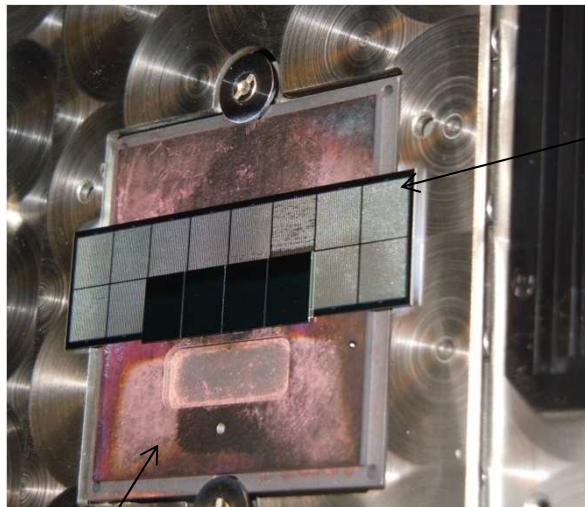


Available Femto test bond stage was too small for the entire module

PICTURE OF DUMMY SENSOR IN FEMTO BOND PROCESS



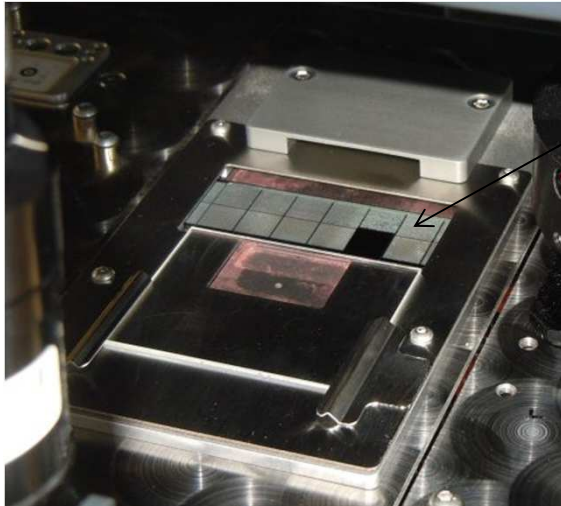
Bumped dummy sensor with
4 tacked ROC

Heated area (W-Cu chuck)

- Heated chuck was 50x50 mm²
 - Four ROC areas protrude over chuck size
- Only 12 ROC could be bonded

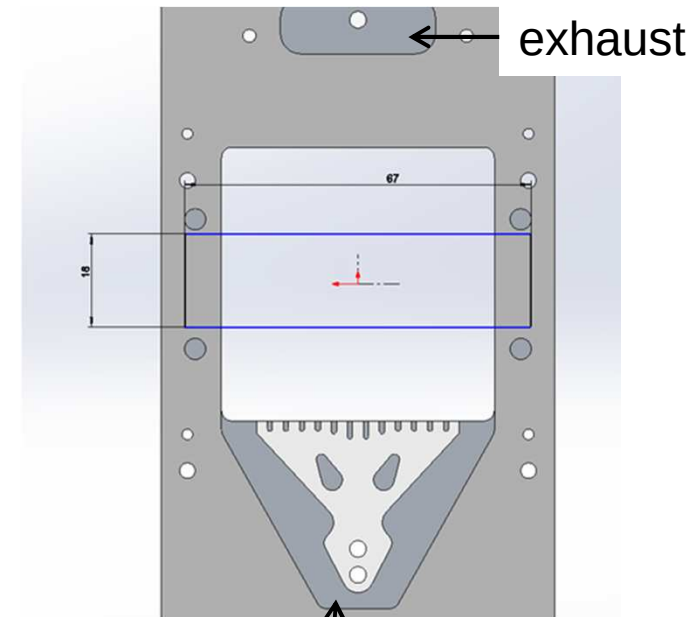
Available Femto test bond stage was too small for the entire module

