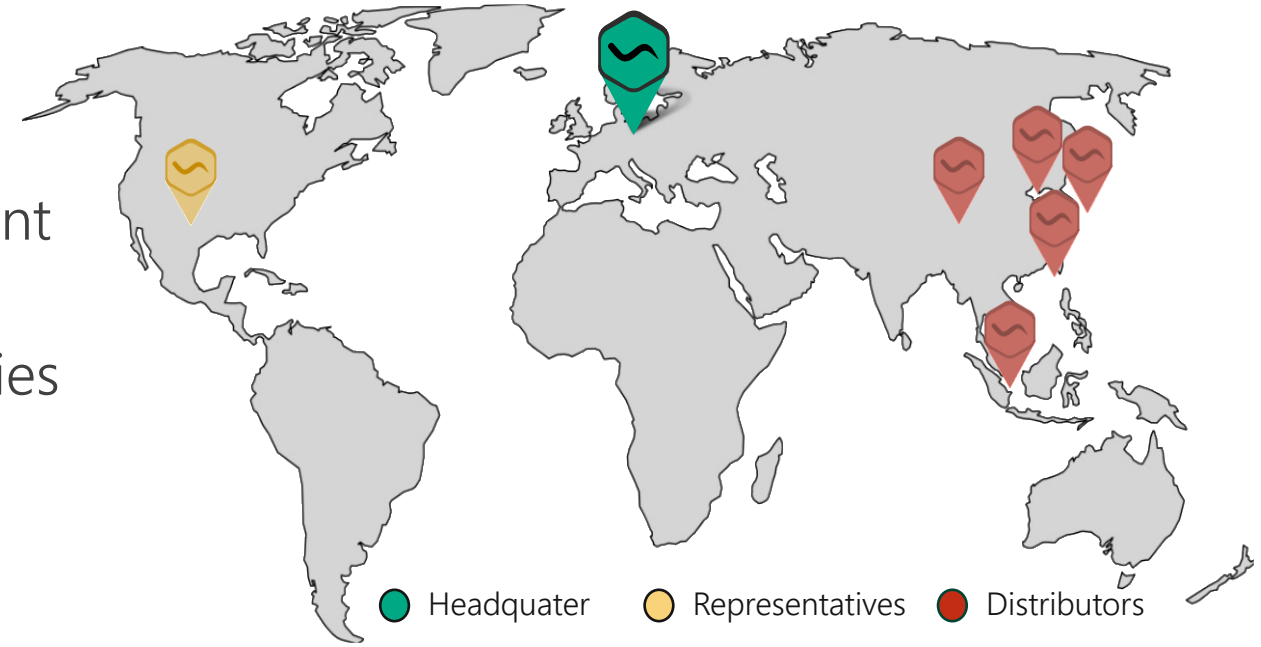
Company Portfolio

NANOTEST

simply measured

Origin - from Spin-Off to Global Supplier for Thermal Management

- **Founded in 2004** – Specialized in thermal management and characterization
- **Global Technology Supplier** – Our measurement systems and Thermal Test Vehicles are used by leading electronics and semiconductor companies worldwide
- **German Engineering** – High-precision measurement systems developed and manufactured in Germany
- **Technology Ecosystem** – Co-founder of:
  - Joint Lab Berlin for thermal management (JLB)
  - International Semiconductor Alliance (ISA)



NANOTEST in numbers

- **22** years of experience
- **45** motivated employees
- **300+** satisfied customers

NANOTEST

Advanced thermal solutions for semiconductor packages and electronic systems

Thermal Material Characterization

- Thermal interface materials
  - TIMA5
  - TIMA6
- highly conductive materials
  - LaTIMA
- Liquid and polymers
  - TOCS

Thermal Package Characterization

- Custom TTVs
- Off-the-shelf TTVs
- Scalable Control Units for TTV
- Thermal Transient Testing
- Active Power Cycling

Thermal imaging-based Failure analysis

- IR Thermography
- Pulse, pulse-phase and lock-in thermography
- Detection of delamination, voids, cracks und more
- Device diagnostics

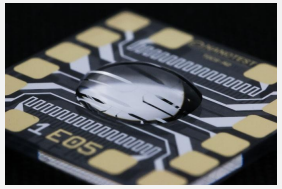
Thermal Characterization of Materials (liquids → TIM → solids)

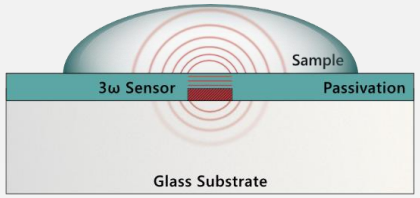
TOCS®

- 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



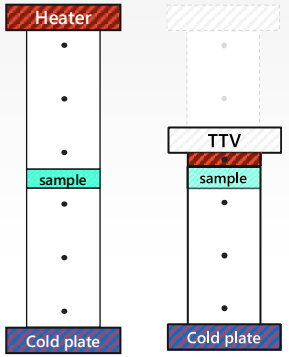


TIMA®

- 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

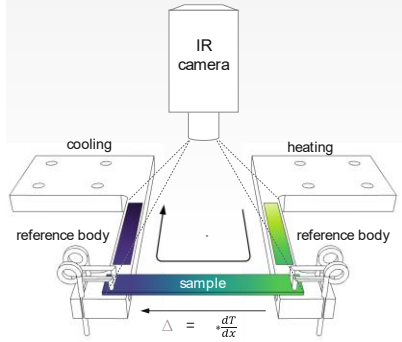


LaTIMA®

- Solids
- Substrates & metals
- Thermal conductivity
- Thermal diffusivity

★ Two-in-one system
★ Dog-bone samples

Features
» High conductivities
» Industrial sample compatibility



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Fast-paced thermal material characterization

