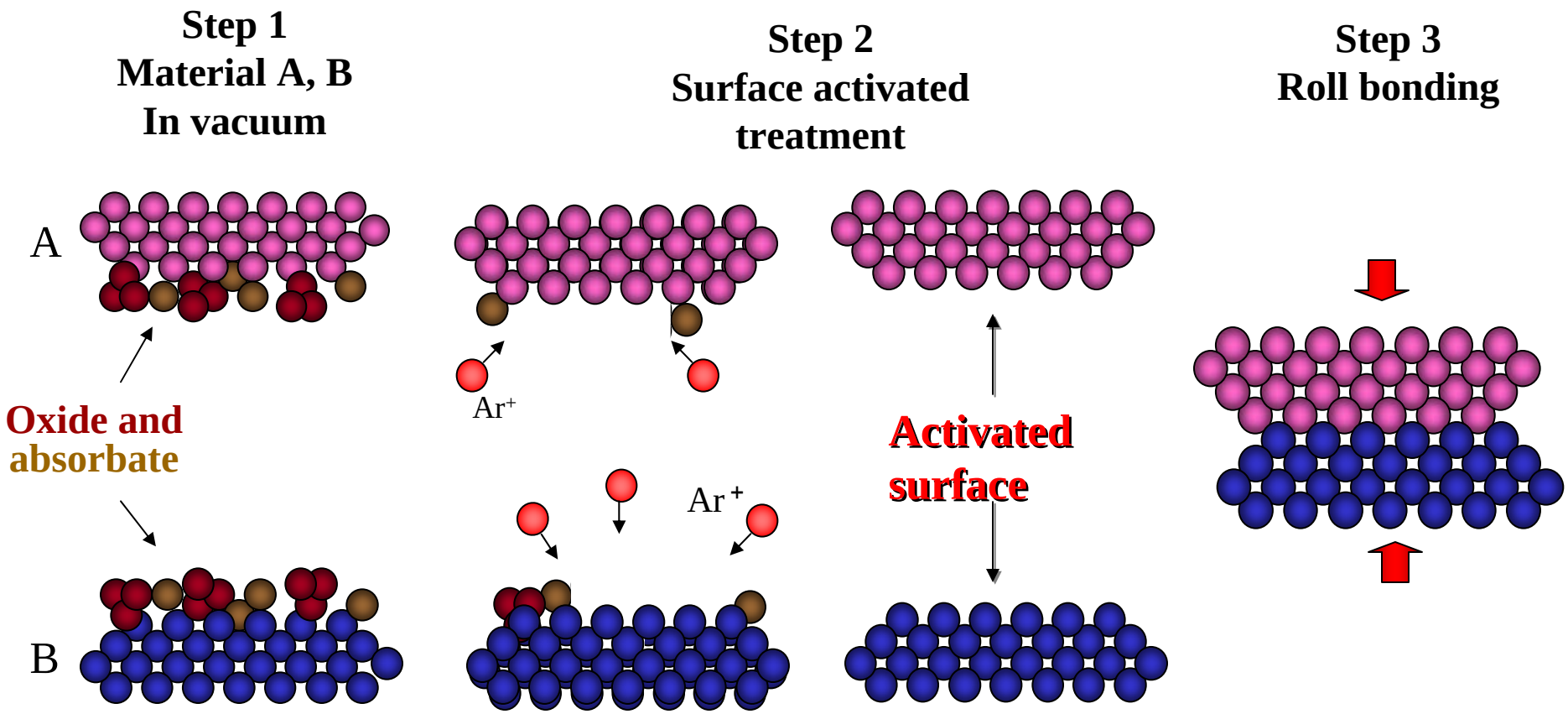
FINE CLAD

~ CLAD MATERIAL ~

FINE CLAD is a solution for high density, low cost PWB.

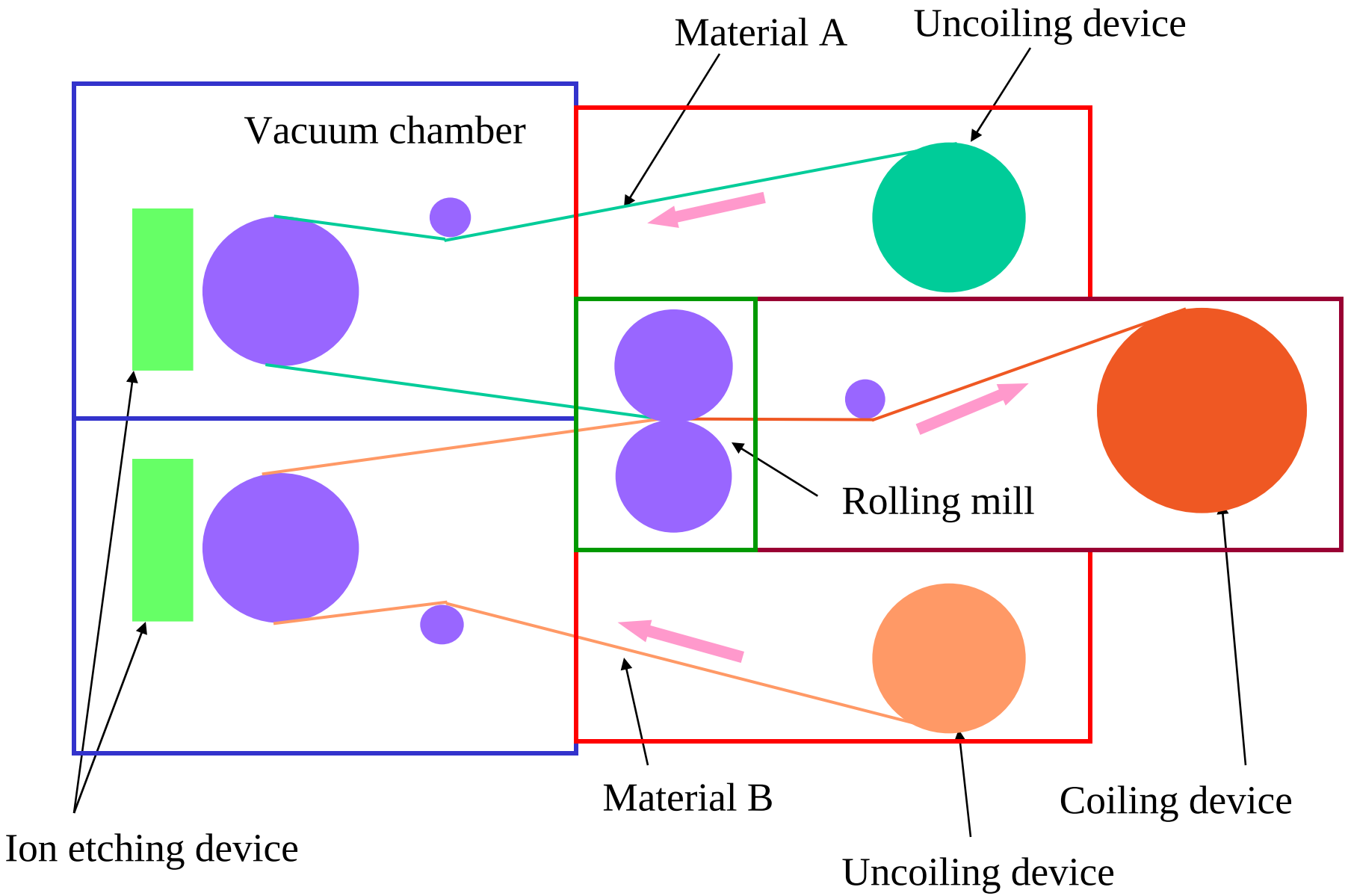
Principle of bonding technique

Principle of bonding technique



Manufacturing process

Manufacturing process



Features of FINE CLAD

Feature 1 **Flat and clean bonding interface**

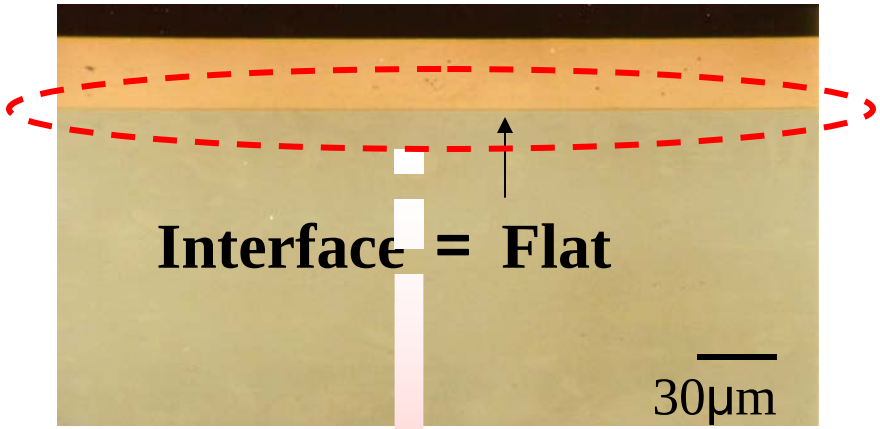
Feature2 **A variety of possible metal combinations**

