

G.J.Tech

Au Bumped IC
Flip Chip Bonding for LCD
Application

Onishi Tetsuya

Grand Joint Technology Ltd

onishite@hk.ntt.net

G.J.Tech

Au Bumped IC Flip Chip for LCD

- 1. General & LCD module trend**
- 2. Bonding method**
- 3. ACF bonding and process control**
- 4. Au – Sn Bonding & Ultra Sonic bonding**
- 5. Bonding Pitch**
- 6. Substrate**
- 7. Bumped IC**

G.J.Tech

Au Bumped IC Flip Chip for LCD

- 1. General & LCD module trend**
2. Bonding method
3. ACF bonding and process control
4. Au – Sn Bonding & Ultra Sonic bonding
5. Bonding Pitch
6. Substrate
7. Bumped IC

10th Annual International **KGD Packaging & Test Workshop**

Sept. 8-10, 2003 Napa, CA

G.J.Tech

LCD Monitor Interface



Auto
Vendor,
Tokyo
Dec-2002



From HK to
China, MU
Boeing 737
Feb-2003



G.J.Tech

LCD Module Connection History

- **Rubber Zebra Connector**
- **Heat Seal & TCP or COB**
- **ACF TCP**
- **ACF COG**
- **ACF COF ILB & OLB**
- **Au-Sn COF ILB**
- **Au-Au COF ILB**
- **Ultra Sonic Au-Au COF ILB**

G.J.Tech

Au Bumped IC Flip Chip for LCD

1. General & LCD module trend
- 2. Bonding method**
3. ACF bonding and process control
4. Au – Sn Bonding & Ultra Sonic bonding
5. Bonding Pitch
6. Substrate
7. Bumped IC

G.J.Tech

Au Bumped IC FC for LCD

LCD Bonding Process Type

- **COG ACF Bonding**
- **COF Bonding :**

ACF / Au – Sn / Au – Au

/ ACP / NCP / NCF / US Au - Au

10th Annual International
KGD Packaging & Test Workshop

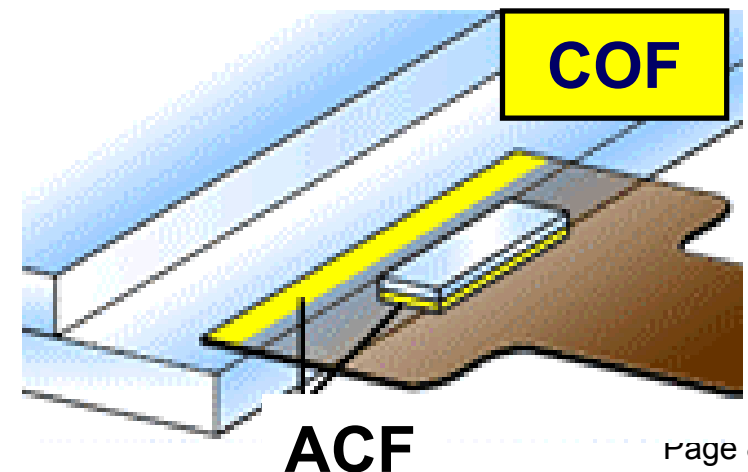
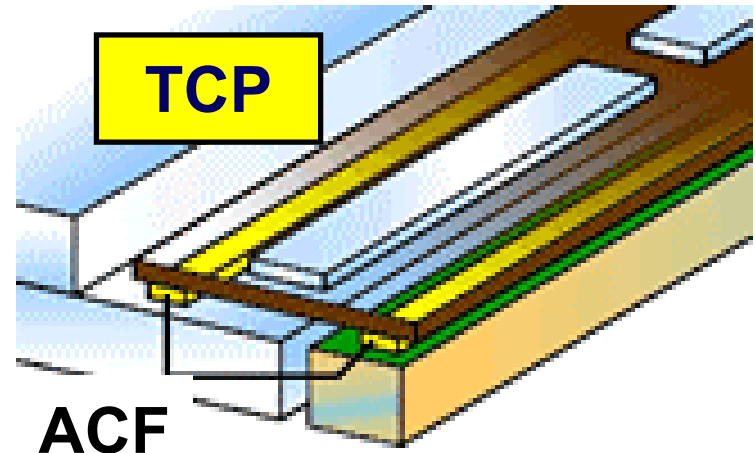
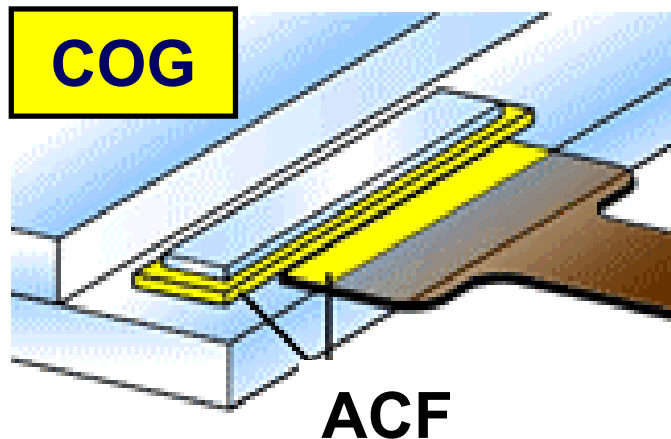
Sept. 8-10, 2003 Napa, CA