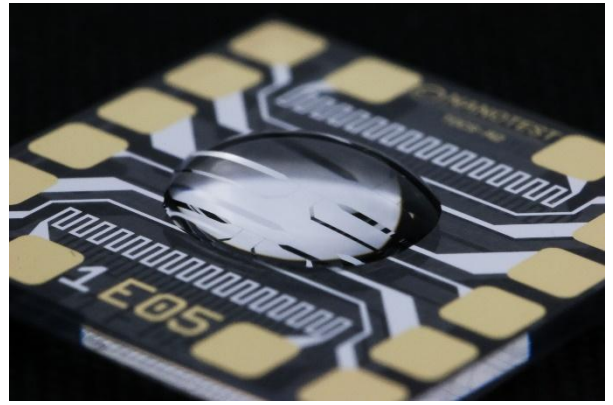
Material parameters

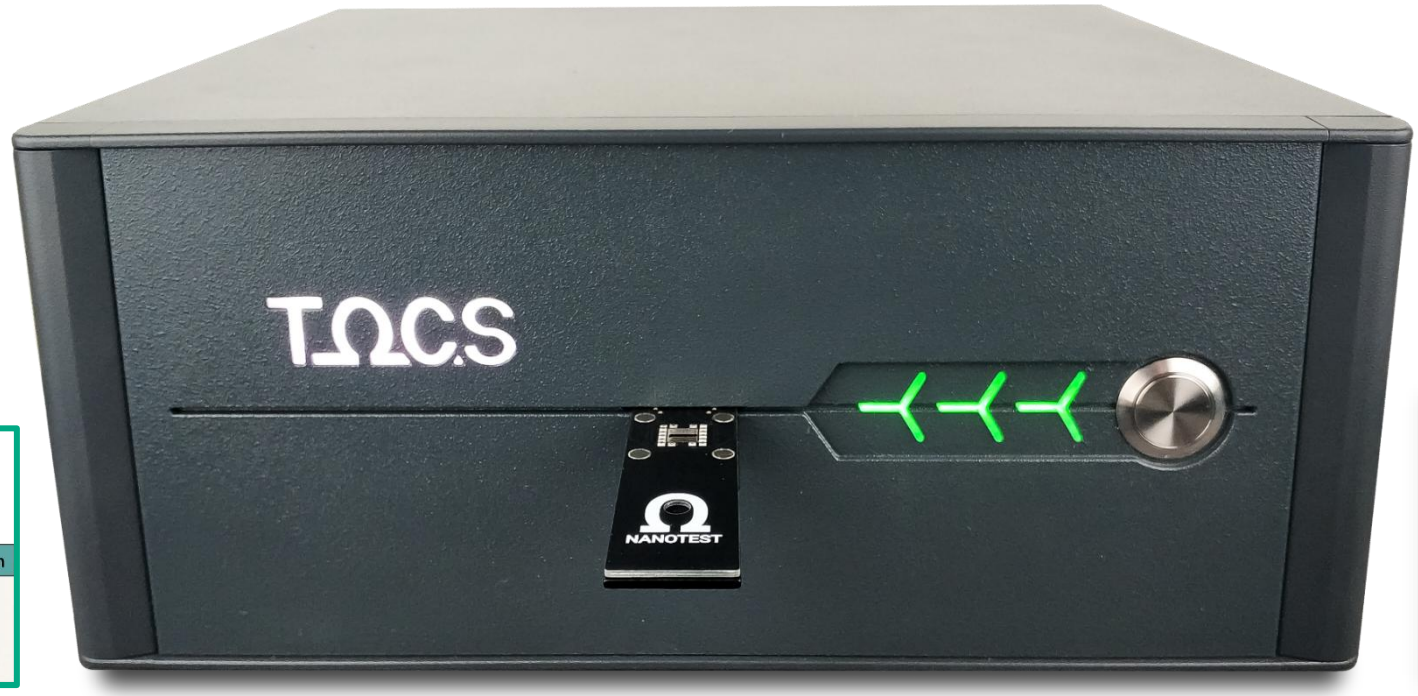
- Bulk thermal conductivity
- Thermal diffusivity

Feasible samples

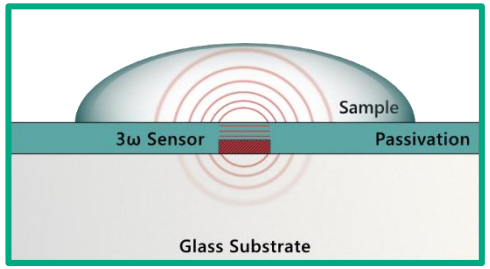
- Liquids
- Gels
- Pastes
- Soft solids

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

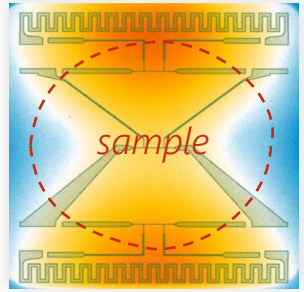


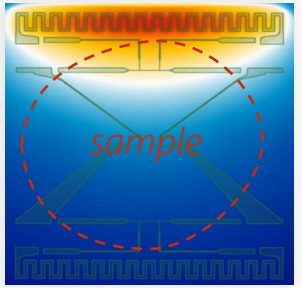


Measurement x-section



Custom temperature profiles



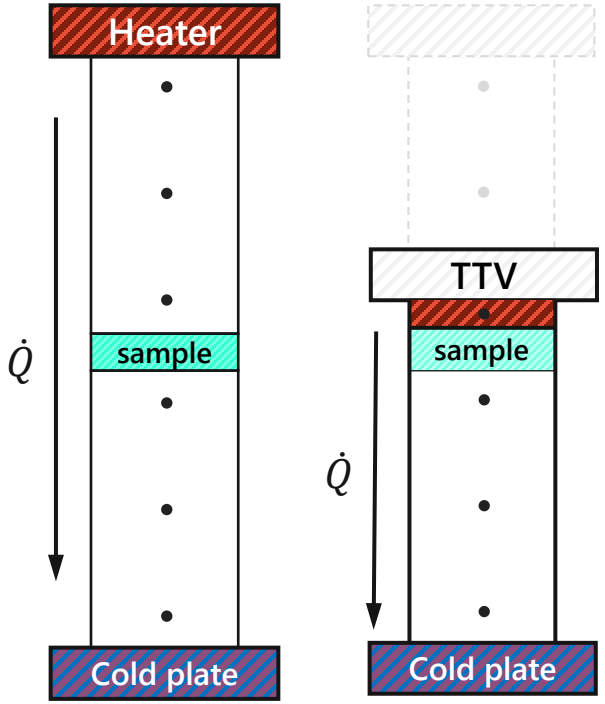


Beyond ASTM D5470

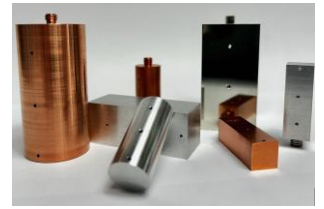
- Effective and bulk thermal conductivity
- Thermal effective and interface resistance
- Temperature and pressure dependency
- Aging and reliability testing
- Compact all-in-one system