PICTURE AND SCHEMATIC OF THE FORMIC ACID CHAMBER OF THE FEMTO



Dummy sensor in formic acid chamber with opened glass cover

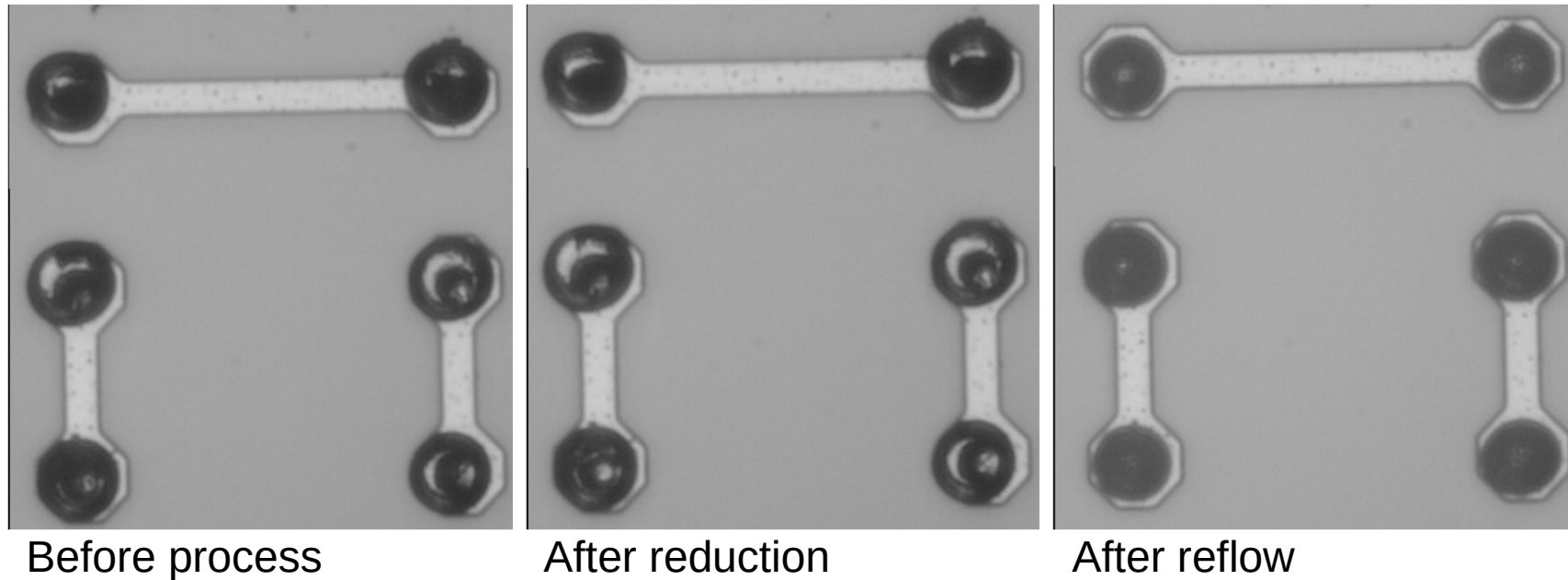
- Formic acid chamber was modified to accept sensor
- Protruding sensor area was cut out
- Chamber was still sealing completely



N₂ and formic acid inlet

Ball cleaning and reflow is possible with the Femto formic acid chamber

MICROSCOPE PICTURE OF SOLDER BALLS DURING PROCESS



Reduction: at 145°C for 180 s

Reflow: ramp from 145°C to 240°C by 2 K/s

stay at 240°C for 15 sec

ramp down (4 K/s)