G.J.Tech

ACF bonding for LCD

ACF for TCP, COG, COF

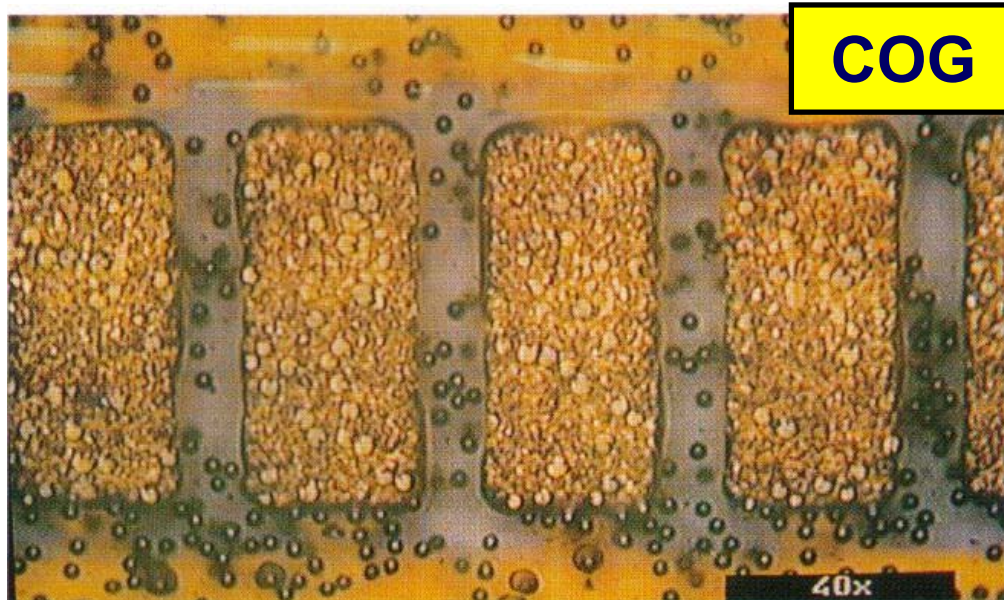
(Source : Hitachi Chemical)



G.J.Tech

Au Bumped IC FC for LCD

ACF COG Bonding in Hong Kong & China
3million IC's per month (www.varitronix.com)



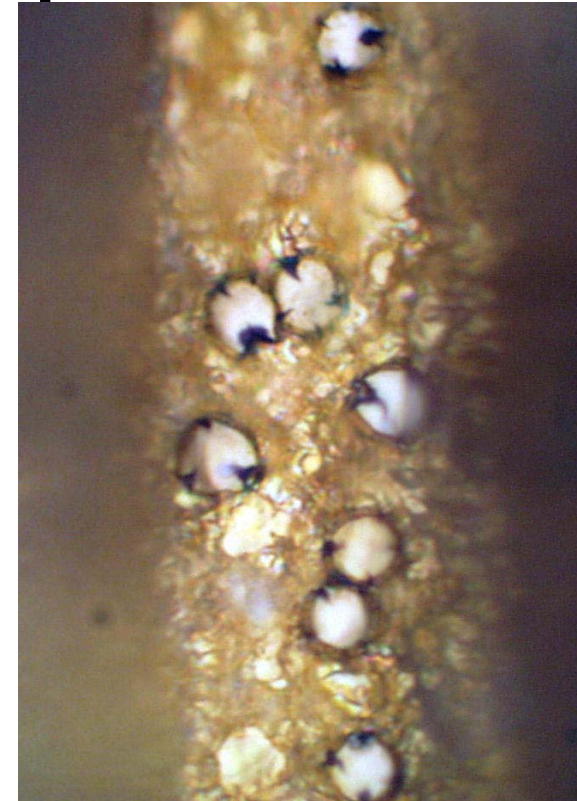
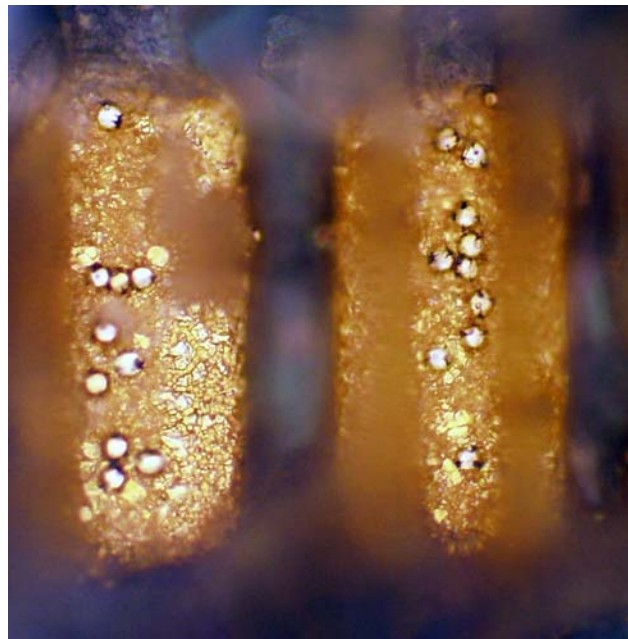
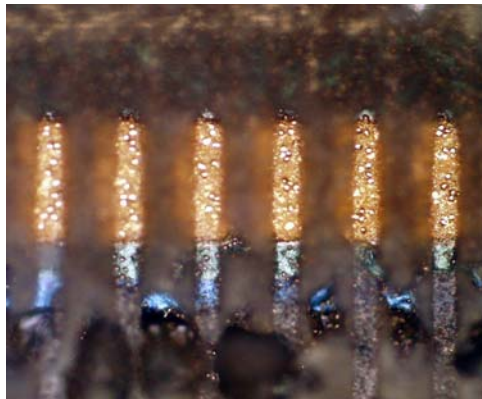
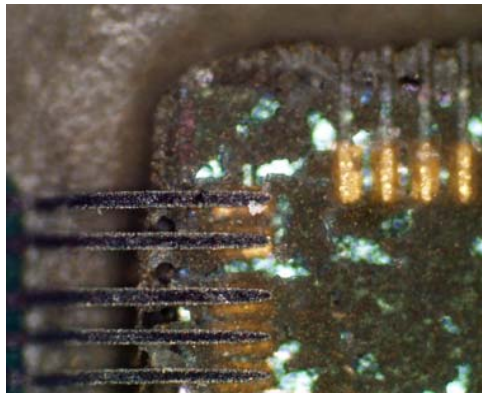
10th Annual International
KGD Packaging & Test Workshop

