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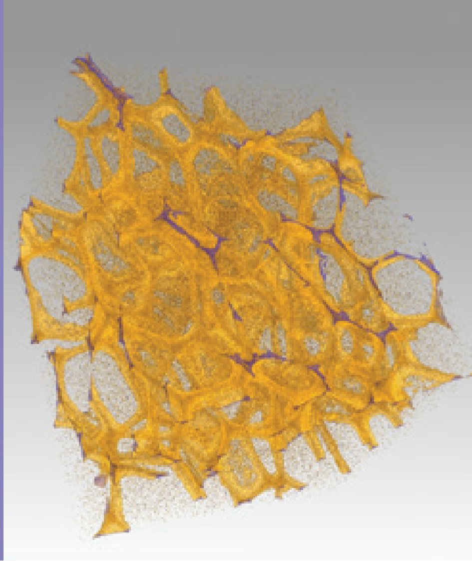
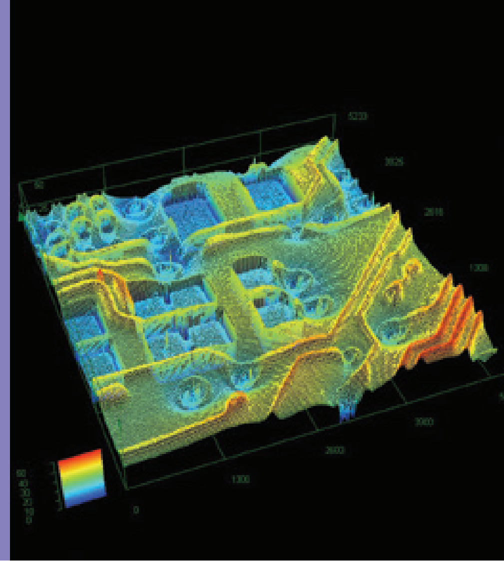
FRAUNHOFER-INSTITUT FÜR SILIZIUMTECHNOLOGIE ISIT