Feature 3 **Pattern roll bonding**

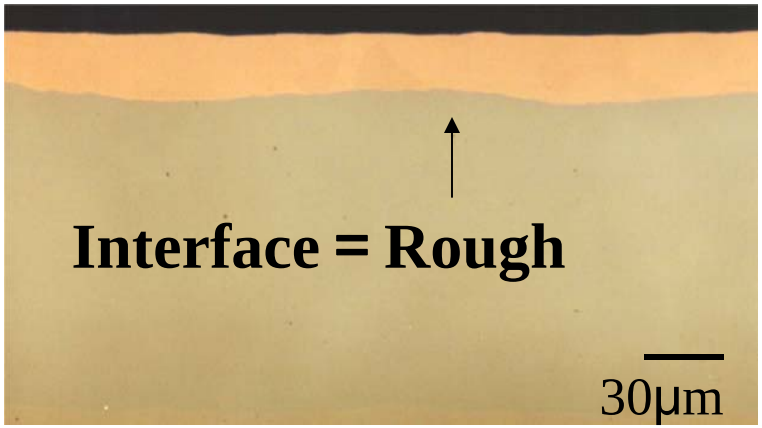
Feature 1 Bonding interface

Cross section of FINE CLAD

Cu/Ni FINE CLAD



Conventional Cu/Ni clad



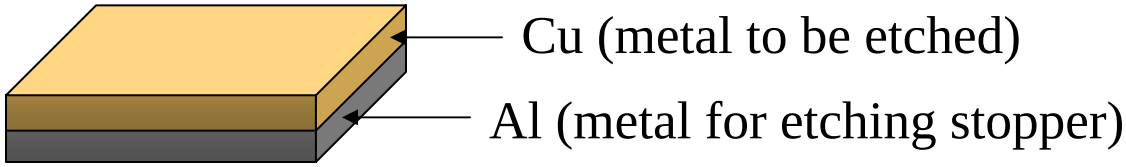
Is there alloy layer in the interface?

No! → **Suitable for selective etching**

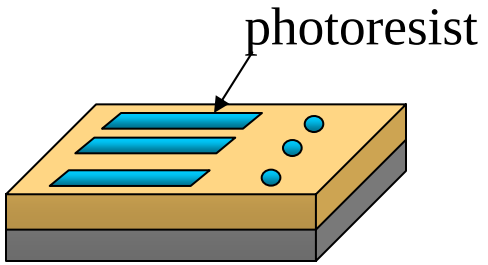
Outline of selective etching

（ Selective etching：Etching only one side metal of clad material ）

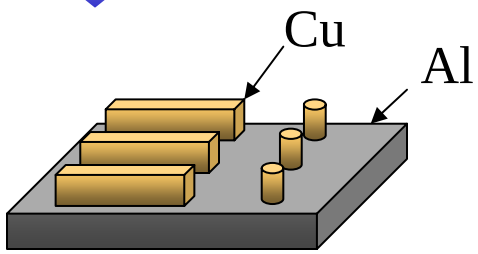
Example： Cu/Al FINE CLAD

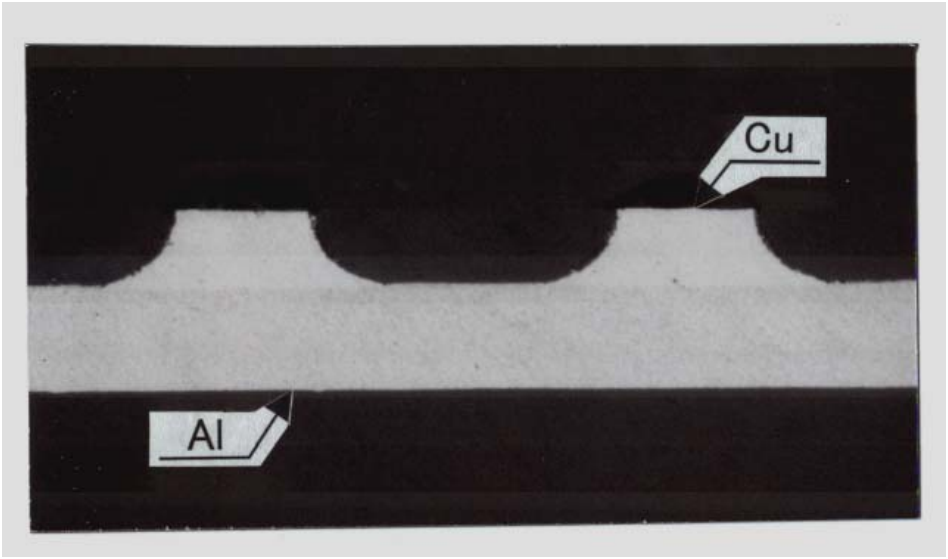


Patterning photoresist



Selective etching Cu





Cross section of Cu/Al after Cu selective etching

Metal combinations for selective etching

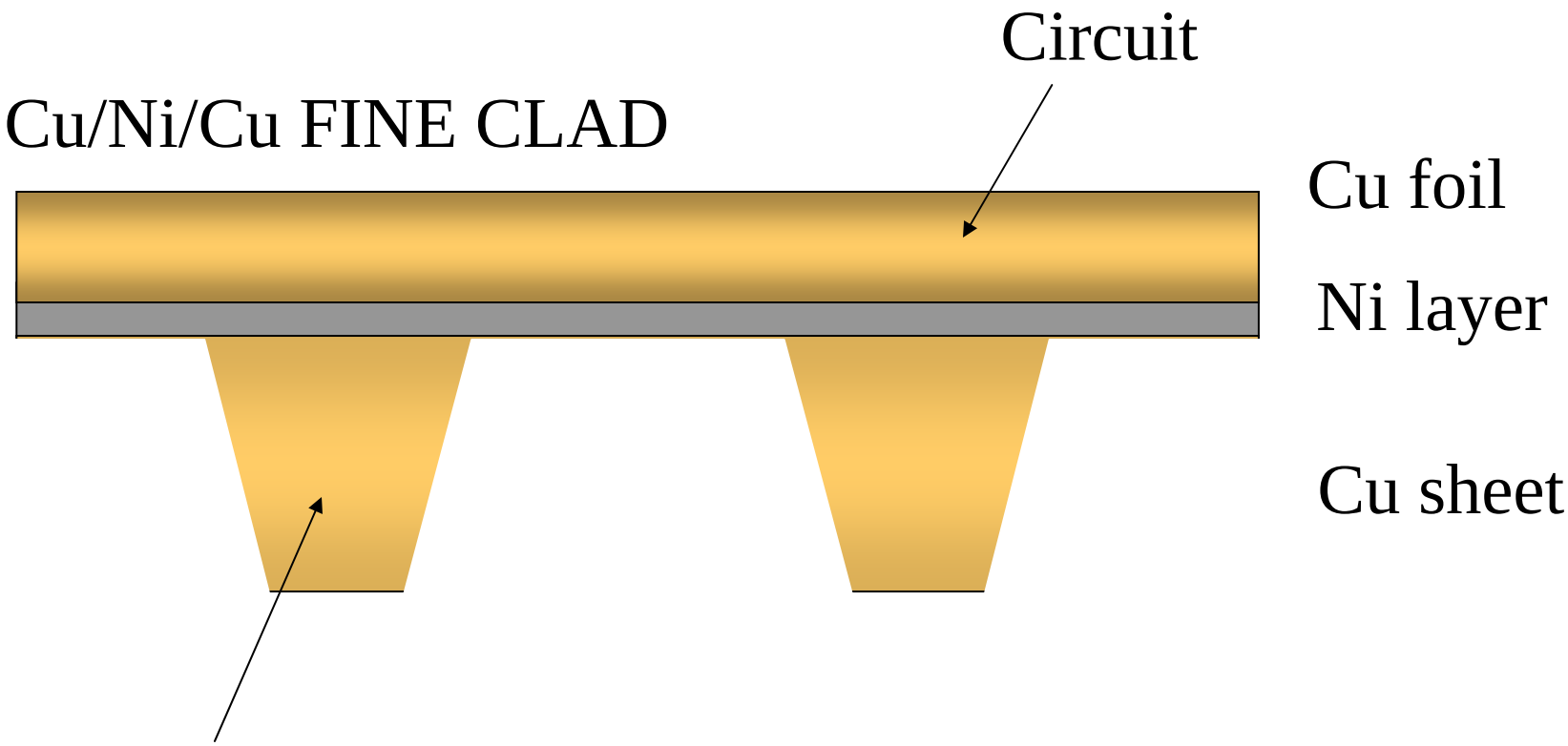
Etching metals	Metals for etching stopper	Etchant for selective etching
Cu	Al	Acid etchant (sulfuric acid etc.)
Al	Cu	Sodium hydroxide etchant etc.
Cu	Ni	Sulfuric acid + hydrogen peroxide etchant Ammonium persulfate etchant Commercial Alkaline etchant
Ni	Cu	Commercial Ni etchant
Cu, SUS	Pd, Ag	Ferric chloride etchant
Ag, Cu	SUS	Ferric nitrate etchant

What is the best use of FINE CLAD by using these merit?

