

High Lifetime, High Temperature and excellent Reliability

Packaging for Electronics

Double sided silver sintering of power semiconductors; design study of various top side ribbons for extended lifetime and processability

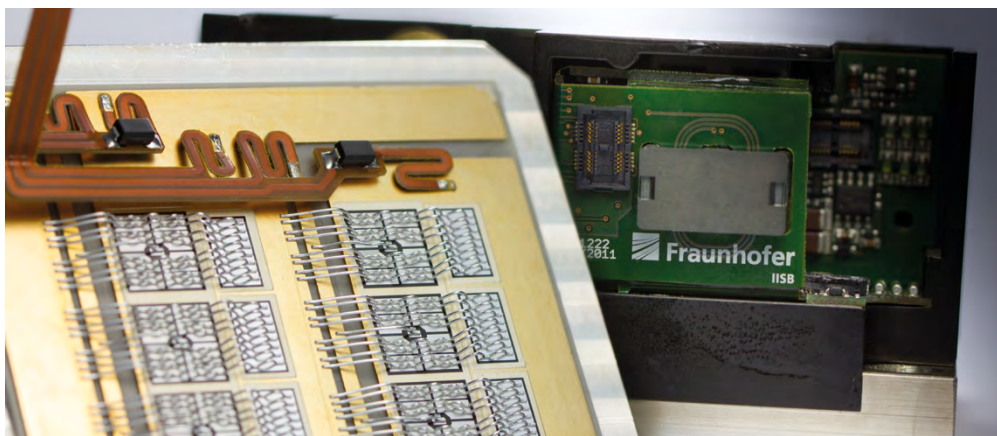
© Thomas Richter / Fraunhofer IISB

Equipment

- Multi-physics simulation tools (electro-thermo-mechanical), CAD
- Plasma cleaning and activation of surfaces
- Printer for paste materials
- Vapor-phase vacuum soldering
- Formic acid-activated infrared vacuum reflow
- Hydrogen-activated infrared vacuum reflow
- Full automatic die placer with high temperature and extended tool force capability
- Automatic wire and ribbon bonders (aluminium, copper, composites, and gold)
- Servo press for sintering
- Ultrasonic and resistance welding machines for electric terminals

Conceptual investigations

- Evaluation of cooling concepts, liquid and air, single and double sided cooling, heat spreading
- Lifetime improvement by matching and minimization of coefficients of thermal expansion (CTE) for different components and materials
- Designs with and without baseplate
- Design for electrical, thermal, mechanical and lifetime constraints
- Low parasitic inductance commutation cells especially for SiC and GaN
- High temperature applications up to 300 °C junction



Inverter building block for the IISB electric vehicle technology demonstrator; robust concept with directly cooled CTE matched baseplate, full aluminium approach, integrated gate driver, current sensor and DC link capacitor (600 V IGBT half bridge) © Fraunhofer IISB

Silver sintering

- Pressureless and pressure assisted (up to 75 kN) process for small and large areas
- Single and double sided semiconductor devices
- Multichip power modules using pre-attaching
- Selective sintering on populated circuit boards or in cavities of busbars
- Sintering of active and passive components
- Sintering on DBC, PCB and leadframe
- Screening of different sinter materials interesting for aerospace application

Wire and ribbon bonding

- From 25 μm gold wire to 500 μm copper wire
- Different materials such as gold, aluminum, copper and composites

Prototyping

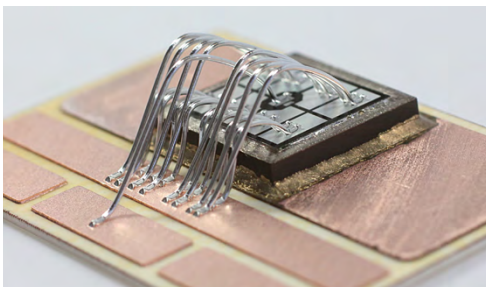
- Material selection including housing and potting
- Procurement of materials
- Small-scale production and qualification

Soldering

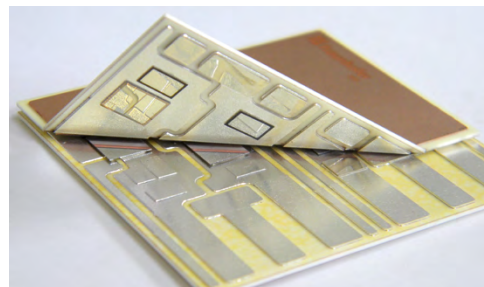
- Standard lead free tin-based and high-temperature alloys
- Void-free soldering with paste and preform material

Testing

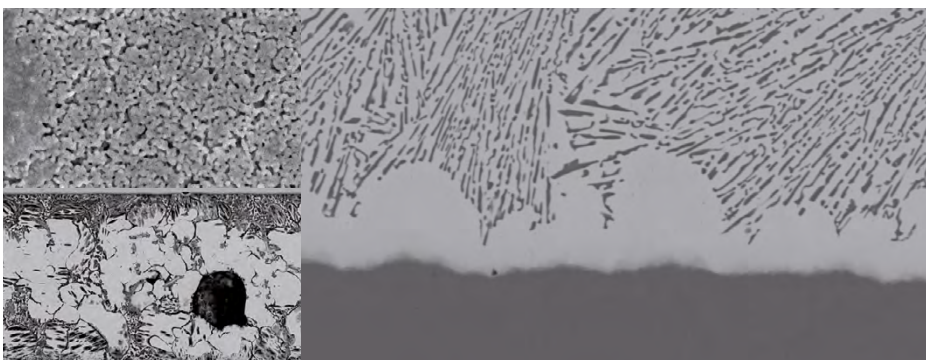
- Static and dynamic thermal measurements from chip to coolant
- Thermal measurements with thermography
- Static electrical characterization
- Dynamic switching characterization
- Scanning acoustic microscopy
- Shear, pull, peel test
- Active power cycling
- Passive temperature cycling



Head spreading and CTE matching by graphite
© Fraunhofer IISB



Double sided cooled sintered power module
© Fraunhofer IISB



Cross section of silver sintered, gold-germanium, aluminum-zinc and high lead-soldered bond lines © Fraunhofer IISB

Contact

Dr. Hubert Rauh
Power Modules
Tel.: +49 9131 761 141
hubert.rauh@
iisb.fraunhofer.de

Fraunhofer IISB
Schottkystr. 10
91058 Erlangen
Germany
www.iisb.fraunhofer.de



vCard Hubert Rauh