Feasible samples

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

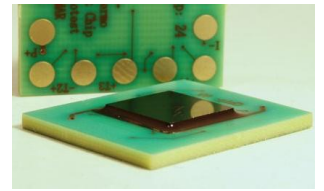


examples of feasible material samples



selection of available test heads

Assembly and curing tool adhesive

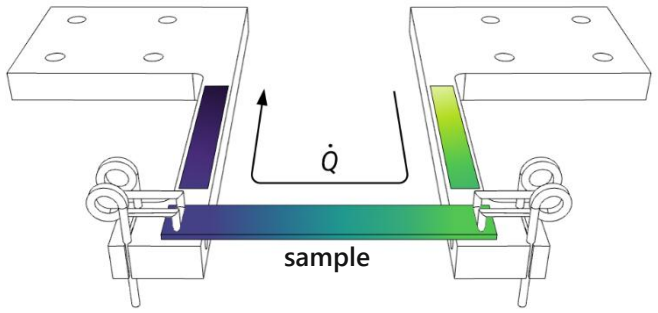


Thermal test chip

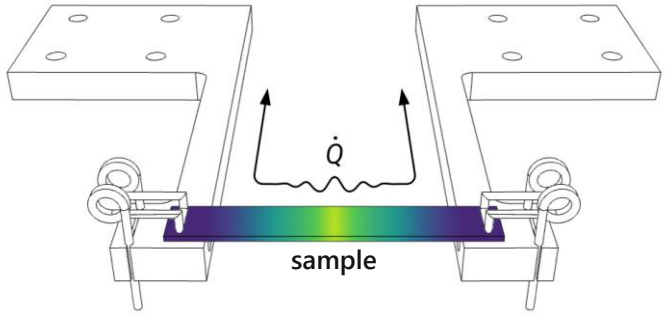
LaTIMA base

TIMAwave add-on

» Thermal conductivity

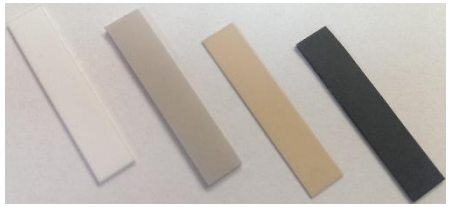


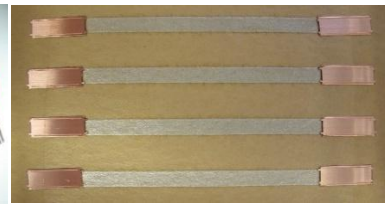
» Thermal diffusivity



For highly conductive materials

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





Development steps of Thermal Test Vehicles (TTV)

Design of customized TTV

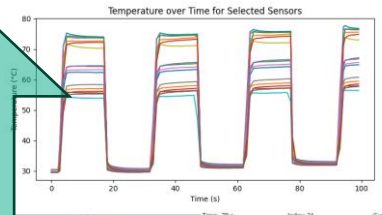
We support customers in developing customized TTV solutions—from concept to validation.

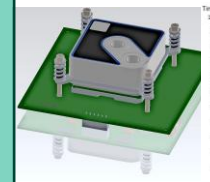
This includes:

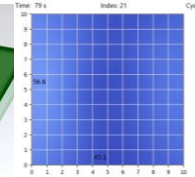
- Thermal test chip design and wafer fabrication
- Chip configuration and feasibility studies
- Substrate and ETB design & manufacturing
- Assembly and quality verification
- Measurement hardware development
- Measurement and control software
- Calibration and qualification
- Performance and reliability testing

ALL-IN-ONE TTV DEVELOPMENT FROM TEST CHIP DESIGN TO THERMAL VALIDATION

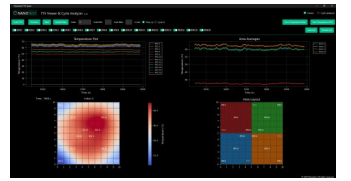
Performance & Reliability Testing



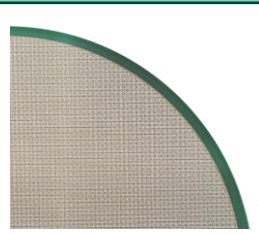


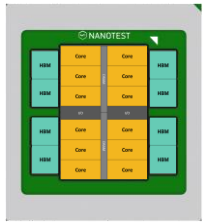


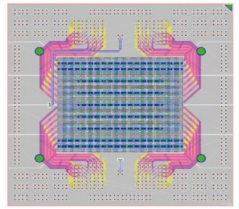
Measurement & Analysis & post processing Software

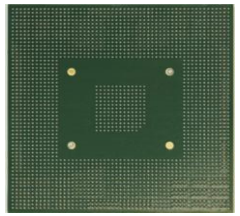


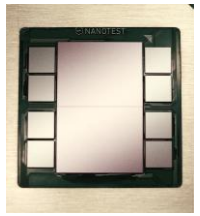
Thermal test chip wafer	Concept and feasibility	Substrate design	Substrate manufacturing	Chip and Board assembly	Quality control Calibration & test	Measurement hardware

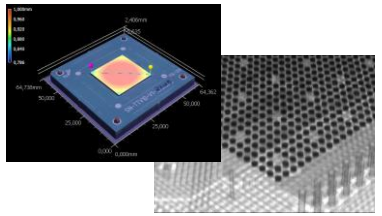












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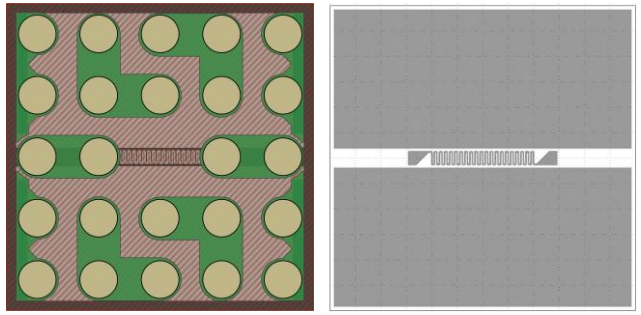
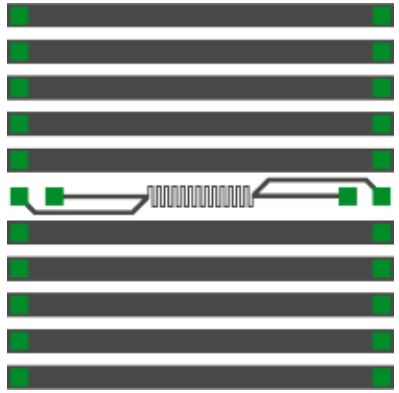
Off-the-Shelf Thermal Test Chip (TTC) Wafers