FINE CLAD for Printed Wiring Board

Etching bump provides high density, low cost PWB

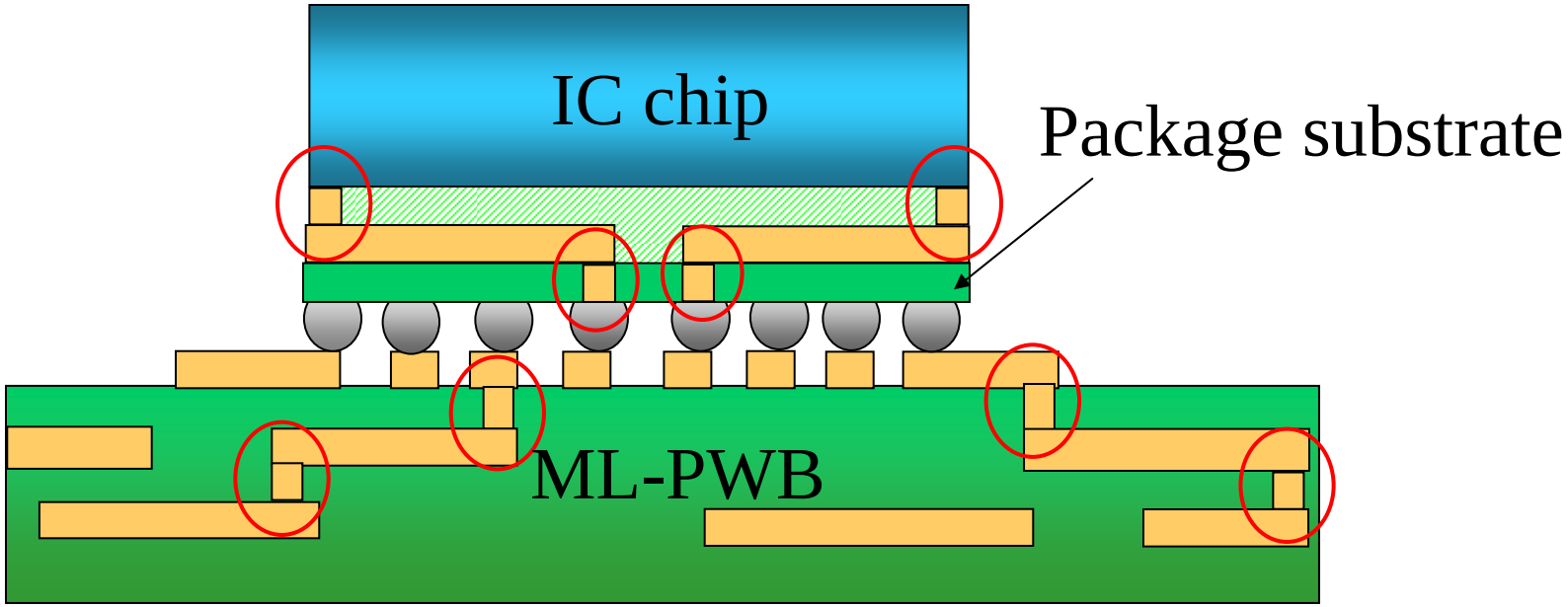
Structure and etching process



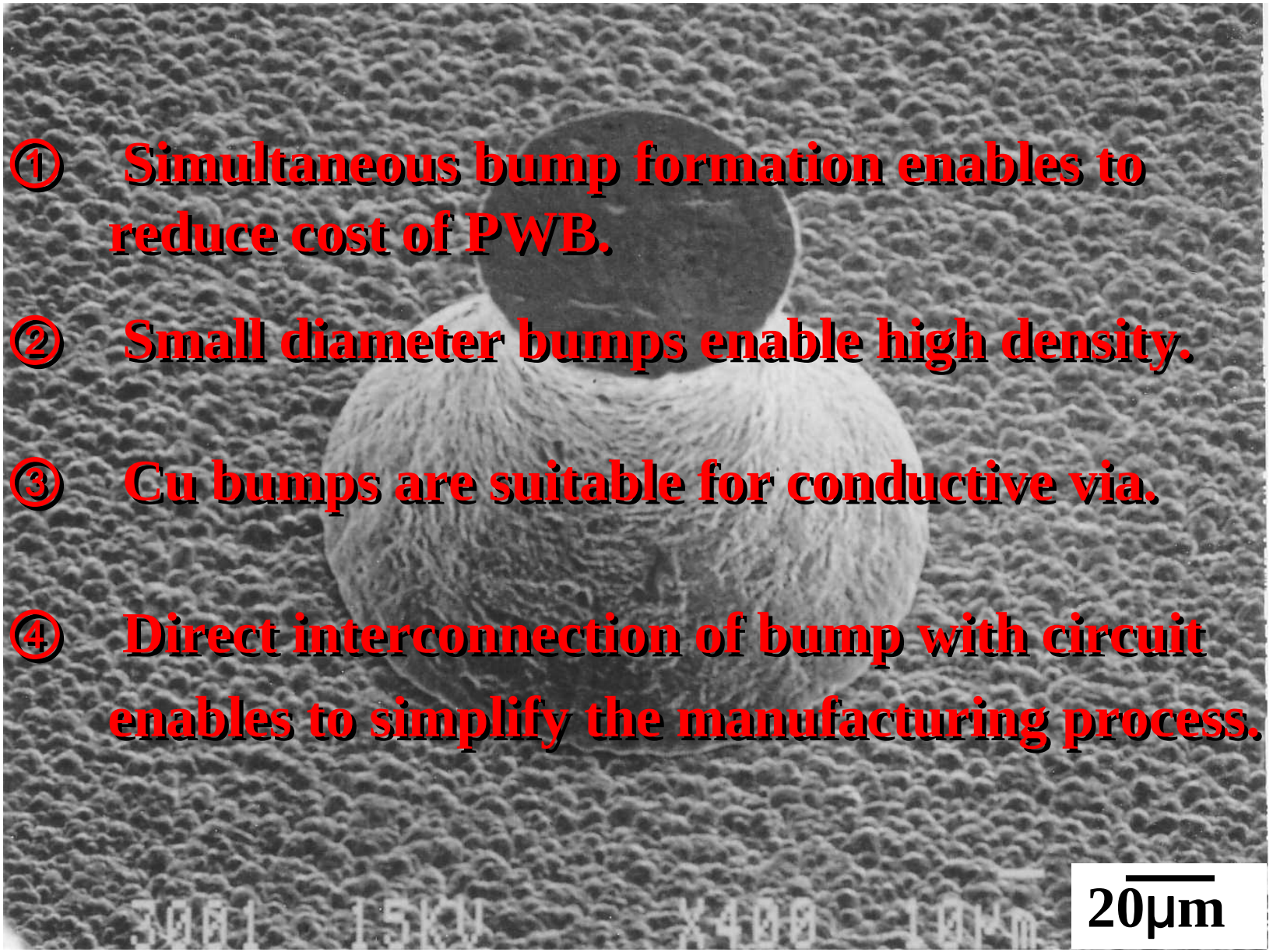
Cu selective etching and bump forming

Cu for circuit : 10 ~ 35μm thickness
Ni layer : 0.5 ~ 3 μm (electrolytic plating)
Cu for bump : 50 ~ 150 μm