QUALITY AND RELIABILITY

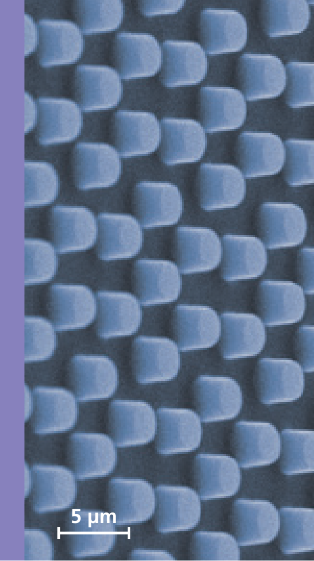
| COMPONENTS | ASSEMBLIES | SYSTEMS | POWER ELECTRONICS |



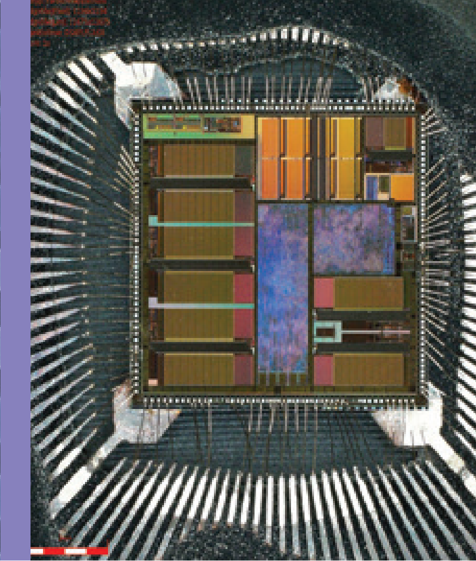
CT of a foam structure



Profile of a PCB surface



SEM: Small Si bumps



Wet-etch opened chip package

CT of a relay coil

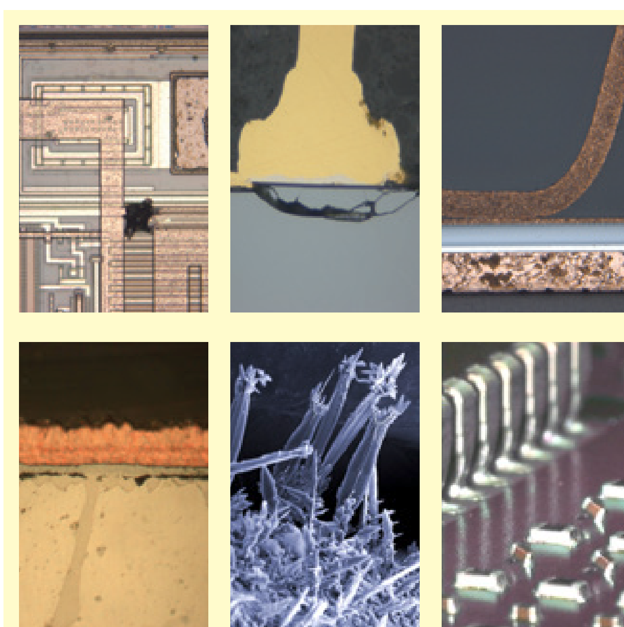
QUALITY AND RELIABILITY: COMPONENTS, ASSEMBLIES, SYSTEMS, POWER ELECTRONICS

Product quality evaluation

- Standard equipment for electrical and thermal measurements
- Automated electrical measurement (wafer prober)
- Consultance during electronics development, layout and assembling by IPC and legal experts
- Scanning electron microscopy (SEM)
- Atom force microscopy (AFM)
- Material analysis: Energy dispersive X-ray spectroscopy (EDX)
- Ionography

Destructive analysis methods

- Cross section preparation
- Cross section polishing
- Focussed Ion Beam (FIB)
- Selective metal etching
- Package opening
- Solder heat resistance
- Process and production capability, MSL



Non destructive analysis methods

- Solder point and PCB inspection according IPC-A610 and other standards (e.g. DIN, ISO, JEDEC, AEC-Q100 etc.)
- Optical inspection: Micro- and macro photography, digital microscopy, surface profile analysis (confocal laser profilometry), white light interferometry
- X-ray inspection:
  2D radiography, digital computer tomography (CT)
- Scanning acoustic microscopy (SAM)
- Thermography
- Infrared spectroscopy
- Layer thickness and optical parameter (n,k) measurement: Monochromatic ellipsometry
- Laser vibrometry (e.g. for MEMS oscillating amplitude measurement)

Upper from left to right:
Electrical breakdown between conductive layers on chip
Crack in surface Si below a wire bond contact
Cross section of a Cu ribbon contact (width 2 mm, thickness 200 µm)
Lower from left to right:
Diffusion controlled delamination of a Cu coating
Whisker growth
Tombstoning of SMD parts during solder reflow process

Reliability testing and lifetime prediction

Structure and material analysis

- Cracks after aging
- Damages after thermal overload
- De-alloying effects
- Visualization of solder texture and and of boundary layers
- Intermetallic phase identification

- Climate testing (Shock, thermal variation, humidity, storage, aging)
- Electrical load variation testing up to 2000A, intended damaging of parts and devices
- Combined and automated testing (electrical-thermal-mechanical)
- Determination of mechanical and structural material parameter, e.g. young modulus, shear modulus, tear-off forces, elastic-plastic transition etc.:

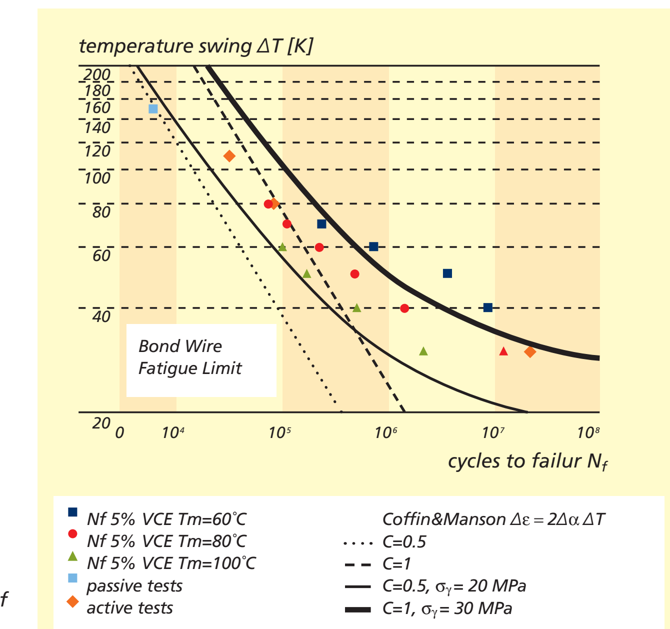
- Draw, shear, strain and pressure testing, also combined with thermal loads,
- Shock and vibration tests
- Nano indenting
- Pull- und shear tests (wire bonds, solder balls)