Sept. 8-10, 2003 Napa, CA

G.J.Tech

Au Bumped IC FC for LCD

COF ACF Bonding Particle Shape

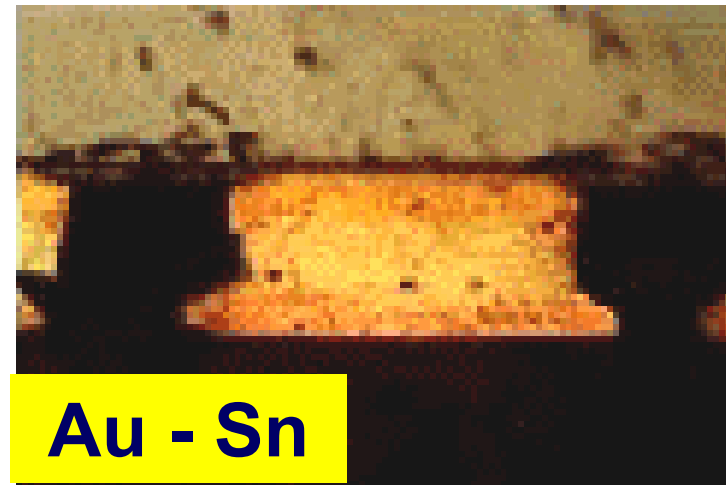
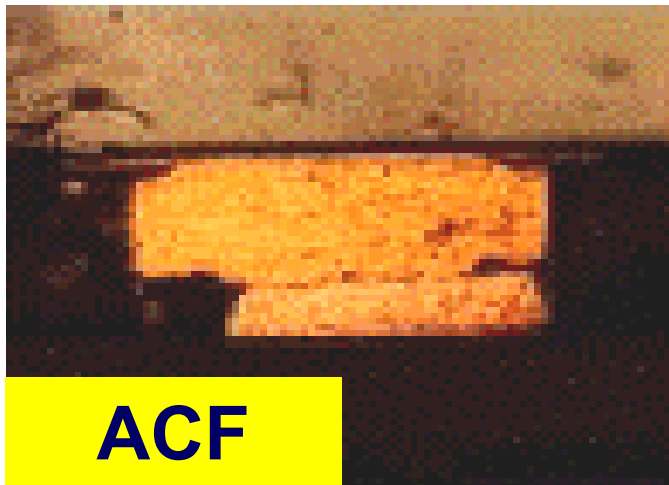


G.J.Tech

Au Bumped IC FC for LCD

COF Bonding

Source: Misuzu



G.J.Tech

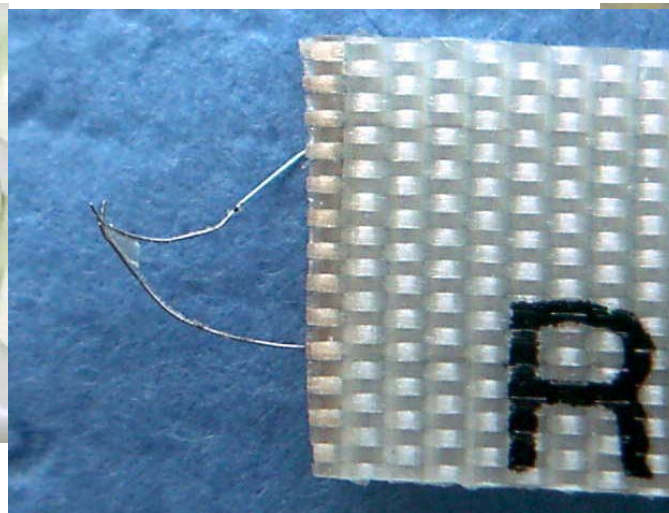
Au Bumped IC Flip Chip for LCD

1. General & LCD module trend
2. Bonding method
- 3. ACF bonding and process control**
4. Au – Sn Bonding & Ultra Sonic bonding
5. Bonding Pitch
6. Substrate
7. Bumped IC