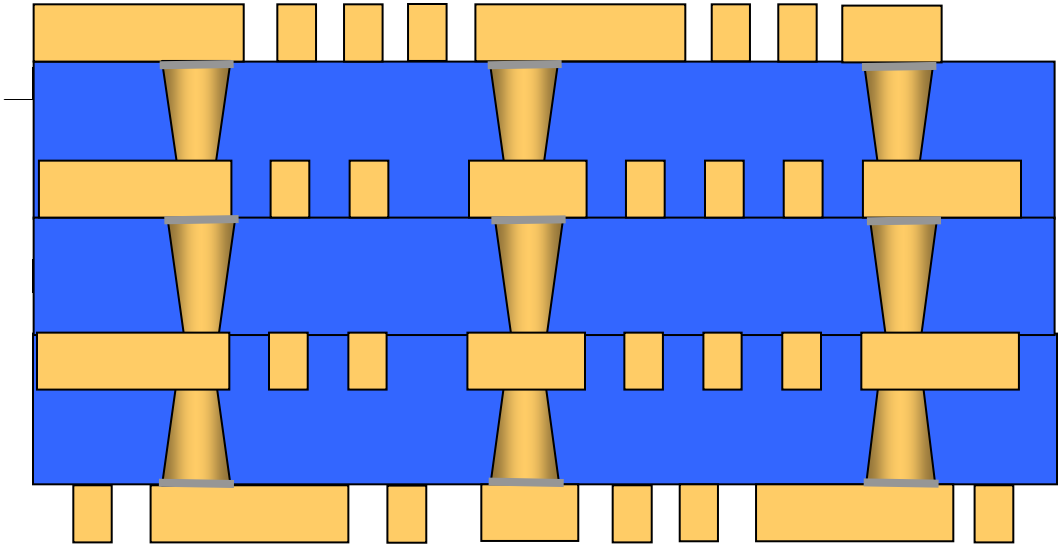
Role of etched Cu bump

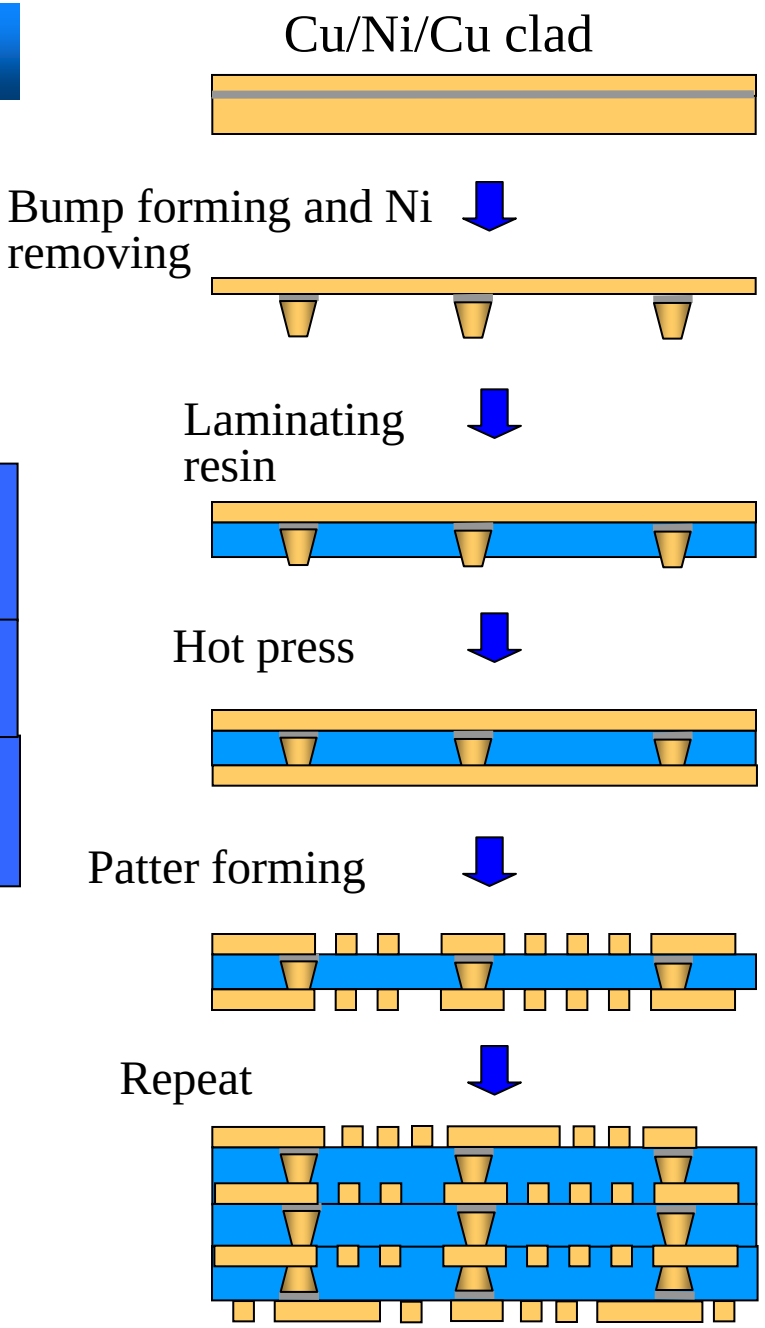


Features of etched Cu bump



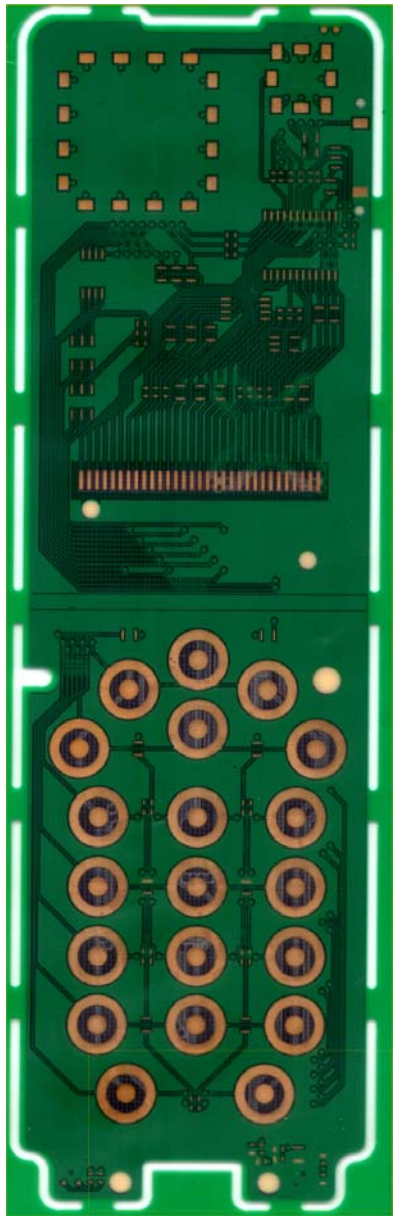
Process of multi layer PWB

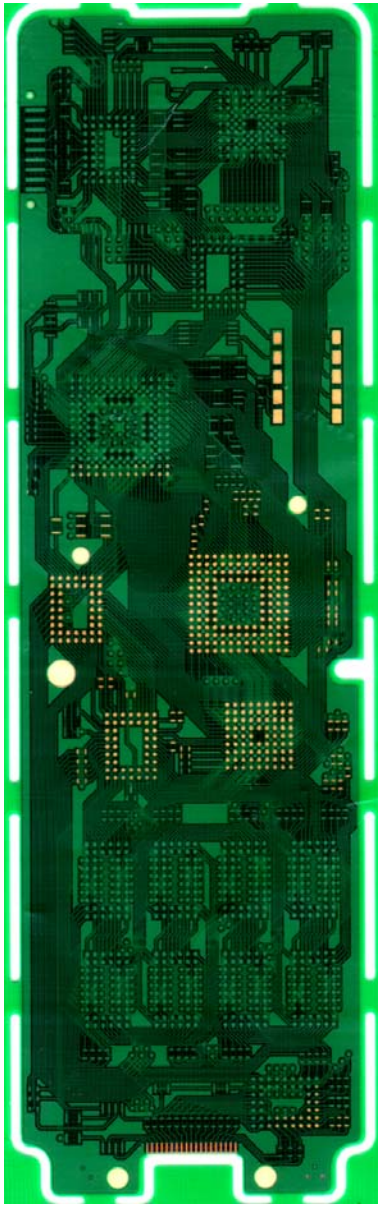




ML-PWB

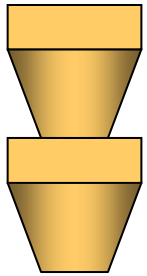
(for mobile phone)



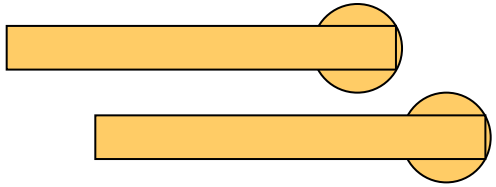


Produced by NORTH corp., Japan
(layer : 1+2+1)