Bumps — NT20-3k FC



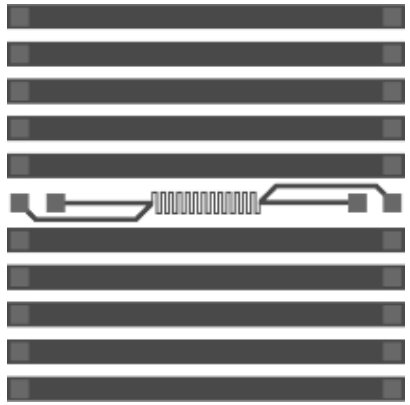
- 2.4 x 2.4 mm² unit cells
- 2 heaters + RTD + 4 monitoring bumps
- 8" wafer / > 4000 cells per wafer
- Power Density: 10 W/mm²
- Wafer thickness: 500 and 725 µm undoped silicon
- Flip-chip assembly
- 300 µm SAC bumps with 500 µm pitch
- BSM:
  - Ti-NiV-Au (100nm-300nm-200nm)
  - Pure silicon

Cu-Pilar — NT16-3k FC



- 3.2 x 3.2 mm² unit cells
- 10 heaters + RTD
- 8" wafer / > 2400 cells per wafer
- Power Density: 10 W/mm²
- Wafer thickness: 620 µm undoped silicon
- Flip-chip assembly
- 80 µm Cu-pillars with 300 µm pitch
- BSM:
  - Ti-NiV-Au (100nm-300nm-200nm)
  - Pure silicon

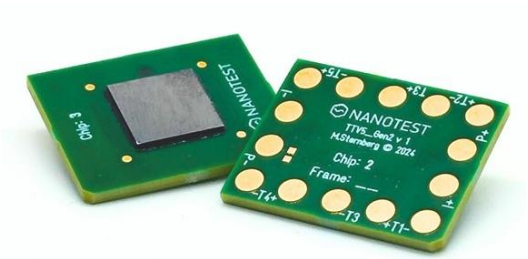
Wire bond — NT16-3k WB

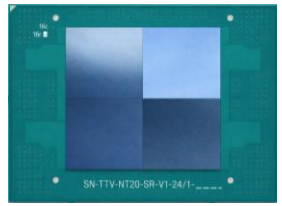


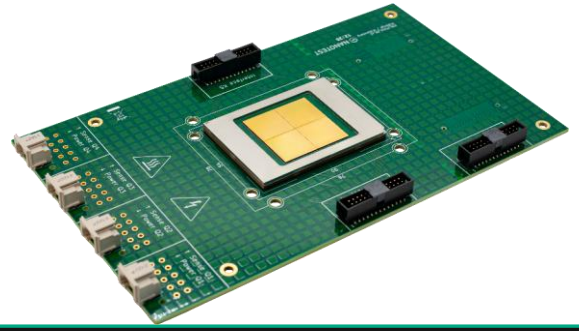
- 3.2 x 3.2 mm² unit cells
- 10 heaters + RTD
- 8" wafer / > 2400 cells per wafer
- Power Density: 10 W/mm²
- Wafer thickness: 400 µm undoped silicon
- Wire-bond assembly
- 150µm Aluminum pads
- BSM:
  - Ti-NiV-Au (100nm-300nm-200nm)

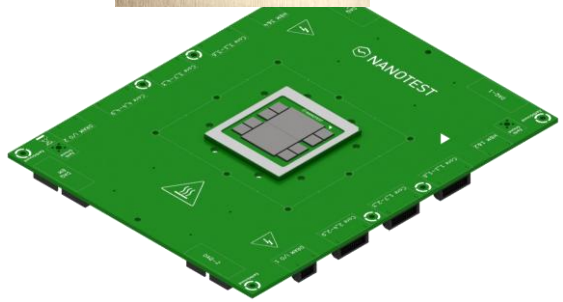
Off-the-Shelf Thermal Test Vehicles (TTV)

TTV5	TTV10	TTV16	TTV200
9.8 x 9.8 mm^2	24.9 x 24.9 mm^2	39.9 x 39.9 mm^2	52.5 x 50.0 mm^2
monolithic die	monolithic die	monolithic die or chiplet (4 dies)	Chiplet (10 dies: 2x SoC and 8x HBM)
One heater	4 heaters, 6 hot spots	Up to 24 heaters	Up to 48 heaters
5 RTDs	16 RTDs	56 RTDs	112 RTDs
Up to 140 W	Up to 2000 W	Up to 5000 W	Up to 7400 W





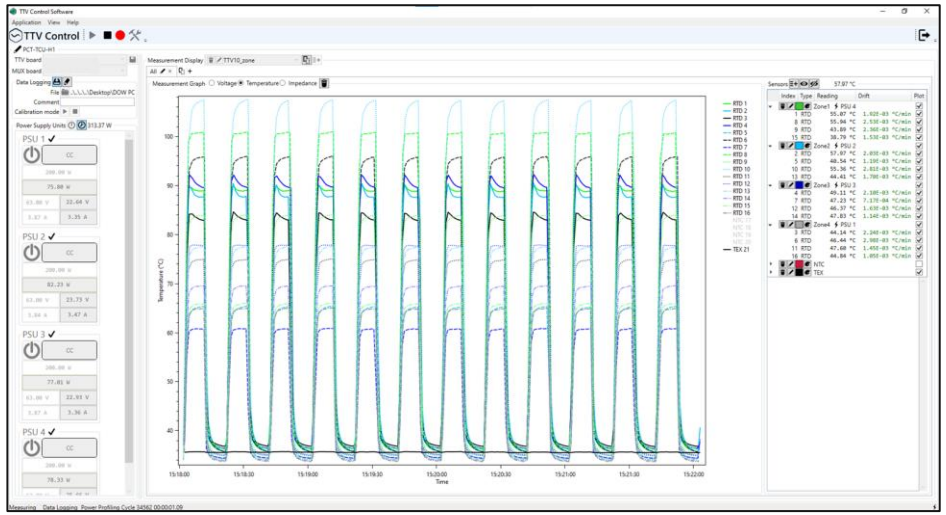




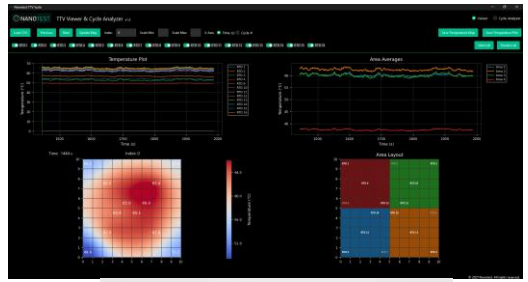
Accompanying Control System - Scalable Solution for every Need