G.J.Tech

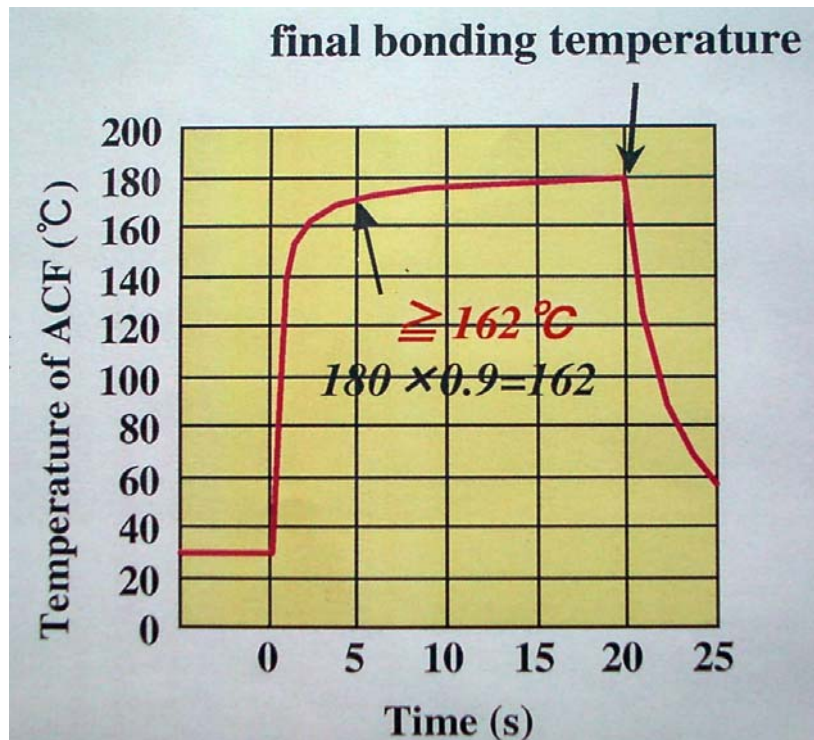
ACF Bonding Process Control

1. Bonding Temperature Profile
2. Bonding Pressure Profile
3. Surface Cleanliness



G.J.Tech

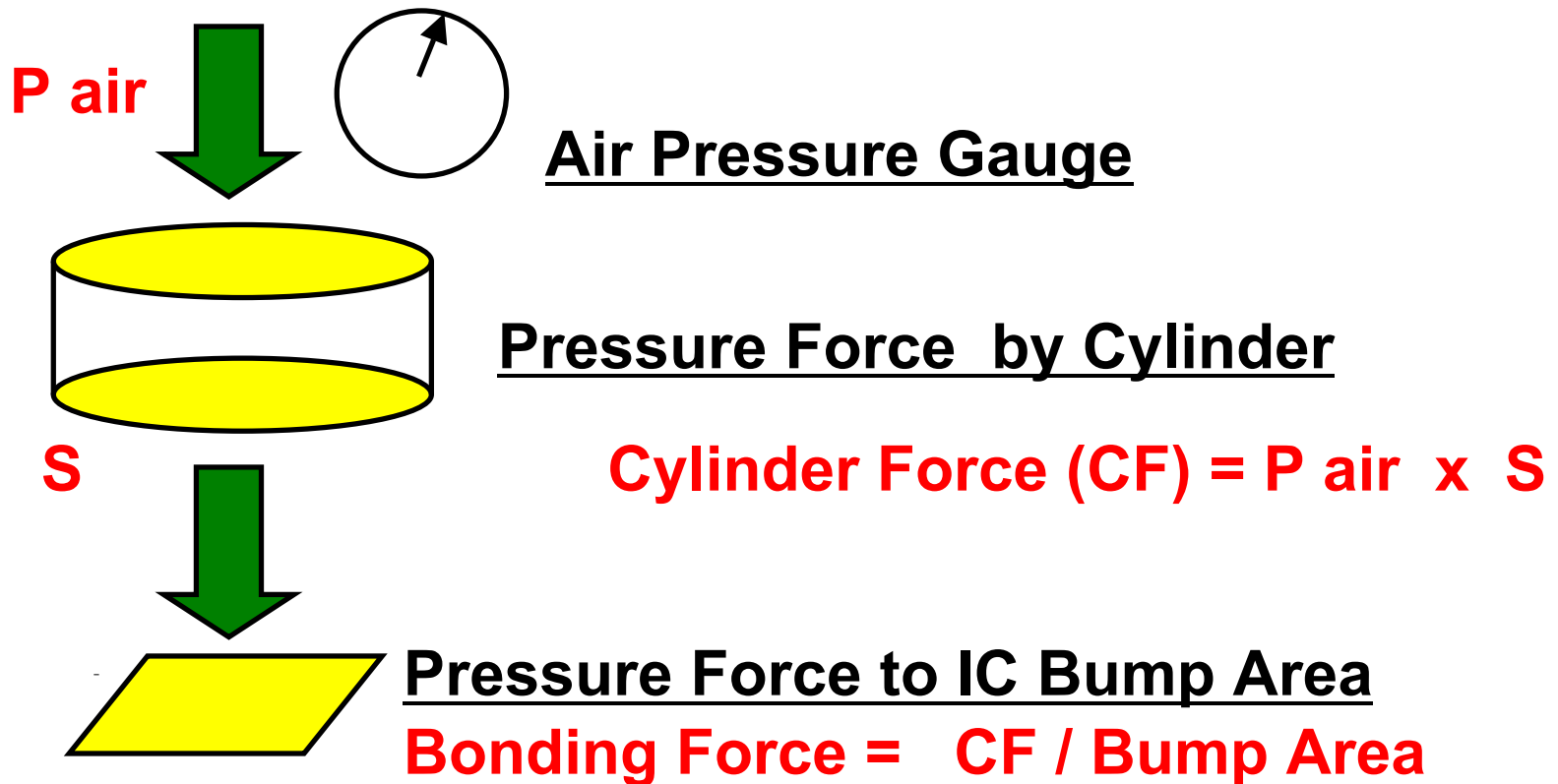
Bonding Process Control : Temperature Profile



Source : Hitachi Chemical , Toray Engineering

G.J.Tech

Bonding Process Control : Pressure Profile



G.J.Tech

ACF Connection

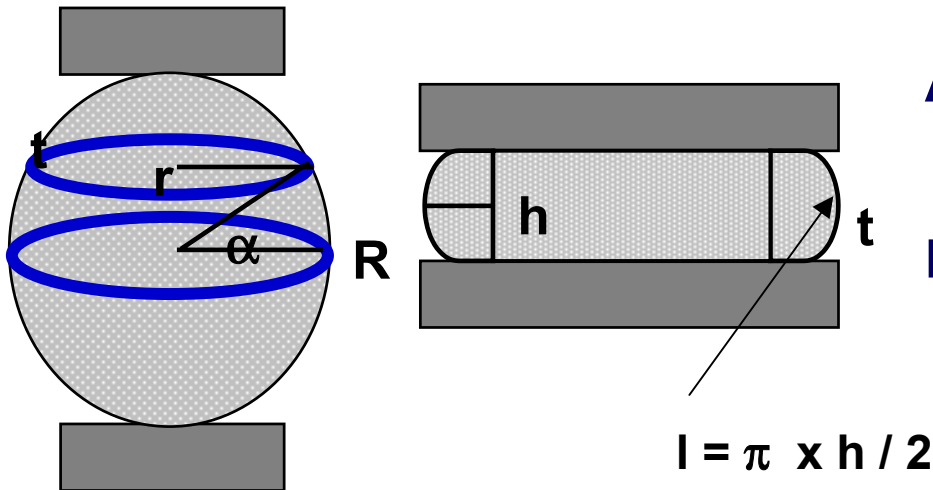
$$R = \rho \times l / AR = \rho \times l / A$$