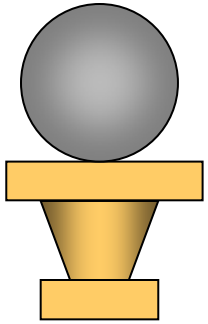
Flexibility of products design



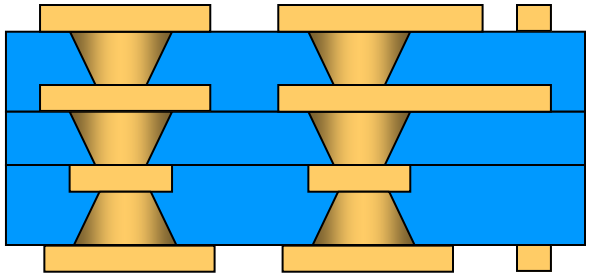
- Stacked via



- Landless design



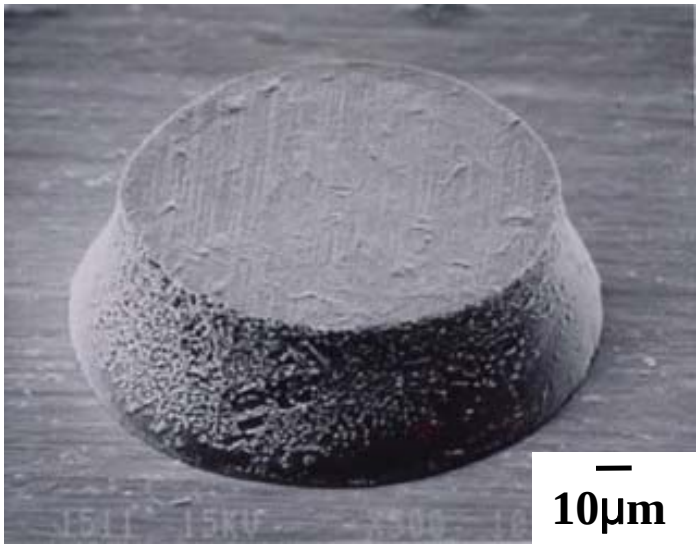
- Pad on via

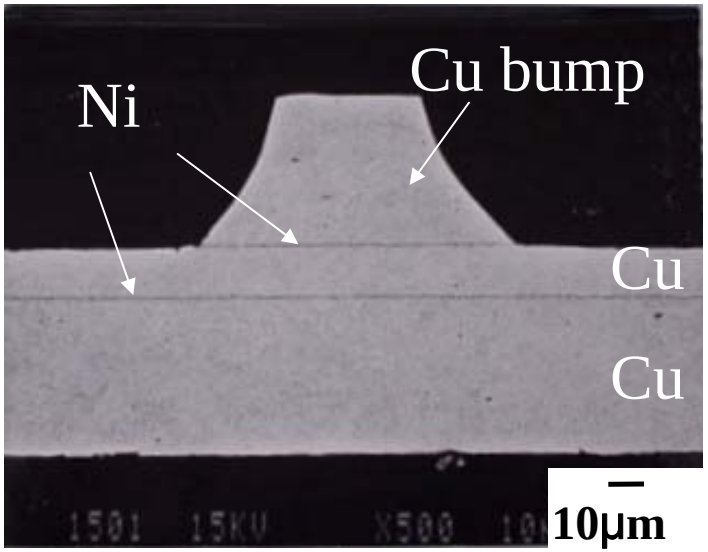


- All IVH

Application to the package substrate

Etched Cu bump

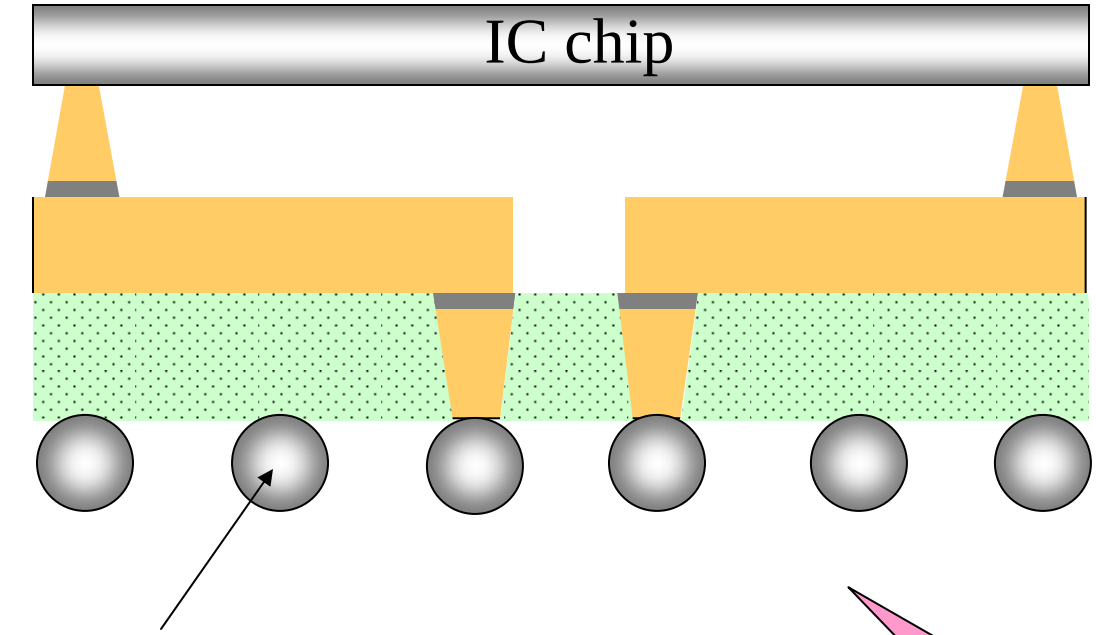




Etched Cu bump

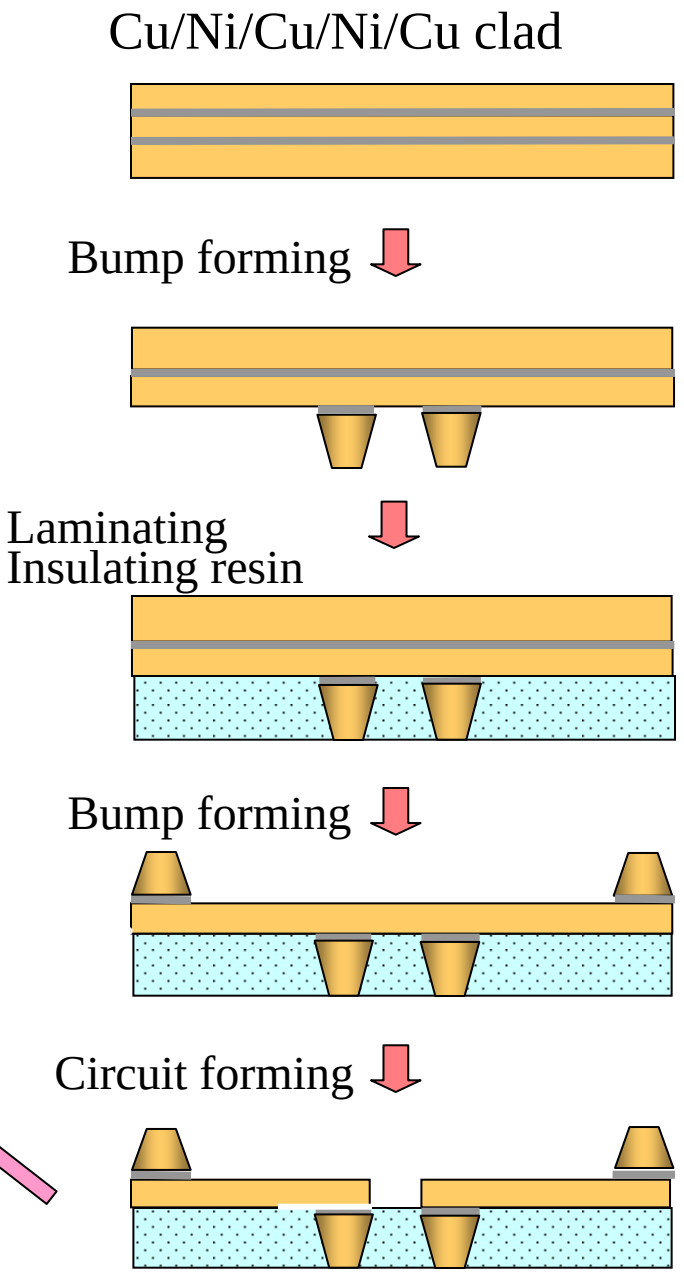
Cross section

Package substrate

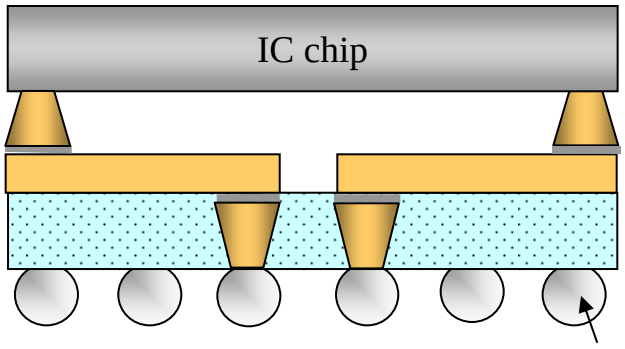