- 19-inch rack-based system scalable to TTV and customer requirements
- Expandable power architecture
  - From 1 up to 48 PSUs
- Integrated data acquisition
  - Up to 16 analog channels
- Integrated control PC with software for:
  - RTD measurement and visualization
  - Automated power cycle scheduling
  - PSU control
  - MUX control
  - Data anaysis

Control and measurement software



Analsis and visualization software



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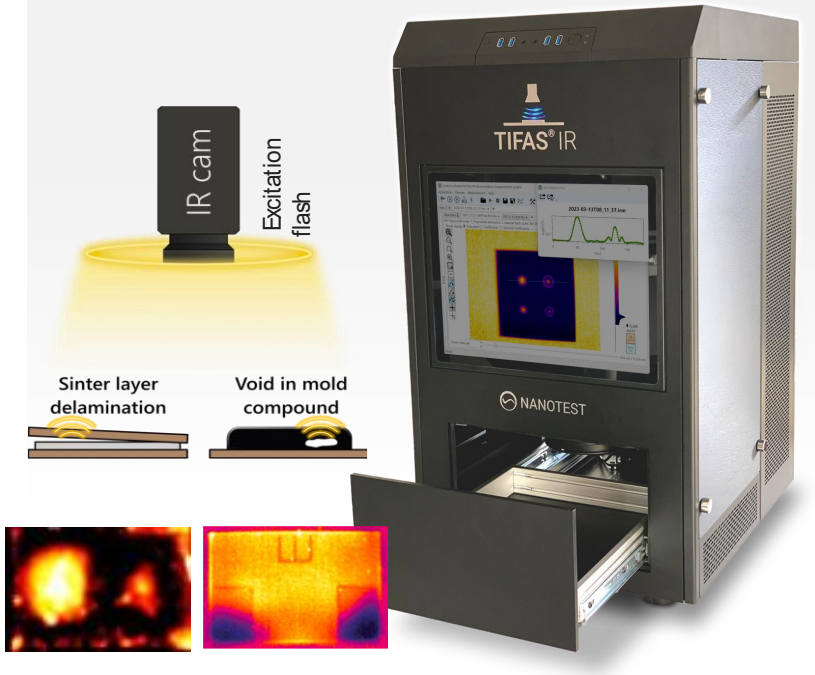
Failure Analysis by Thermal Imaging (Lab → Inline → Mobile)

TIFAS® IR Lab

Lab device for contactless failure analysis

Features

- Complete IR 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



TIFAS® IR inline

Intelligent inline failure analysis

Features

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

TIFAS® IR mobile

Mobile failure analysis for field applications

Features

- Mobile IR thermography-based failure analysis setup
- Contactless and non-destructive
- Great variety of detectable defects
- Comprehensive analysis software
- Testing of fiber composites and bonded joints

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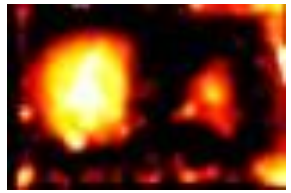
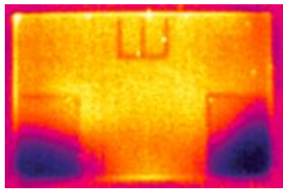
Contactless failure analysis in a nutshell

Features

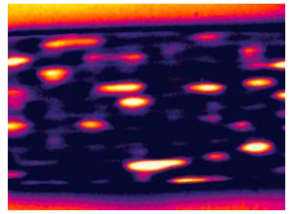
- Complete pulsed infrared thermography-based failure analysis setup
- Contactless and non-destructive
- Short testing times, high throughput
- Great variety of detectable defects
- Comprehensive analysis software
- Adaptable to special needs



