

Topside Connection for Semiconductors

Wire Bonding

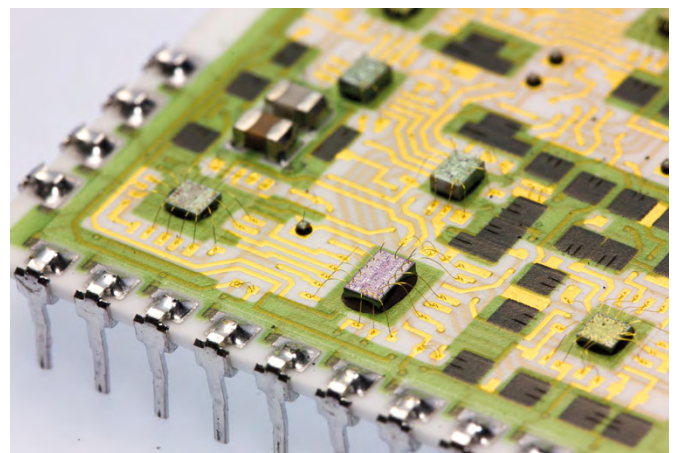
*Automated wire bonding of power
electronic modules © Fraunhofer IISB*

Research fields

- New materials for bond wires, like copper, composites or alloys
- Influence of bonding parameters, geometry and materials on reliability and life-time optimization
- Metalization and surface optimization of semiconductors for bondability
- Cleaning processes to achieve reliable bond connections
- Correlation between bonding parameters and lifetime using power cycling tests

Our services

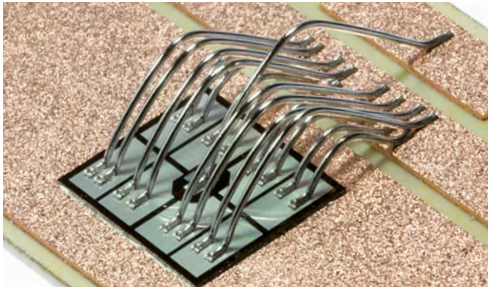
- Aluminum and copper wedge/wedge bonding with diameters from 100 μm to 500 μm
- Ribbon bonding
- Gold ball bonding with diameters from 25 μm to 75 μm
- Heatable chuck for bond process under temperature for up to 200 °C
- Quality assurance by pull and shear tests
- Control of reliability and lifetime by active power cycling test, passive temperature cycling and vibration tests
- Design of experiment techniques to optimize bonding parameters



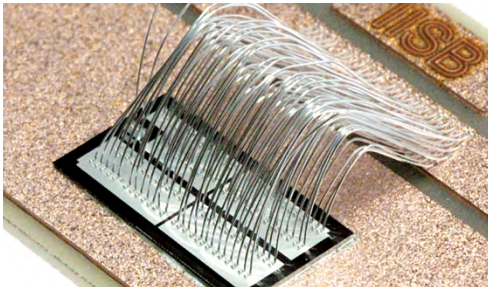
Gold wire (25 μm) © Fraunhofer IISB

Functional principle

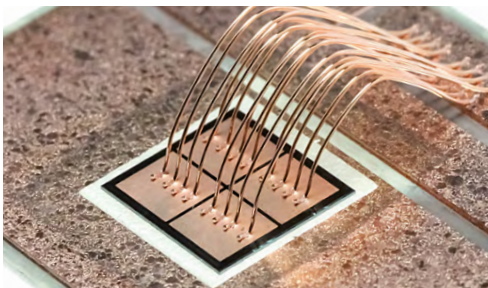
- Ultrasonic bonding works with high-frequency acoustic vibrations under pressure creating solid-state welded joints
- For aluminum wedge/wedge-wire bonding, ultrasonic energy is applied to the wire for a specific duration while being held down by a bond force
- Thermosonic gold bonding includes heat treatment and can be used to form solid-state bonds below the melting points of the mating metals
- For ball bonding, a gold ball is formed before the bonding process by melting the end of the wire applying a high voltage



Aluminum wire (125 μm) © Fraunhofer IISB



Aluminum wire (375 μm) © Fraunhofer IISB



Copper wire (250 μm) © Fraunhofer IISB

Devices and packaging

- Power electronic modules
- Discrete semiconductors
- Si, SiC, and GaN devices
- Surfaces providing best weld solutions: aluminum, copper, gold, and silver
- Various material combinations of wires and surfaces - please refer to table below

Bonder features

- Semi-automatic bonding process
- Programmable bond layouts
- Deformation limit control
- Image recognition of semiconductors and substrates
- Large area modules as well as small micro-electronic devices bondable
- Fast changing/mounting of bond heads and pull or shear heads

Table of materials combinations

	surfaces						
wires	Al	Cu	Au	Ni	Pd	Ag	Sn
Al	✓	✓	✓	✓	✓	✓	✓
Cu	✓	✓	✓	✓	X	✓	X
Au	✓	X	✓	✓	X	✓	X
Pd	✓	X	X	X	X	✓	X
Ag	✓	✓	✓	✓	✓	✓	X
Sn	✓	X	X	X	X	X	✓

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