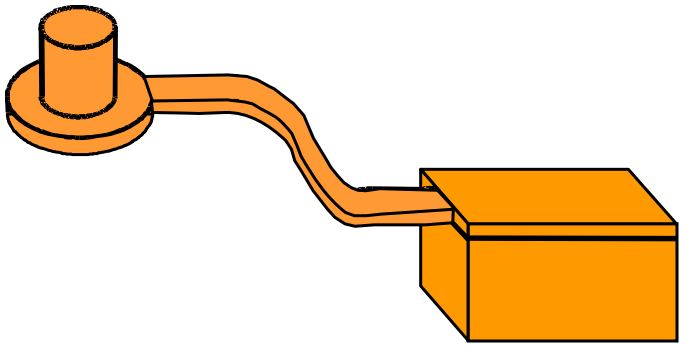
Solder ball

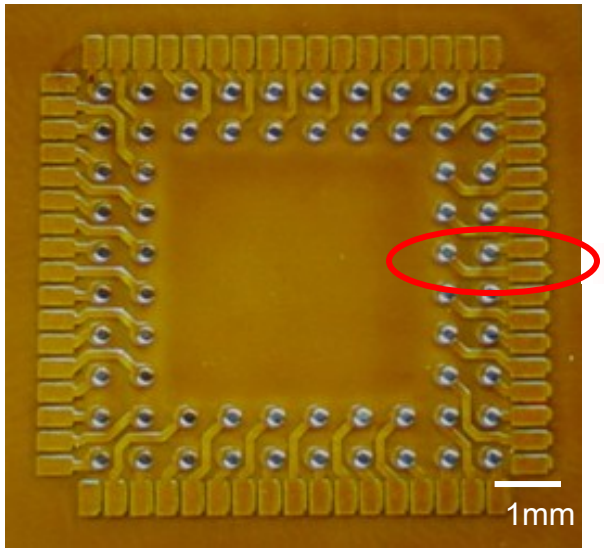
Packaging



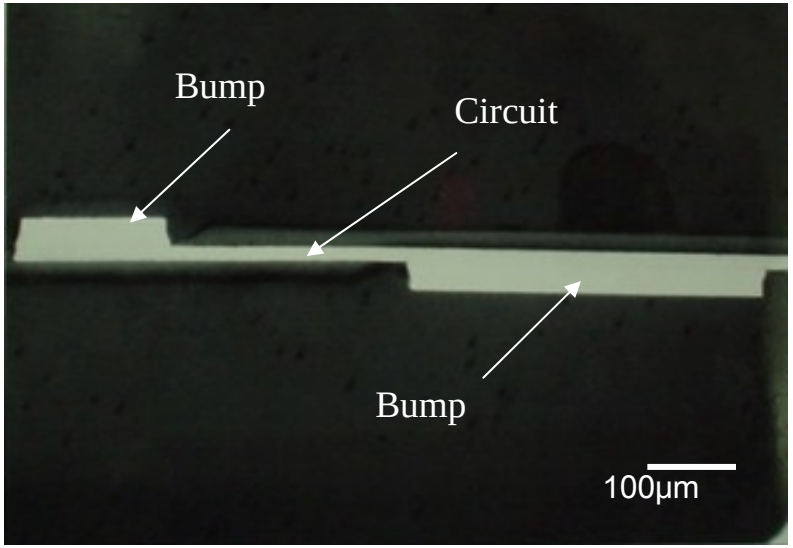
Package substrate







Substrate sample (resin : polyimide)

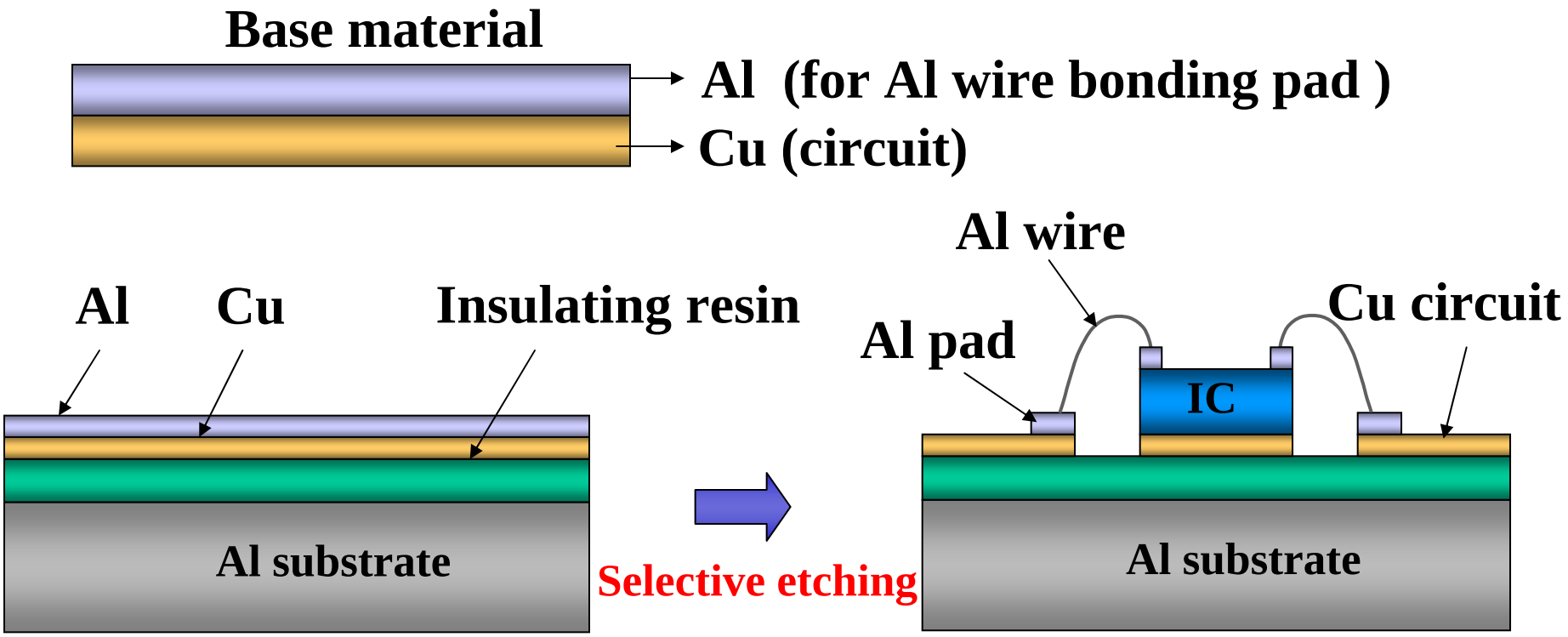


Cross section

Material for power module substrate

Structure : Cu/Al

Merit : Possible to form Al pad for Al wiring and Cu circuit.



Bump formation for QFN

Structure : Cu alloy / Cu alloy

Merit : Possible to improve the reliability of QFN mounting.