} formic acid-N₂ flow

N₂ flow

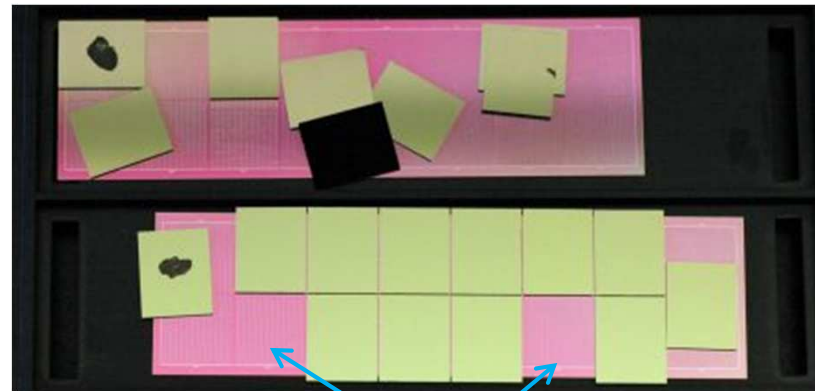
Dummy ROC bond#2
Finetech 31.01.2012

One of two dummy module bonds was successful

PICTURE OF SAMPLE CONDITION AFTER TRANSPORT FROM
BERLIN TO HAMBURG

Modulebond#1

Modulebond#2



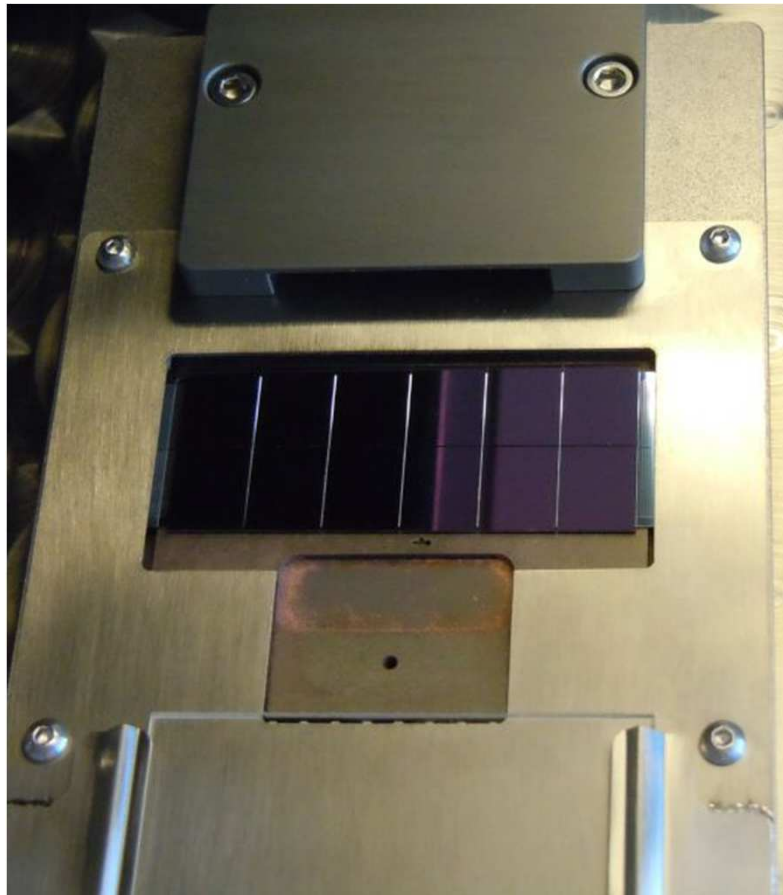
No chip remained in
place

Two ROC broke apart

ROC to ROC bond#2
Finetech 31.01.2012

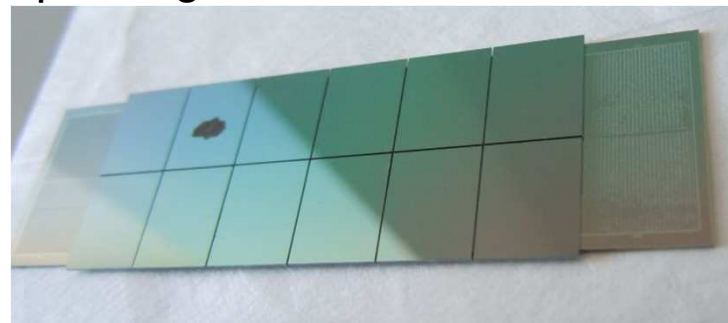
Dummy bare module was produced

PICTURES OF DUMMY MODULE AFTER FINISHED BOND PROCESS



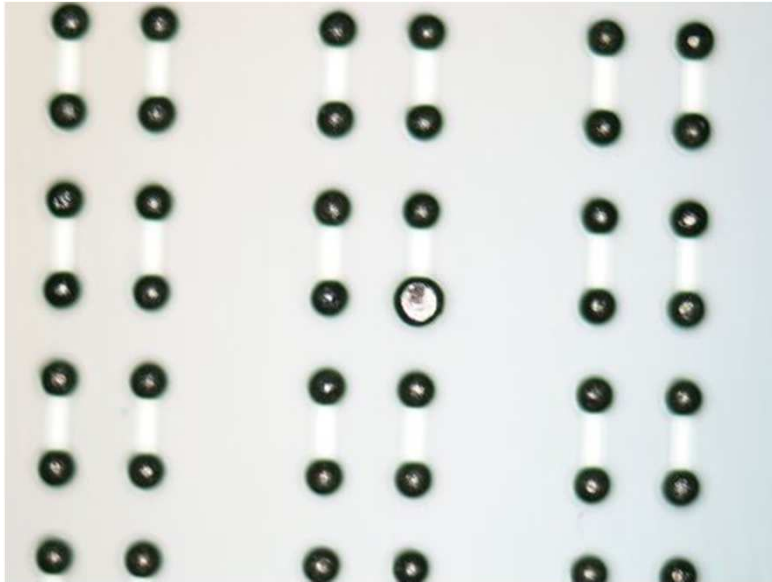
12 ROC on sensor in formic acid chamber on Femto stage