ρ : resistivity of the metal coating

l : length of the conductor

A : crossectional area of the conductor

R : resistance of the particle



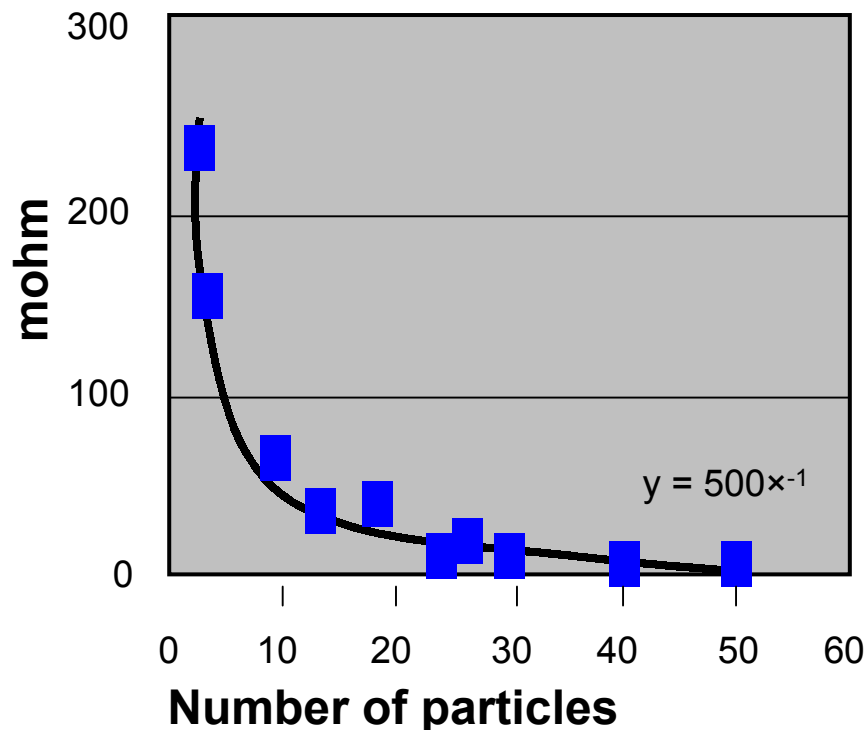
Source : Elcoteq

$$\begin{aligned} &\text{Degree of Deformation} \\ &\text{Ratio \% (Def\%)} \\ &= 100 \times (1 - (h/2R)) \end{aligned}$$

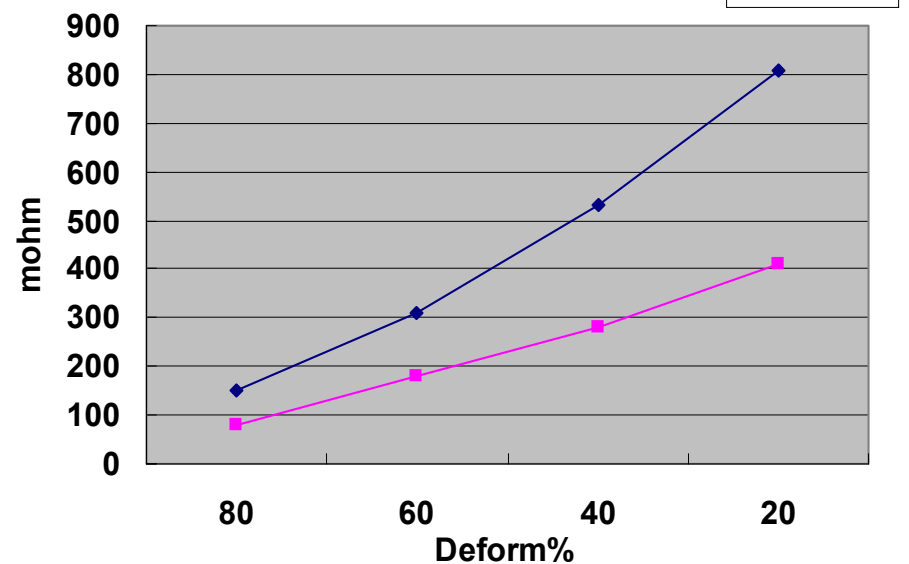
G.J.Tech

Bonding Process Control : Resistance

Contact resistance vs. number of particles



Resistance of the 5um Au/Ni-coated polymer particle



Source : Elocteq

Page 17

G.J.Tech

Au Bumped IC Flip Chip for LCD

1. General & LCD module trend
2. Bonding method
3. ACF bonding and process control
- 4. Au – Sn Bonding & Ultra Sonic bonding**
5. Bonding Pitch
6. Substrate
7. Bumped IC

G.J.Tech

Au-Sn COF Bonding

Test Item	Test Condition	Results
Thermal Cycle	- 40°C / 125°C 300 cycle	0/22
PCT	121°C/ 100%RH 300 hour	0/22
HT/HH Bias	85°C/85%RH 1000 hour	0/22