Clad material

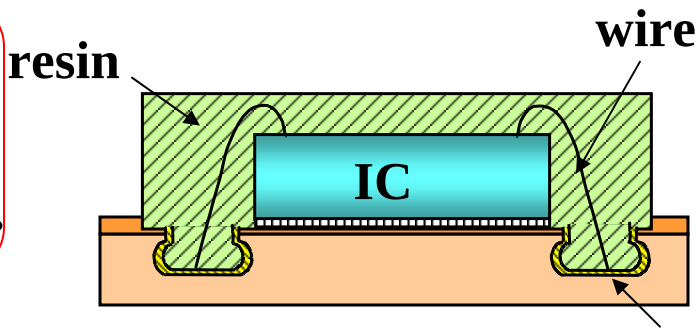
Cu alloy A

Cu alloy B

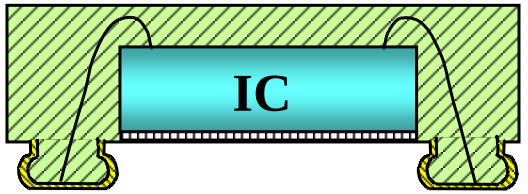
Half etching

Selective etching Cu alloy B

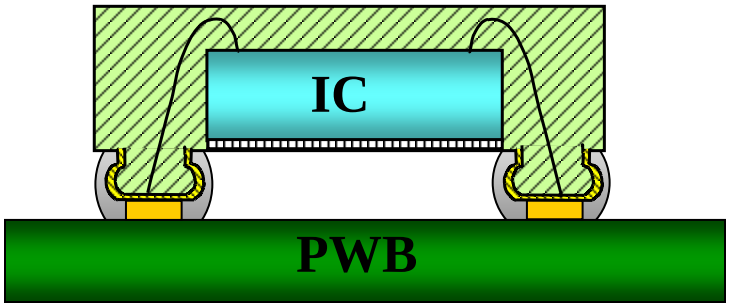
IC chip setting and molding



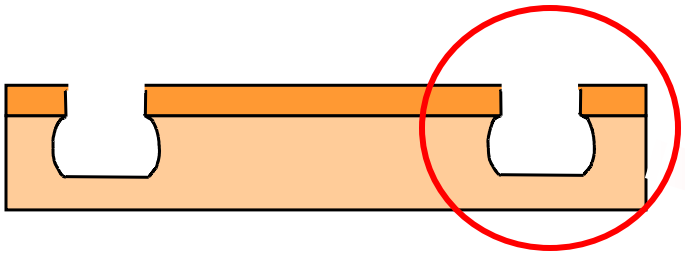
Removing clad material

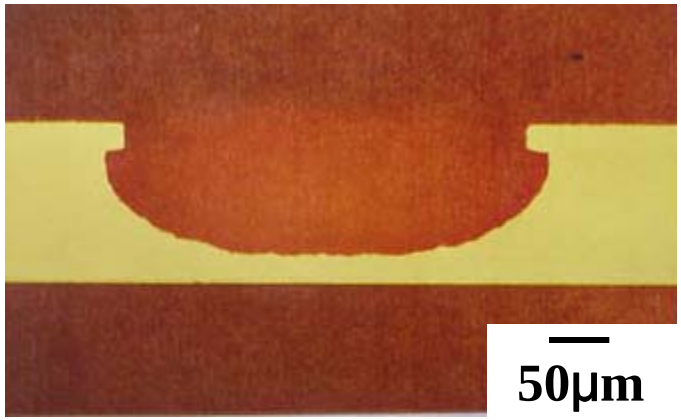


Mounting

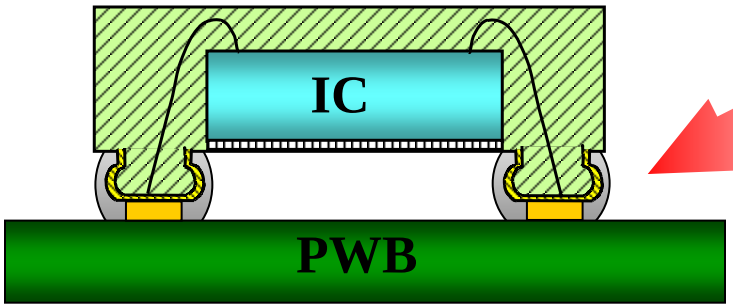


Bump formation for QFN





Cross section after etch

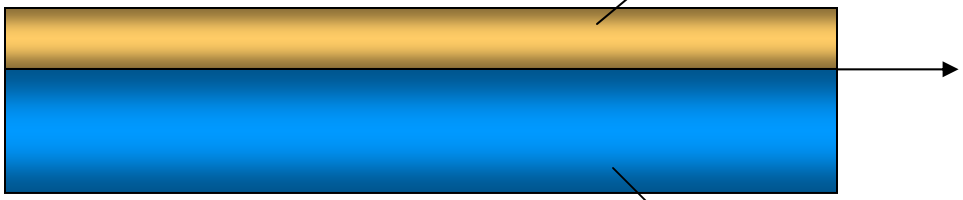


Reverse mushroom shape bumps improve the mounting reliability.

Copper Laminated Resin sheet

FINE CLAD changes the RF PWB design.

Structure

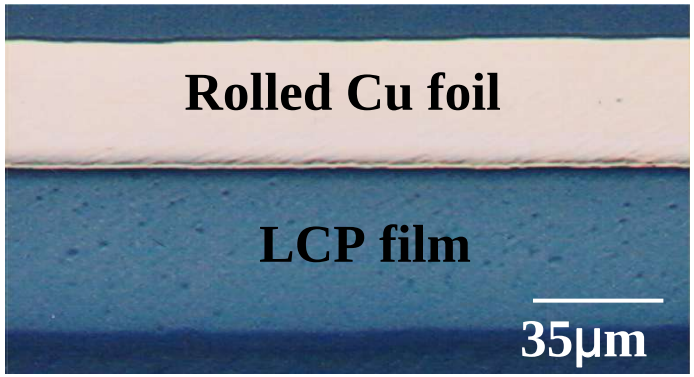


Rolled Cu foil (10 ~ 35μm thickness)

Flat interface

Low dielectric constant resin sheet
(25 ~ 100μm thickness)
(Liquid crystal polymer : LCP)

Advantages



Developed material

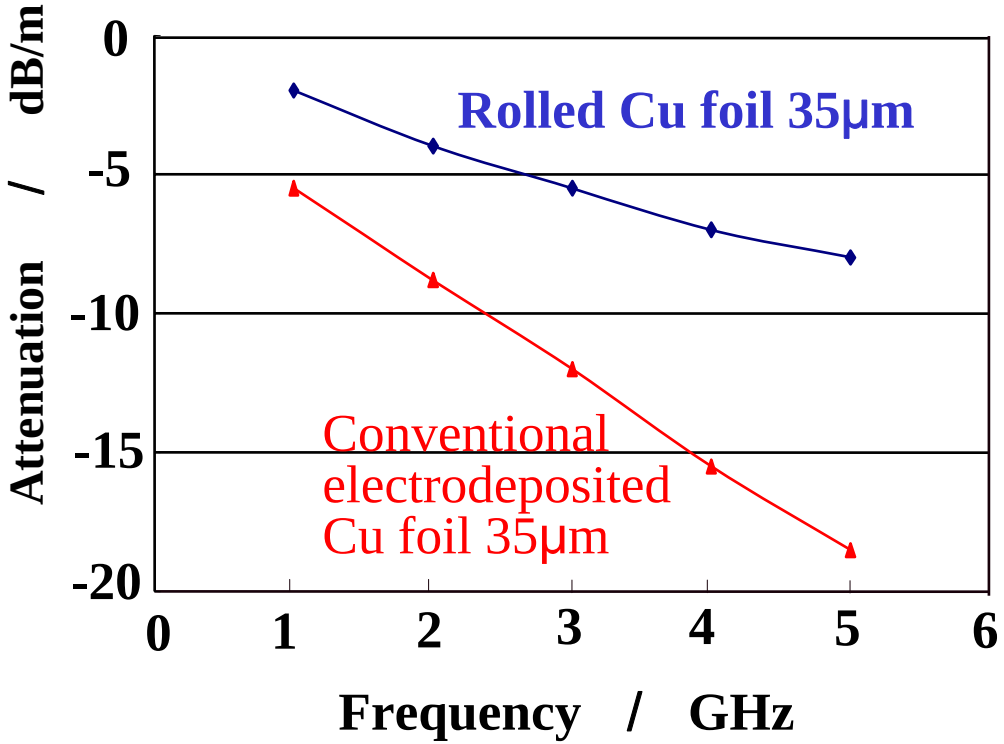
Conventional hot press type

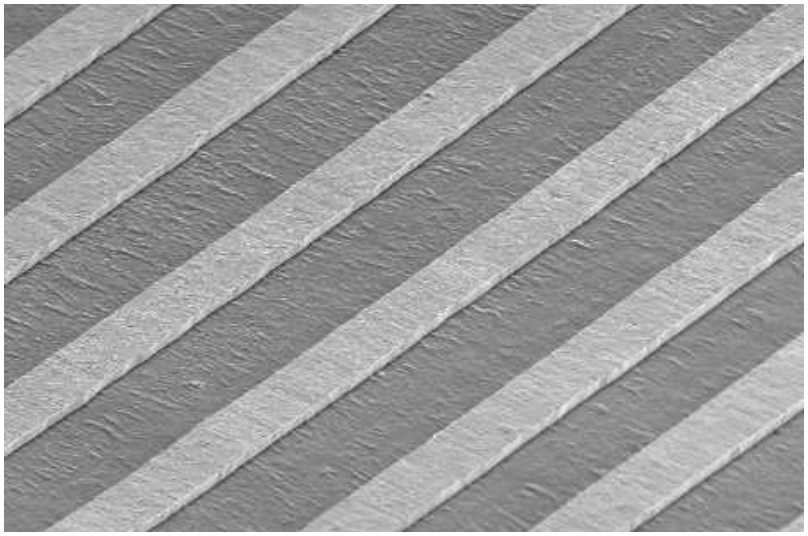
Cross section of Cu laminated resin sheet