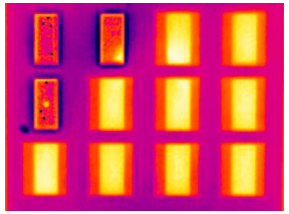
Voids in solder die attach layer



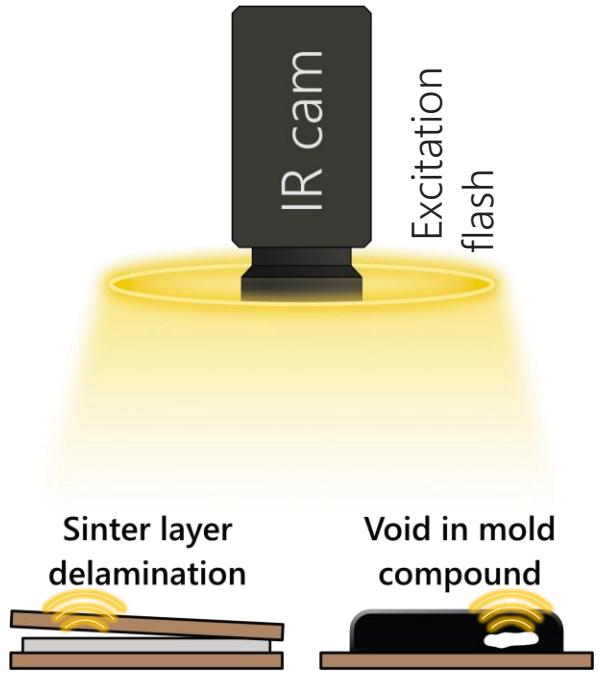
Delamination in sintered power module

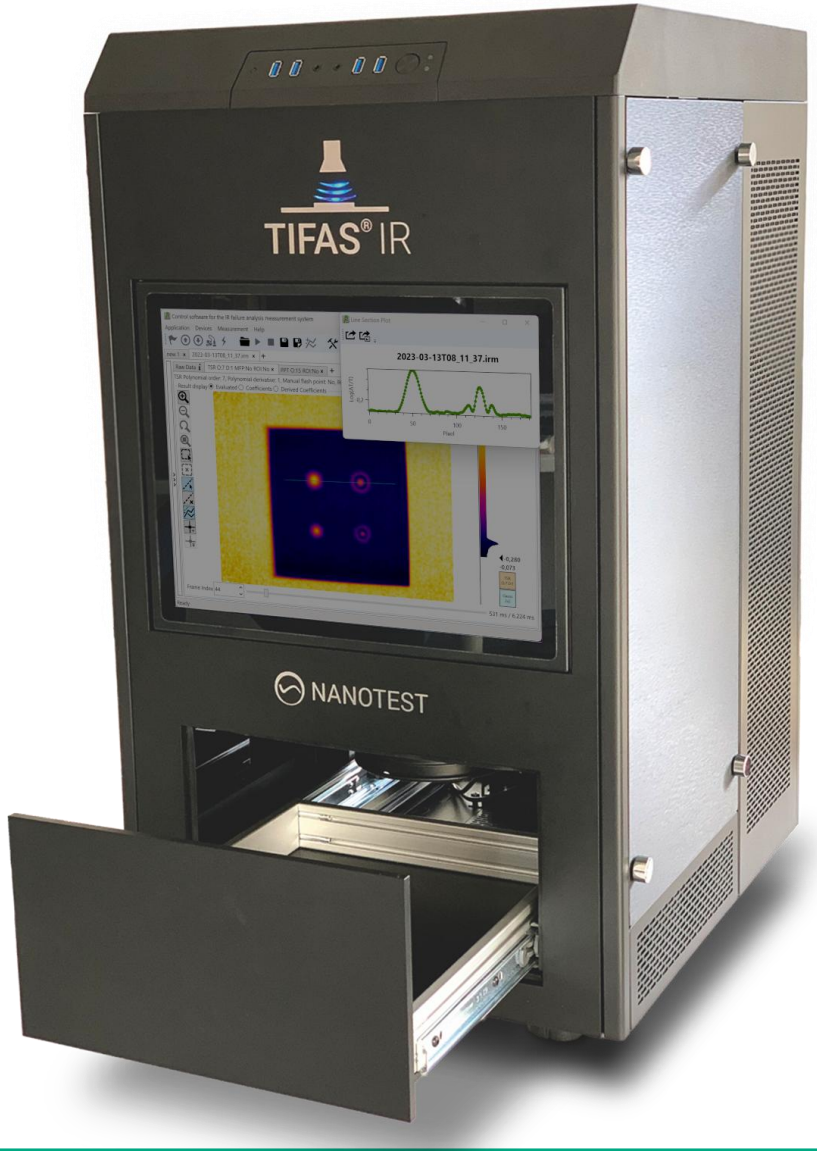


Voids in carbon fiber reinforced polymer



Voids in molding compound



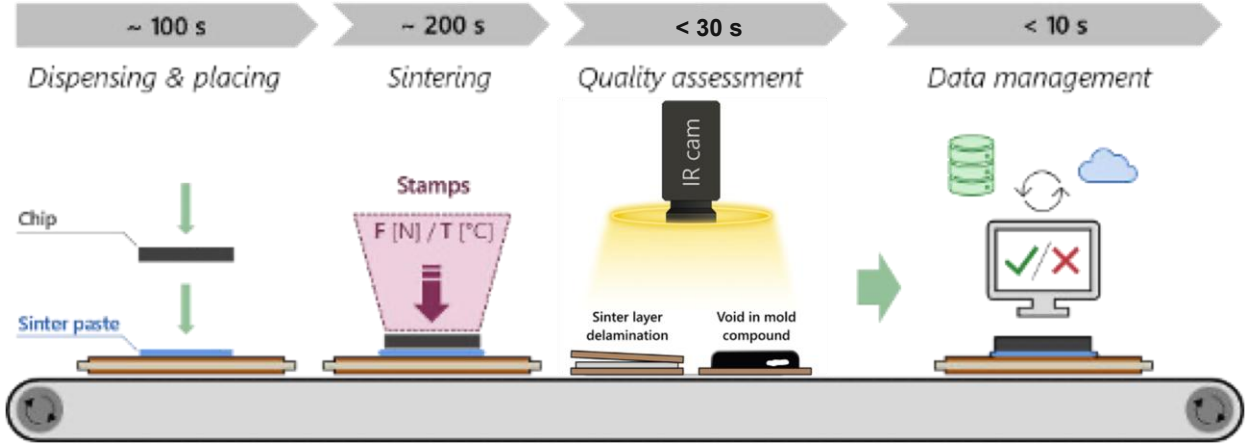


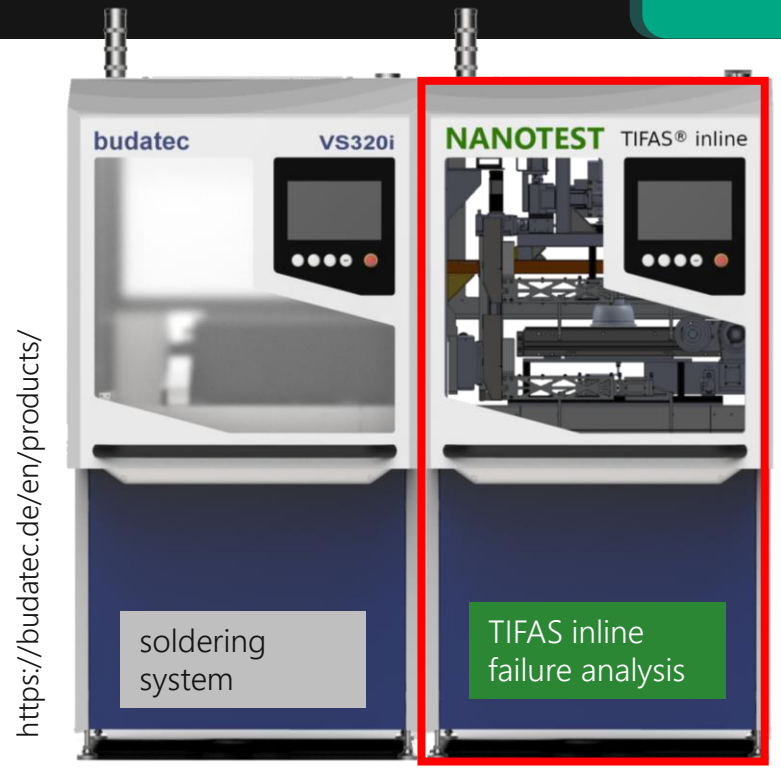
NANOTEST

Intelligent non-destructive 100% inline failure analysis

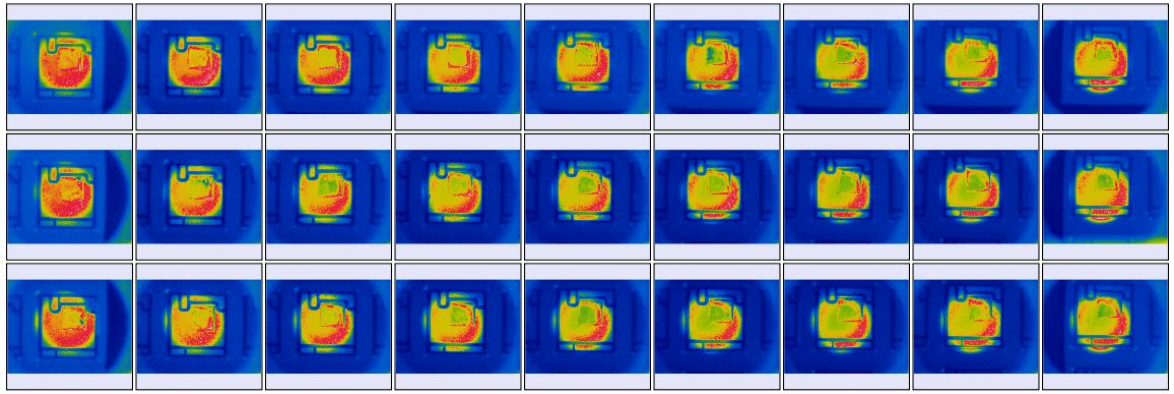
Features

- 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

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