Source : Sharp

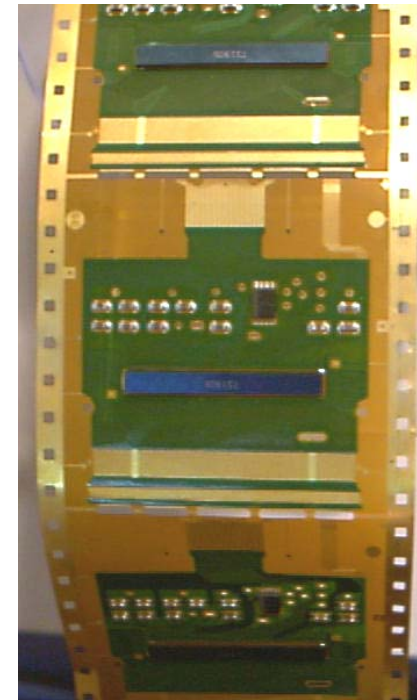
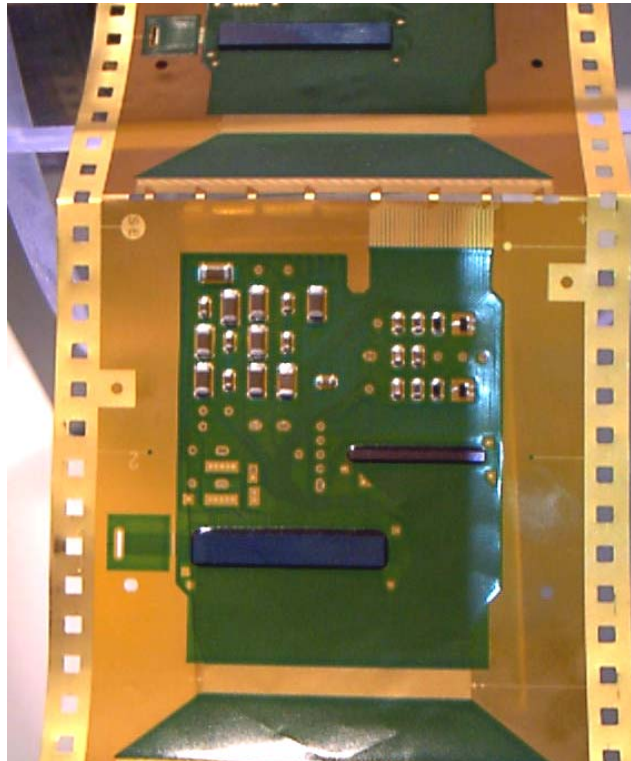
10th Annual International **KGD Packaging & Test Workshop**

Sept. 8-10, 2003 Napa, CA

G.J.Tech

Au-Sn COF Bonding

Au-Sn Bonding



Source : Epson

G.J.Tech

40 um Pitch Au-Au COF Bonding

Two layer Casting Type Film

Au – Au Thermo Compression 400 - 450° C

Under Fill by dispensing

IC – FPC gap : 20μm level

IC : Au Bump, FPC: Au plating

IC Chip Size : 25.0 x 2.7mm

I/O count : 556 output

OLB : pitch 55μm (4μm φACF)

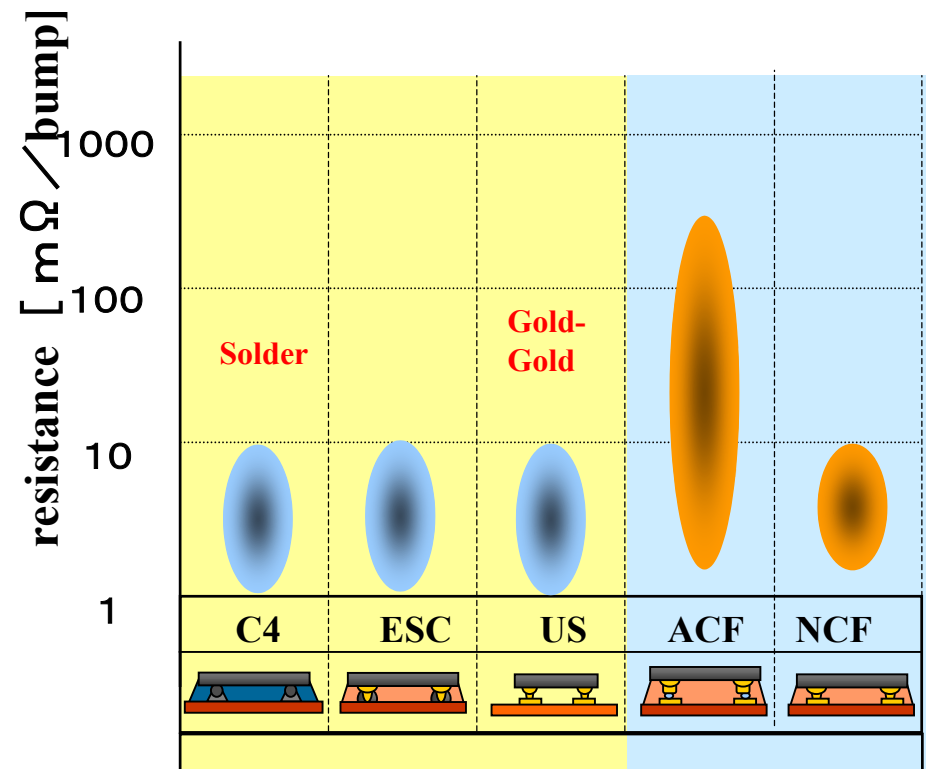
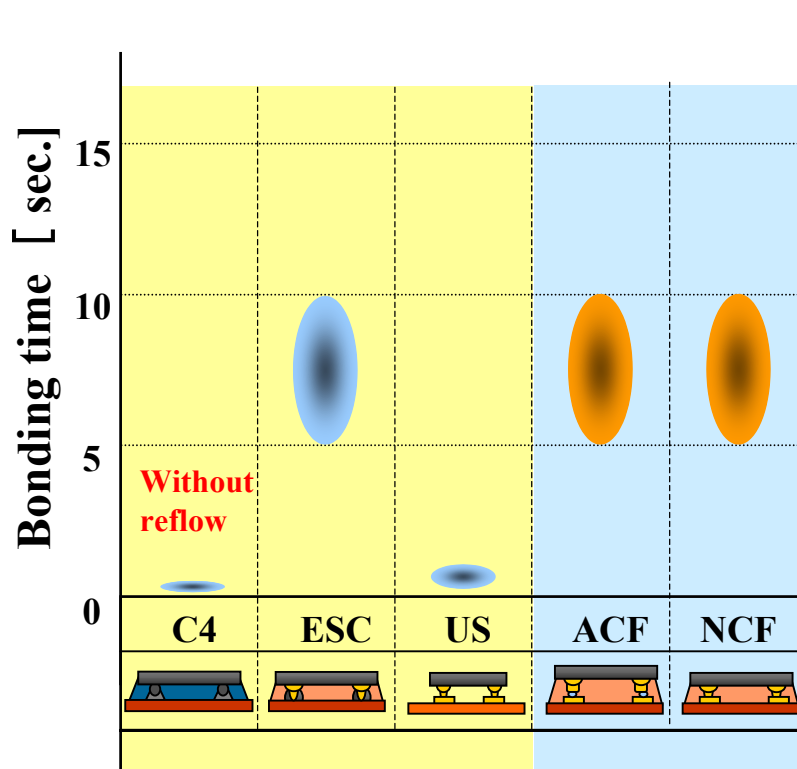
Source : Epson

