IMAPS Flip Chip Technology Workshop 2002

June 24-26, 2002
Four Seasons Hotel Austin, Texas

contactless laser solder jetting for fine pitch flip chip bumps

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  - SB² Laser Soldering Process
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• Summary
Process

• Explanation:

• What stands \( SB^2 \) for?

\[ SB^2 = \text{Solder Ball Bumping} \]

Equipment => \( SB^2 \)- Jet
SB²-SM Process (standard)

Placement & Reflow of Solder Balls
SB² - Equipment

Automatic SB²-Jet

Semiautomatic SB²-SM
SB²-Jet Process (new)

Nitrogen — Laser

SB²-Jet Tool

Solder Mask — Solder Ball — Pad-Metalization

Substrate

Certified DIN EN ISO 9001
ICEP 2002
T. Oppert
Bondhead of the SB²
Videoclip SB²-Jet
Advantages

- No tooling
- Solder ball diameters from 80µm to 760µm
- Solder alloys: (SnPb, SnAg, SnAgCu, AuSn)
- No flux
- No mechanical stress/contact
- No thermal stress
- No additional reflow
- No cleaning of flux residues
Applications

Fast prototyping & production for:
- Wafer bumping
- BGA/CSP, WLCSP
- Optoelectronic components
- MEMS packaging
- HDD
- 3-D packaging

Rework/Repair of
- BGA/CSP
Applications

Solder Ball Placement on RF modules

- Mobile Phone, 0,9 - 1,9 GHz
- Bluetooth, 2,4 GHz
- Distance Radar, 70 GHz

[Diagram showing solder ball placement on LTCC substrate]
Applications

CSP - Bumping
Applications

Solder Ball Placement on a Flex CSP

200µm Sn63Pb37 on top of 300µm Sn10Pb90
Applications

Optoelectronic Substrate

Fluxfree Solder Bumping using SB²-Jet
Applications

Fluxless Bumping of HGA‘s for HDD
Applications

CSP Reballing

μBGA

300 μm Solder Ball diameter
Reliability

Solder Ball Placement on Wafer Level

Cross section of eutetic SnPb bump

Area configuration of solder bumps
Reliability

Optimal Solder Wetability

Metallographic Cross Sections
Reliability

Cross section of an HDD Flex Suspension
Reliability

CSP Ball placement using SB²

Shear mode: 100% Ball shear with optimal laser parameters
Reliability

Shear Test

Shear Force: min. 300 g
(Solder Ball diameter: 300µm)
Reliability

SB² Reliability Shear Test Data

Average Shearforce, 368g, standard dev. = 16,8 g

Cpk: 2,33

Solder Ball diameter: 300µm

Solder Alloy – Eutectic SnPb 63/37

Fracture Mode: Solder Shear
Reliability

Lead-free Solder Bumping, SnAgCu

Shearmode: solder/solder

Shearforce:
Mean: 96.75 g
Sigma: 5.24 g

Sample size: 20
Pad size: 100 µm

after Reflow and Flux-Cleaning
Reliability

CSP Ball placement using SB\(^2\)

shear force / bump versus laser power
solder ball diameter: 300µm
Reliability

FC on FR4 after Thermal Storage

Contact Resistance [mΩ] vs. Time [h]

Storage temperature 150 °C
Summary & Outlook

• Overview on the SB²-Process
  Laser Soldering
    - Process
    - Equipment
    - Applications
    - Reliability

→ High flexibility of a reliable & proven solder ball attachment method on various kind of components