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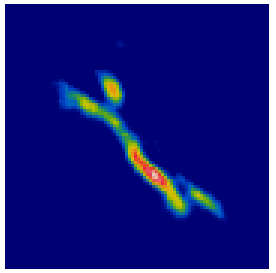
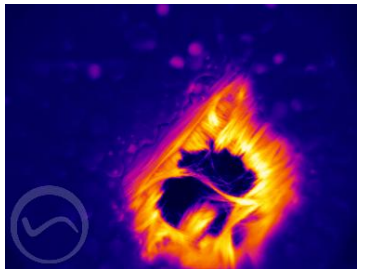
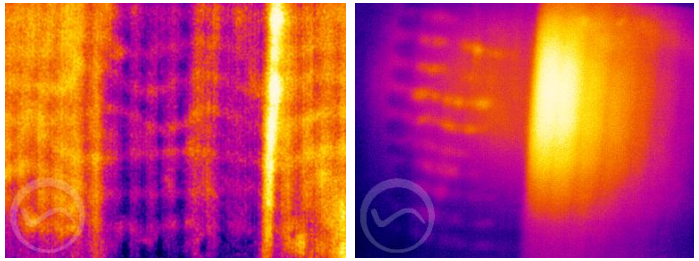
ZfP heute | Berlin 2020 p 54-55
M. Kaczmarek, M. Müller, Zerstörungsfreie Bauteilprüfung von großflächigen, glasfaserverstärkten Schienenfahrzeug-Komponenten

Impact defect



Lightning strike defect





Inner structure of a wind turbine blade

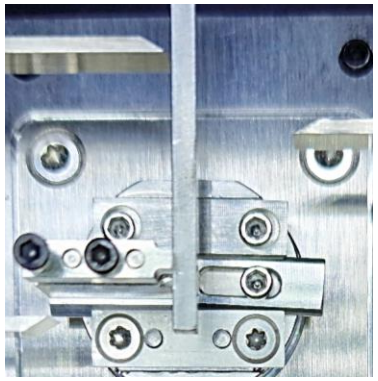
Rapid, inexpensive and effective interfacial adhesion strength characterization

Material parameters

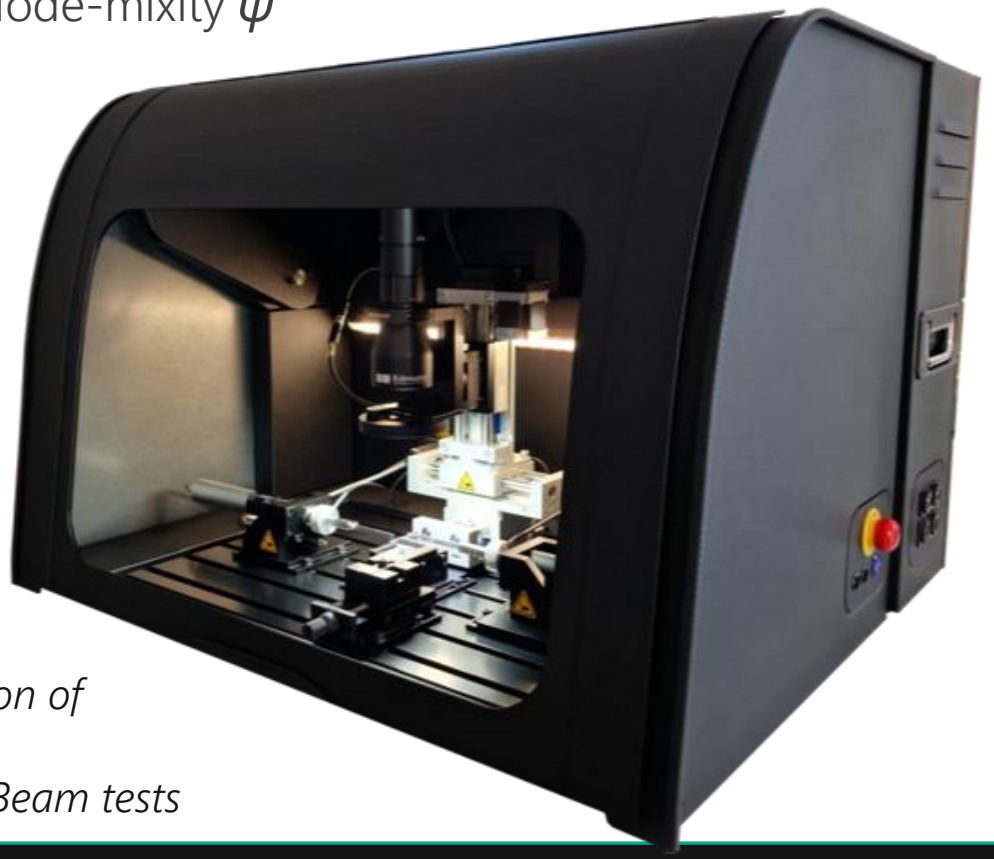
- Critical Energy Release Rate G_c vs. Mode-mixity ψ