G.J.Tech

Flip chip type : LCD → Module

Source :
Panasonic

Bonding time & Resistance

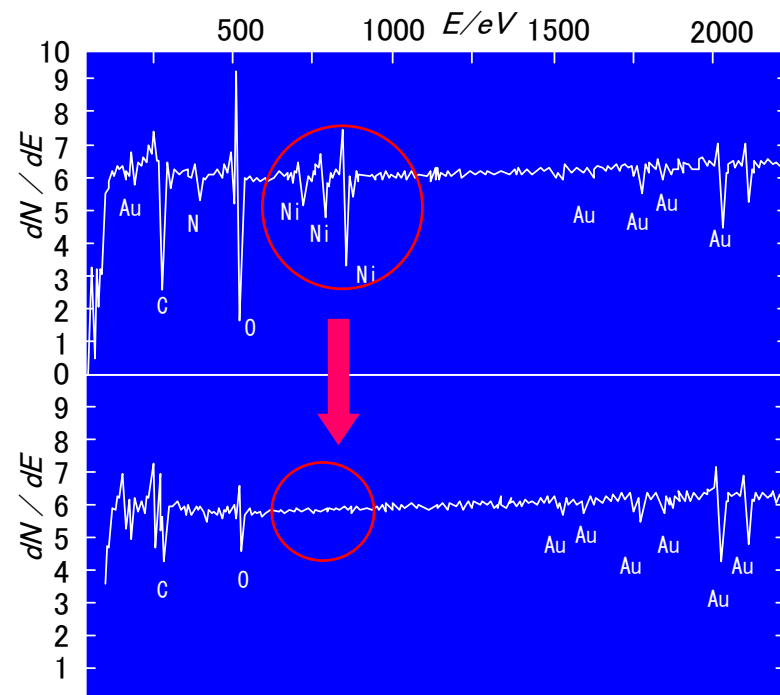
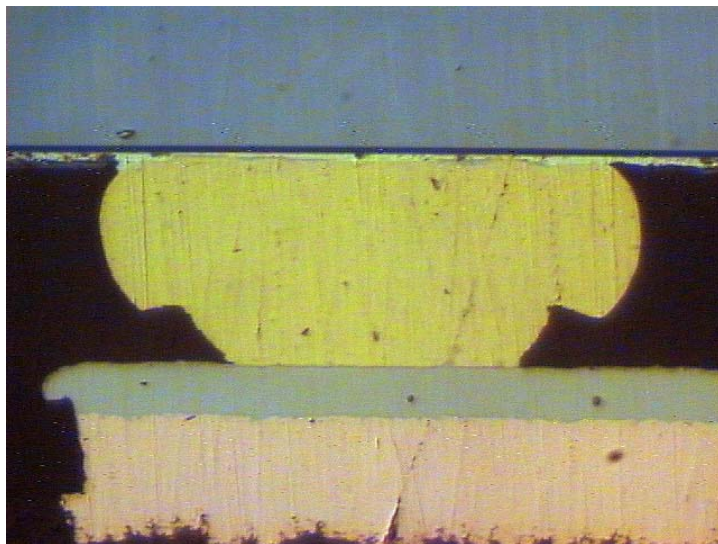


G.J.Tech

Au Bumped IC FC

Au – Au ultra sonic FC (Source : Panasonic)

→ Need Plasma Cleaning



G.J.Tech

Au Bumped IC Flip Chip for LCD

1. General & LCD module trend
2. Bonding method
3. ACF bonding and process control
4. Au – Sn Bonding & Ultra Sonic bonding
- 5. Bonding Pitch**
6. Substrate
7. Bumped IC

G.J.Tech

Bump Pitch

Solder Bump

Pitch 200 → → 150 → 135 → 125 um

Peripheral Fine Pitch Solution

Pitch 55 → 50 → 45 → 43 → 40 → 38

→ 35 → 30 → 27

--> 25 --> 20 um

G.J.Tech

Au Bumped IC Flip Chip for LCD

1. General & LCD module trend
2. Bonding method
3. ACF bonding and process control
4. Au – Sn Bonding & Ultra Sonic bonding
5. Bonding Pitch
- 6. Substrate**
7. Bumped IC