Demounted bare module before packing

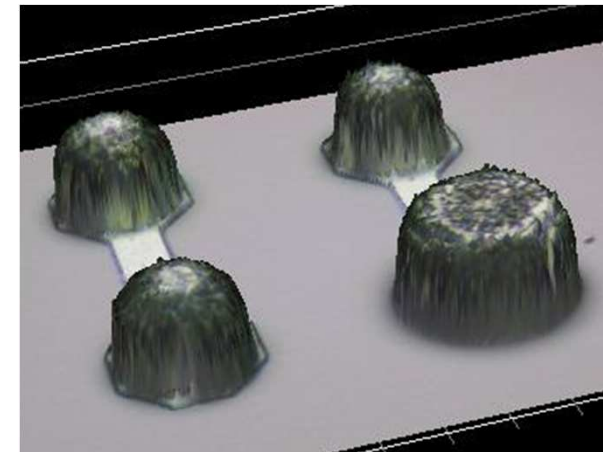
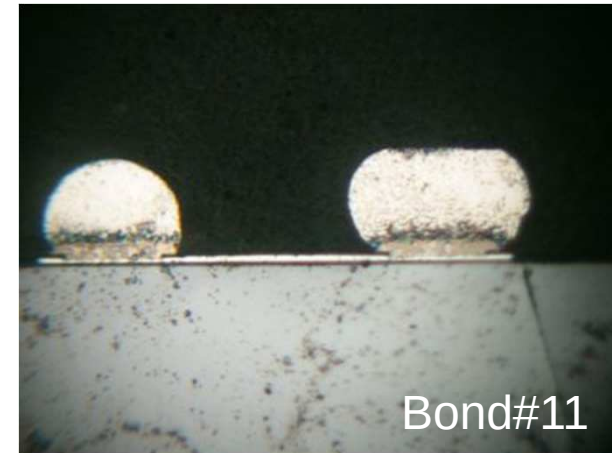


Tacking force was too low to coin makro bumps sufficiently

MICROSCOPE AND LASER SCAN PICTURE OF BOND#1 ON SENSOR 2



5 macro bumps were flattened
All other bumps remained spherical



Dummy module#2 bond#1
Finetech 01.02.2012

Dummy bare module allows electrical tests

PICTURES OF DUMMY MODULE AFTER FINISHED BOND PROCESS

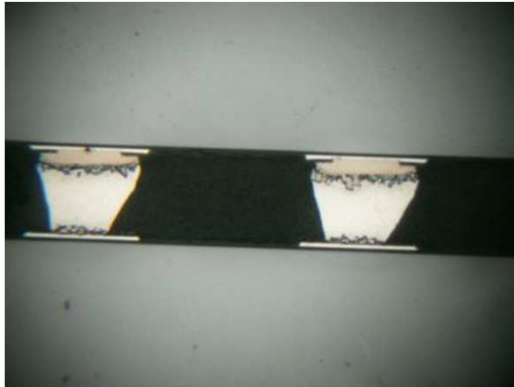


104 pads on each bonded dummy ROC allow 4 wire resistance measures on each of the 26 double columns

All daisy chain resistance measure paths of this sample were open 😞

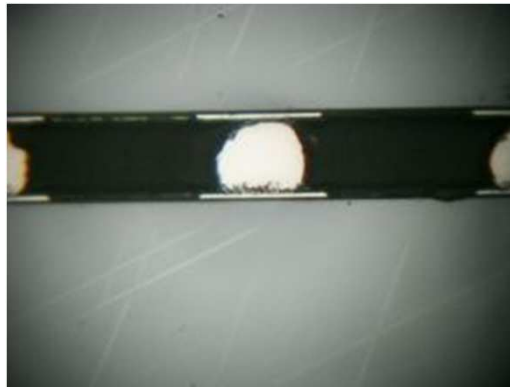
Bond test samples presents bad bond joints due to production failures

CROSS SECTIONAL PICTURES OF TEST SAMPLE PROCESS



Too few UBM

Dummy module#2 bond#6 and #14
Finetech 01.02.2012



Missing UBM / Pad openings

ROC to ROC bond#1
Finetech 01.02.2012



At least kind of bond

Single chip bond presented moderate shear strength due to voids in the bump

SHEAR RESULTS AND LASER SCAN MICROSCOPE PICTURE

- ductile bump fracture 😊
- voids within solder volume are found ☹️

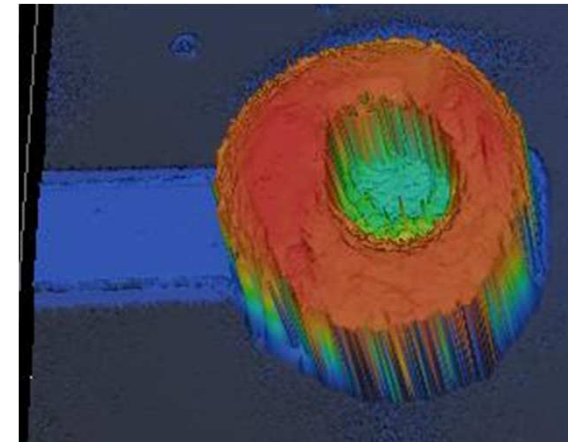
Shear strength: 183.69 N

~ 70% soldered bumps

→ 0.6 N/bump

Problem originates from the solder jetting process

Pac Tech suggests different UBM material



ROC to ROC bond#3
Finetech 31.01.2012