Samples

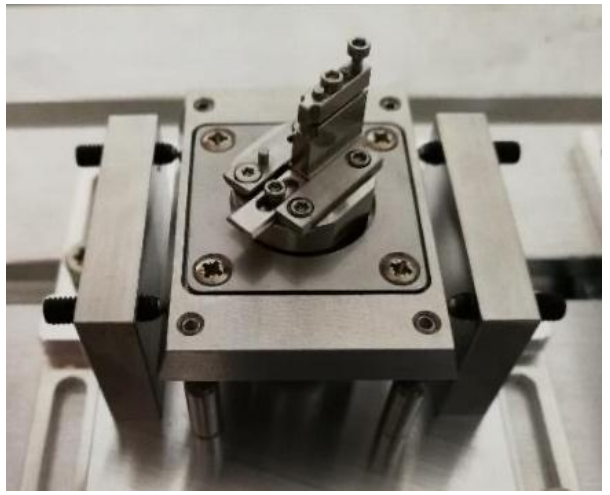
- Artificially manufactured samples
- Bi- or multi-layered beams
- Package origin cut-outs



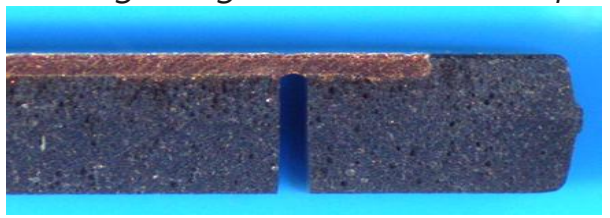
Mode-mixity variation by superposition of End Notch Flexure and Double Cantilever Beam tests



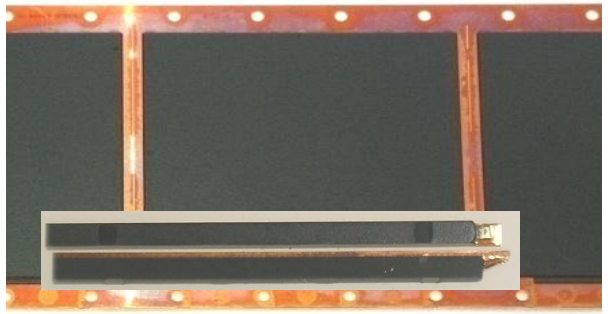
*Specimen is **simply fixated** in the detachable sample holder.*



Package origin cut-out (No chip)



Artificial manufactured (EMC/LF)



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Our Offering

- Thermal expertise
  - 22 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
- You learn - we learn.

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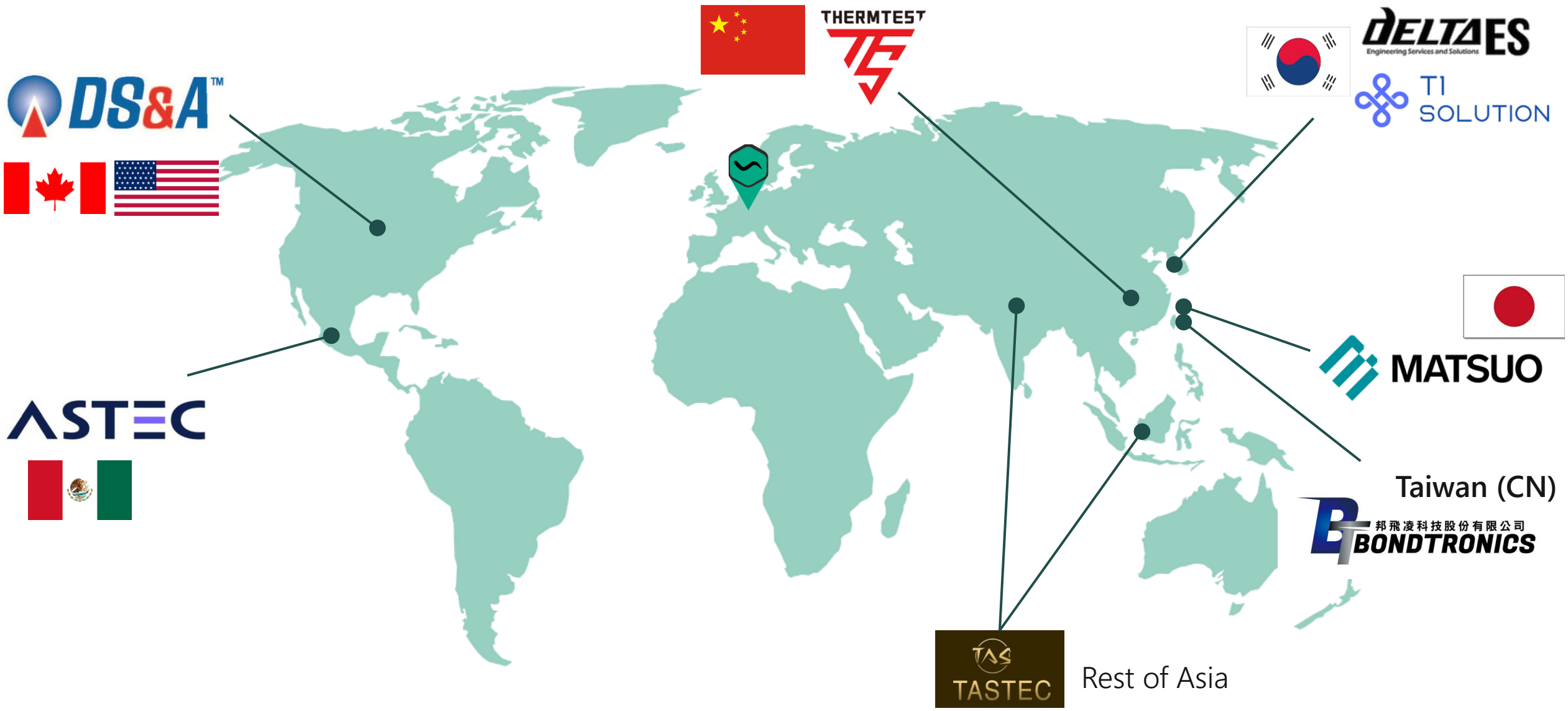

New Facility from April 2026

1300 m² space

- 700 m² office area
- 270 m² production
- 130 m² labs
- 200 m² meeting and social rooms

Thank you

NANOTEST

simply measured

ISO 9001 certified

Certified for in-house R&D

nanotest.eu

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