10th Annual International **KGD Packaging & Test Workshop**

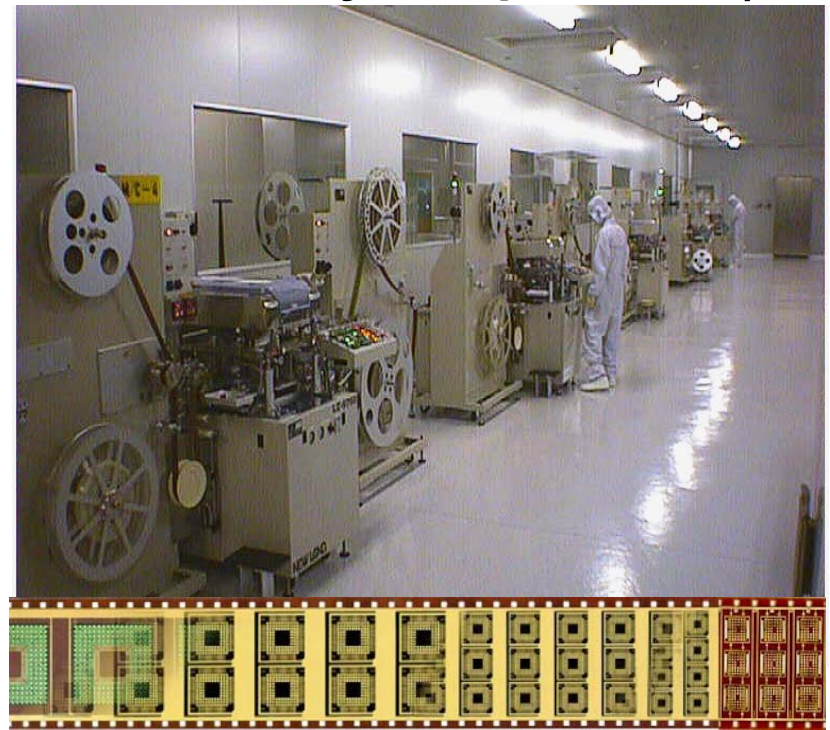
Sept. 8-10, 2003 Napa, CA

G.J.Tech

Flex Substrate for COF

Reel to Reel COF 150km/month (250km in 2003)

(Source: Compass Technology www.flexibility-compass.com)



G.J.Tech

Au Bumped IC Flip Chip for LCD

1. General & LCD module trend
2. Bonding method
3. ACF bonding and process control
4. Au – Sn Bonding & Ultra Sonic bonding
5. Bonding Pitch
6. Substrate
- 7. Bumped IC**

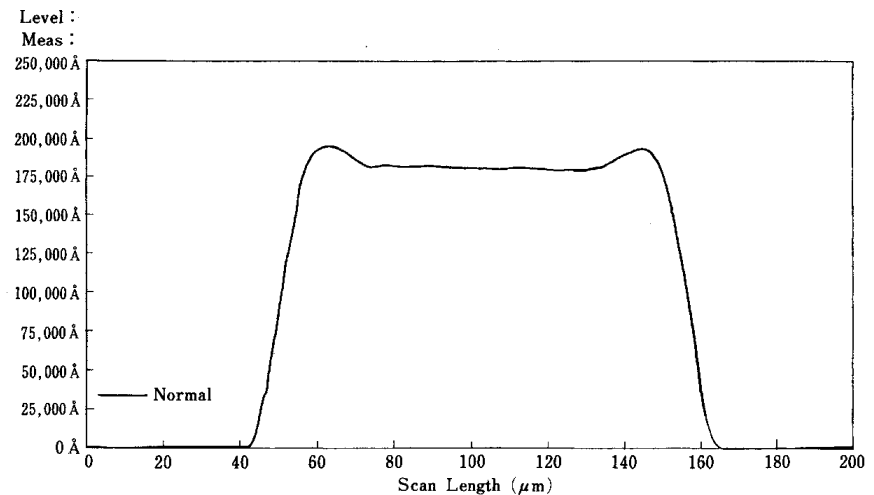
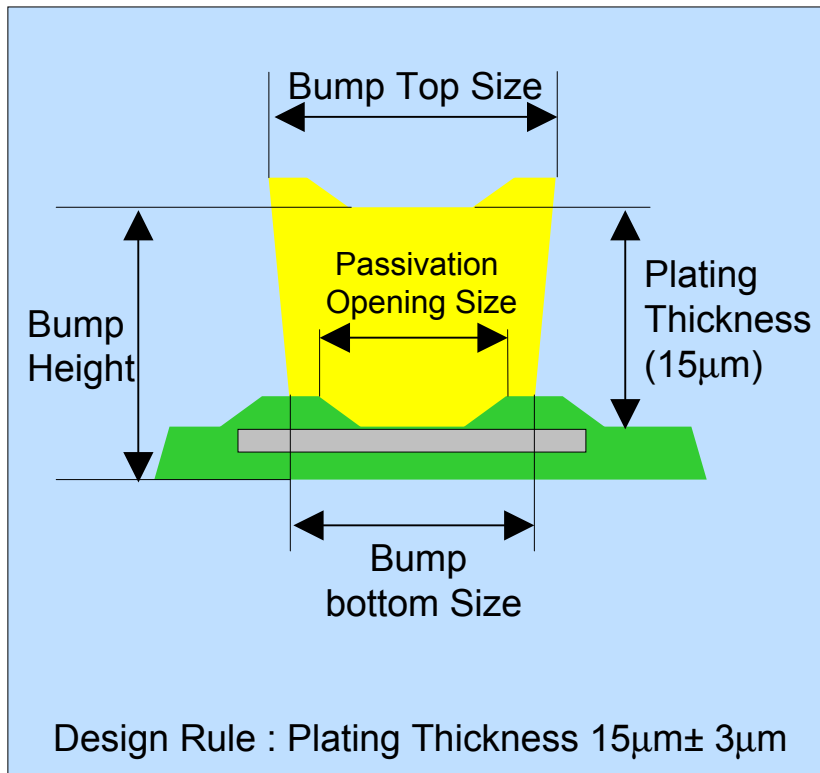
10th Annual International **KGD Packaging & Test Workshop**

Sept. 8-10, 2003 Napa, CA

G.J.Tech

Au Bumped IC FC for LCD

Au bump specification



10th Annual International **KGD Packaging & Test Workshop**

Sept. 8-10, 2003 Napa, CA

G.J.Tech

Au Bumped IC FC for LCD

3D Micro Scope



Source: Keyence

Page 30

G.J.Tech

Grand Joint Technology Ltd.

***Mission : Micro Electronics Ass'y
Total Solution***

Micro Electronics Category Consulting :

**IC Bare Chip, COB, SMT, OLB, Heat Seal,
ACF, LCD Module, COG, COF, BGA, CSP,
Flip Chip, Module, PCB, Substrate**

G.J.Tech

Grand Joint Technology Ltd.

- 1. Quality Improvement**
- 2. Trouble Shooting**
- 3. Yield Improvement**
- 4. New Process & New Material**
- 5. Production System**
- 6. Design**
- 7. Analysis**