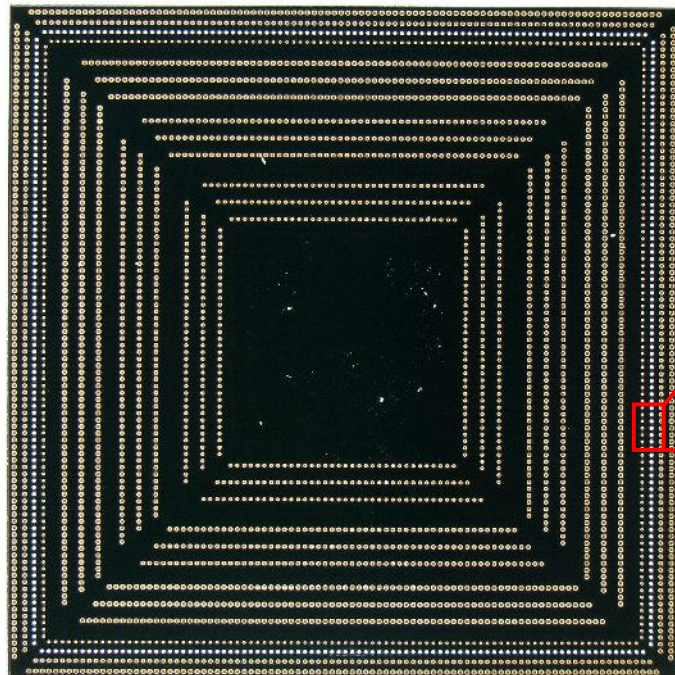
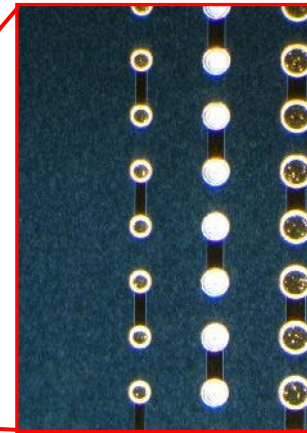


For preliminary tests of FC-bonders a chip layout of various pad sizes and pitches was used

PICTURES OF BUMPED TEST CHIPS



Chip top view



Zoom to bumped pads

Selected for bump test:

- Pad size: 50 μm
 - Pass. open.: 40 μm
(3rd row from edge)
- 360 bumps / chip

Pitch: 100 μm (row pitch: 250 μm)

Pass. open. avail.: 30, 40, 50, 60 μm

Pad sizes avail.: 40, 50, 60, 70 μm

Successful tacking was demonstrated with the FC150 from SET

DESY SHEAR TEST RESULTS

First attempt (nov. 2010)

- Tacking only, on Suss **FC150**
- Force: 1 kg
- Temp.: 163°C (alignment @ RT)
→ 3 samples (no. 7,8,9) were made

Shear tests at DESY:

Shear force for sample

no. 7 = 15.66 N → 0.044 N / bump

no. 8 = 18.35 N → 0.051 N / bump

no. 9 = 18.05 N → 0.05 N / bump



Taken from SET test summary

Residual solder bump material proves adhesion for chosen tacking parameters

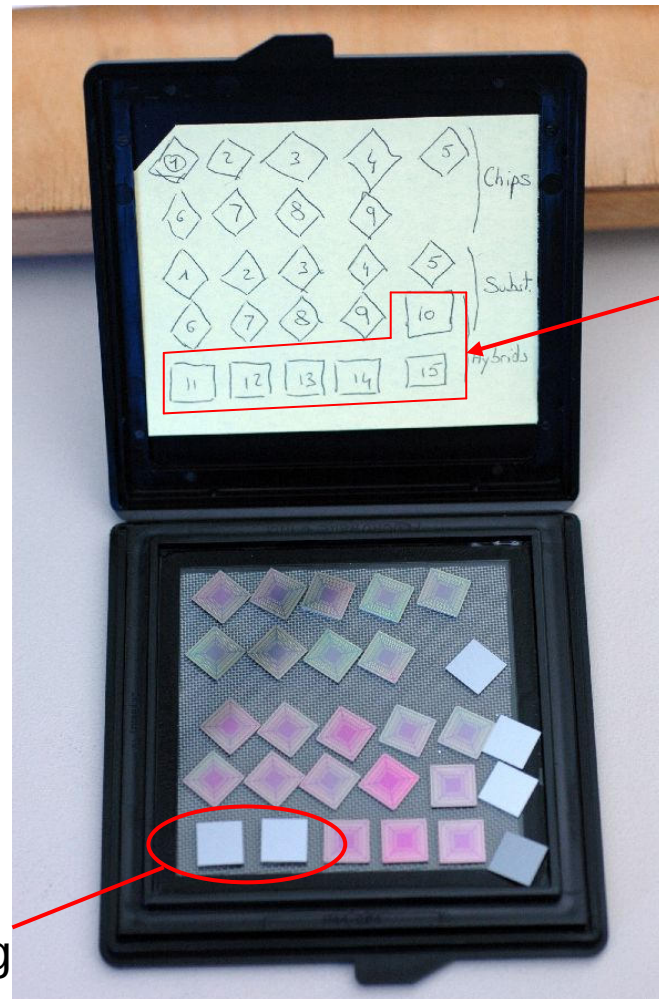
Tacking-only-tests with the Kadett from SET were found less reliable

TEST SUMMARY

Second attempt (mar. 2011)

- Tacking on **Kadett**
- Force: 200 g
- Temp.: 155°C (head and chuck during alignment and tacking)
 - 5 samples for reflow to Unitemp
 - 6 samples to DESY
- Two out of six samples remain tacked after shipping
- Tacking broke on contact with tweezers
 - No shear tests possible

Tacking that survived shipping



Positions of tacked samples

Tacking with the Kadett and reflow with Unitemp process successfully soldered the test chips

DESY SHEAR TEST RESULTS

Second attempt (mar. 2011)

- After tacking on **Kadett**
- Three out of five samples were reflowed at **Unitemp** with **RSS-450-110** oven
- Reflow at 240°C (formic acid atmosphere)

Shear tests at DESY:

Shear force for sample

no. 1 = 65.1 N $\rightarrow$ 0.18 N / bump

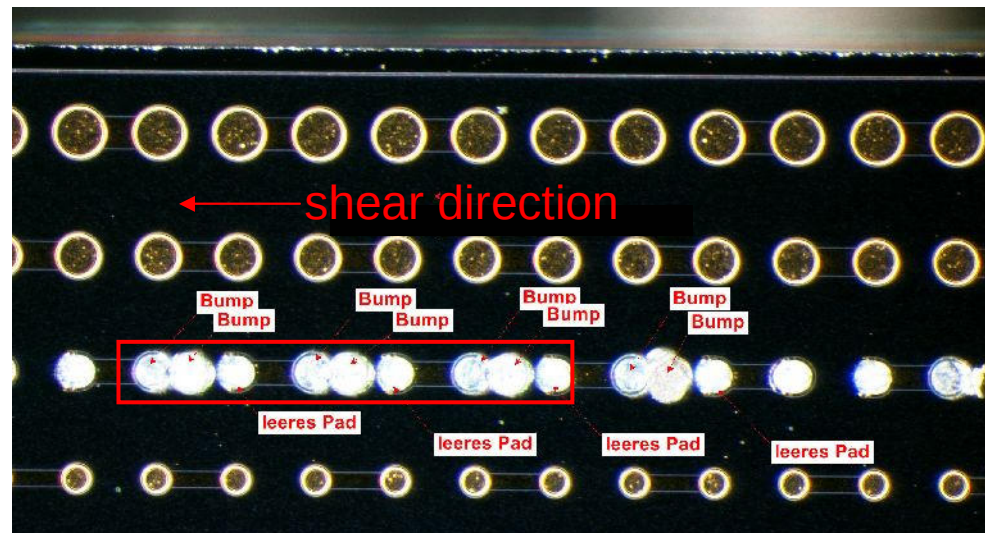
no. 2 = 65.12 N $\rightarrow$ 0.18 N / bump

no. 3 not sheared yet

- Identical shear force
- Detached bumps found on top and bottom chip $\Rightarrow$ Complete soldering achieved