Surface analysis

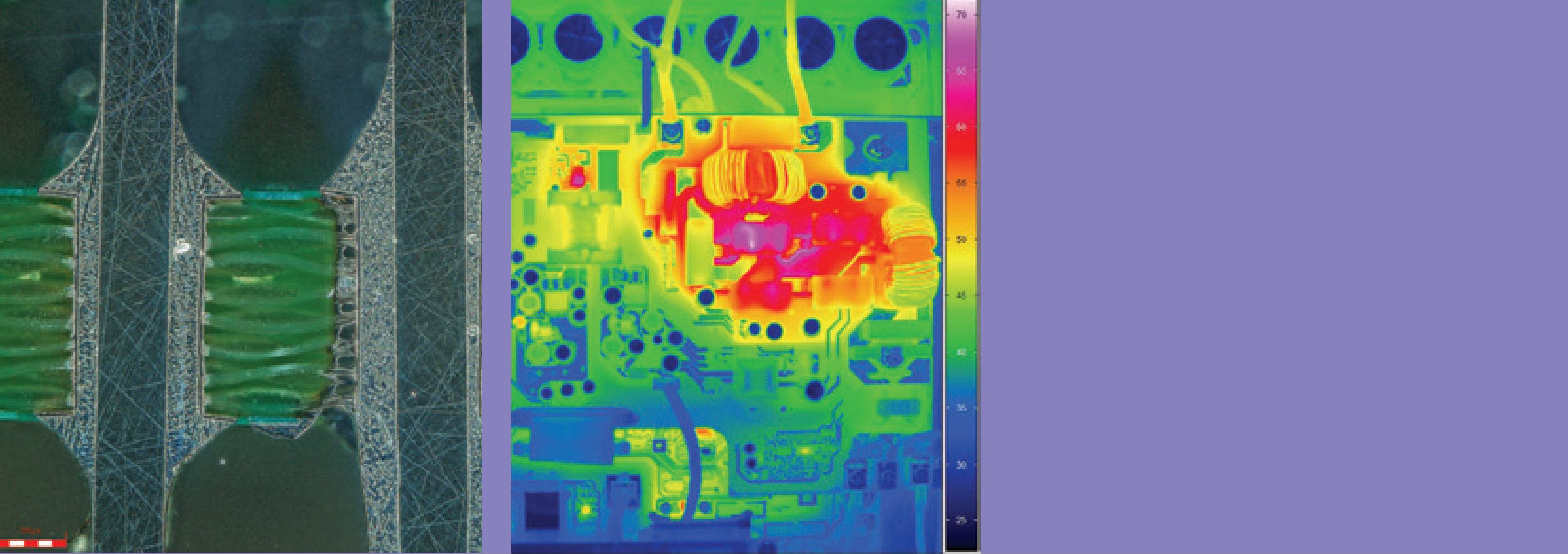
- Contact angle measurements, wetting and sticking tests, adhesion force measurements
- Surface insulation resistance test (SIR)
- Particle contamination
- Corrosion monitoring (EIS)

Lifetimes of parts and devices

- Model calculations
- Prediction on basis of observed failure mechanisms
- Contemporary statements obtained by suited accelerated aging mechanisms



Reliability of heavy wire bond connects



Cross section of a THT plug contact

Heat image of a defect coil

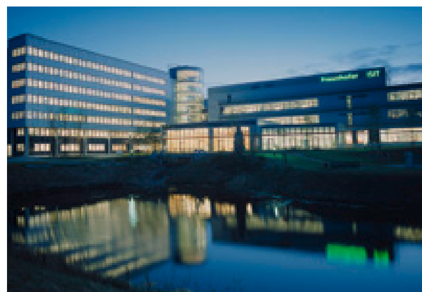
Damage and failure analysis

- Thermomechanical damages mechanisms at solder points, bond wire interconnects and material compounds
- Electrical overloads, ESD
- Cracks, contamination, corrosion, dendrites, whisker, lacquer errors, delaminations
- Dimensioning and positioning errors, parts counterfeits
- Reconstruction of complex damage processes

Development of electronics and assembling concepts

- Electronics and system conception (analog, digital, power electronics)
- Thermal layout (simulations, modelling), modelling of cooling devices
- Thermomechanical behavior modelling (static, transient)
- Prototype fabrication

CONTACT



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