Tacking with the Kadett and reflow with Unitemp process successfully soldered the test chips

MICROGRAPHS OF BONDED, REFLOWED AND SHEARED CHIPS



Zoom to area of interest

Top view

- Solder residues are present on all bonded pads
- Released bumps rest on substrate

PacTech tacking with LaPlace and separate reflow in oven result in comparable numbers to Unitemp samples

DESY SHEAR TEST RESULTS AND CROSS SECTIONAL MICROGRAPHS OF BONDS

- Near forceless tacking with LaPlace
- Reflow with separate oven in formic acid atmosphere

Shear tests at DESY:

Shear force for sample

no. 1 = 56.8 N $\rightarrow$ 0.16 N / bump

no. 2 = 58.72 N $\rightarrow$ 0.16 N / bump

- Identical shear force
- Released bumps found on top and bottom chip

$\Rightarrow$ Complete soldering achieved



Cross sectional view after tacking



Cross sectional view after reflow

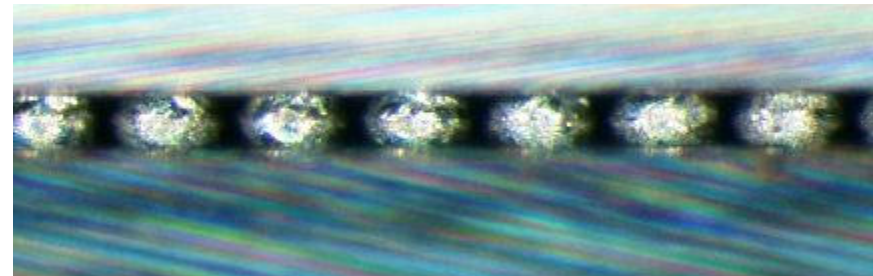
PacTech tacking and reflow with LaPlace alone was done on samples with 60 μm opening

DESY SHEAR TEST RESULTS AND CROSS SECTIONAL MICROGRAPHS OF BONDS

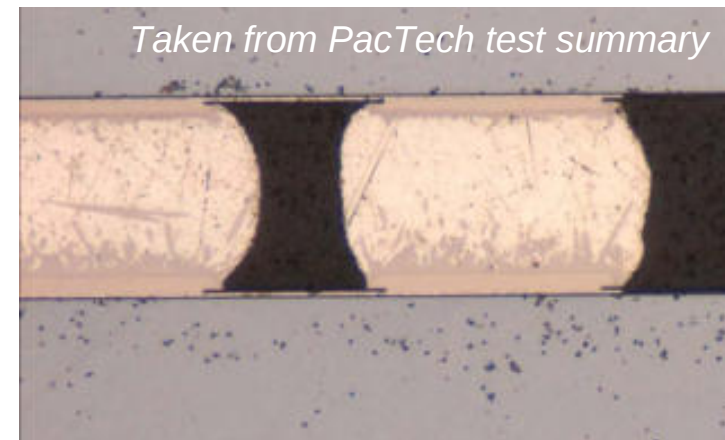
- Reflow in formic acid chamber mounted to LaPlace
- Wrong row of test pads was used:
 - 70 μm pad size
 - 60 μm opening
 - 40 μm solder ball on each side**

Shear tests at DESY:
Shear force for sample
121.3 N $\rightarrow$ 0.32 N / bump

- Test will be repeated using correct row



Bonded chips. Side view



Polished cut image