Advantages of developed material

	Developed material	Conventional
Interface	Flat	Rough
Skin resistance	Low	High
Accuracy of pattern	Excellent	good

High frequency characteristics

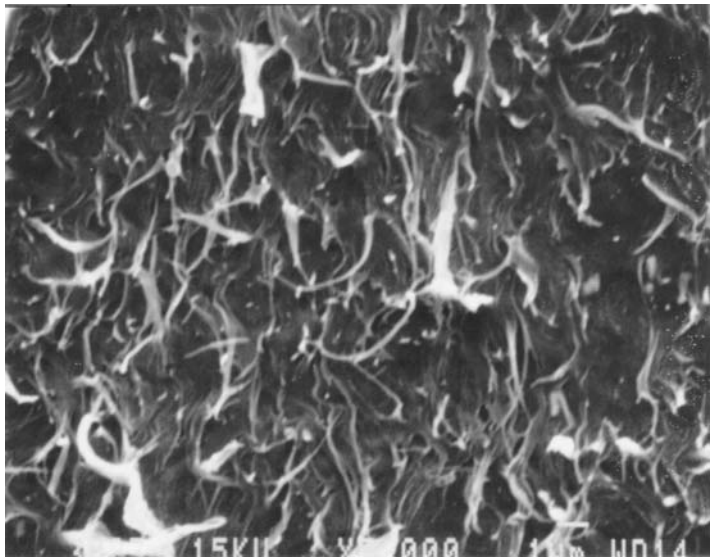




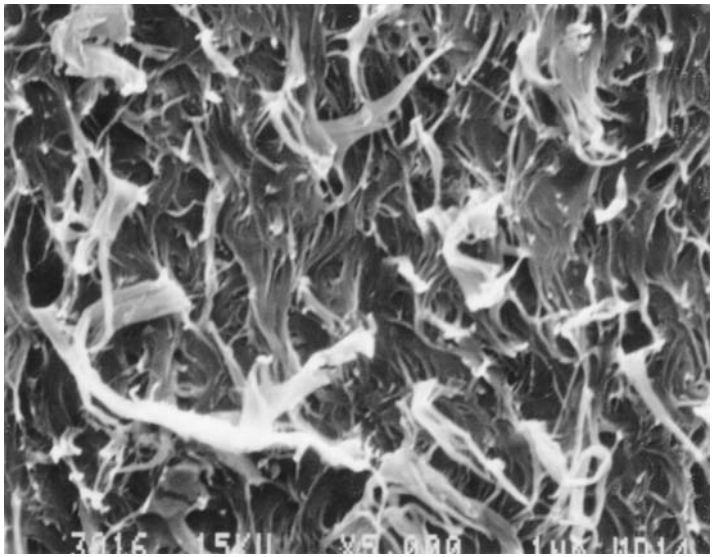
Cu foil : 7μm thickness
LCP film: 50μm thickness
L/S : 50μm / 50μm

Peeled face after peeling test

Peeling strength : over 600g/cm at 180°peeling test



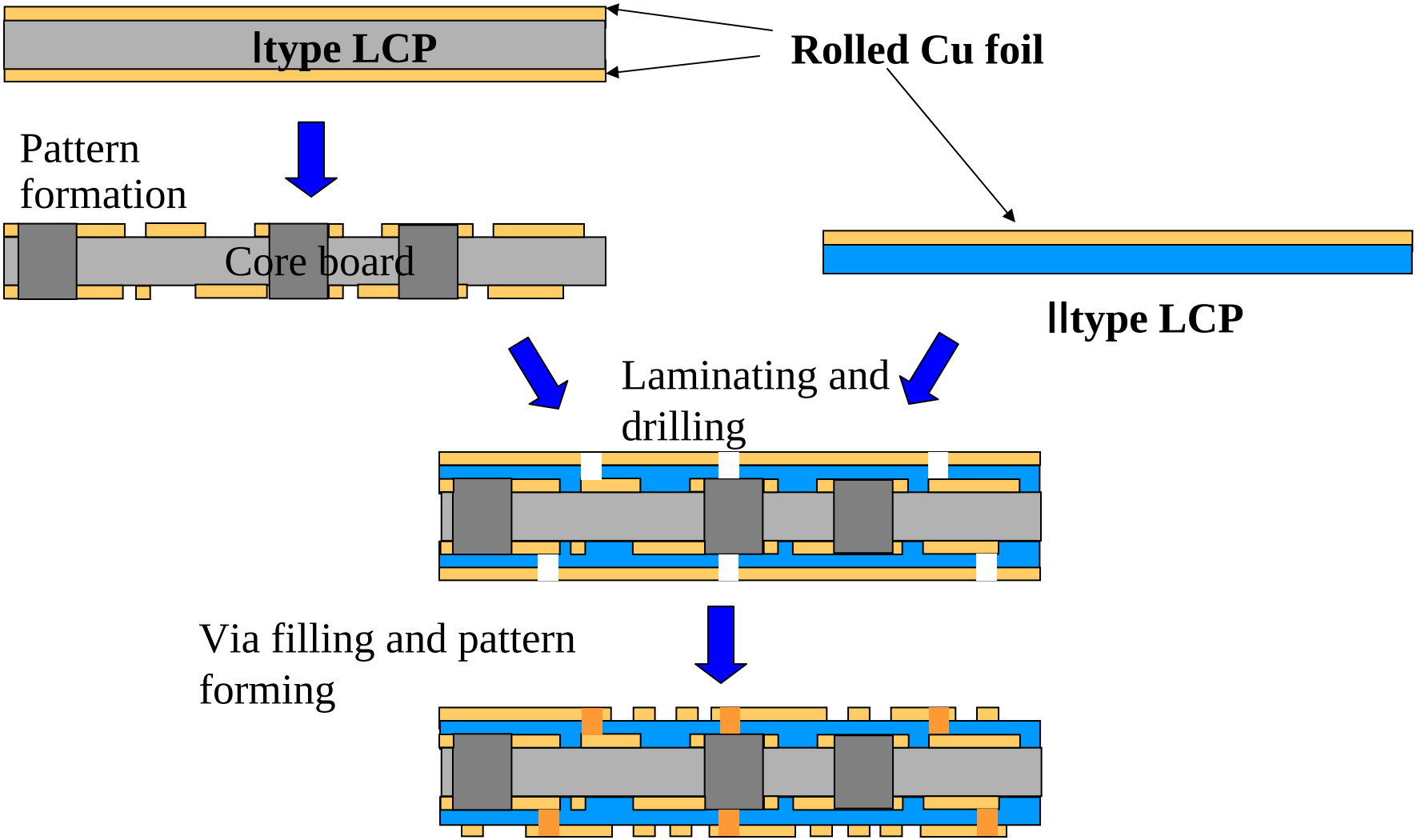
Cu side
(LCP is remained on Cu)



LCP side
(LCP is fractured at inside)

Application to multi-layer PWB

Manufacturing process of all LCP PWB



Features

① Flat interface reduces skin resistance.

② Flat interface enables to form fine pitch pattern.

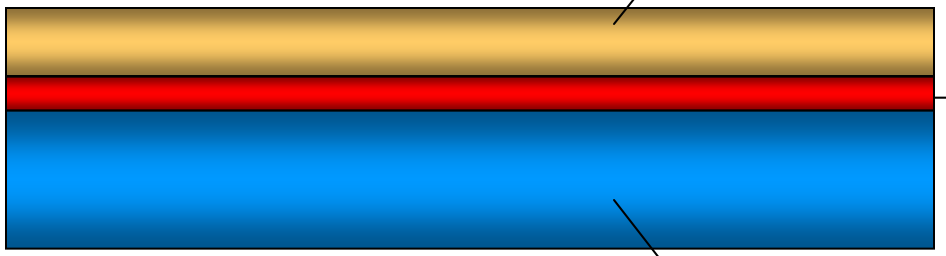
③ Combination with low dielectric constant resin sheet enables the application to RF PWB.

④ A variety of resin sheets are available.

Multi-layer sheet for embedded resistor

FINE CLAD provides
the embedded passive devices.

Structure

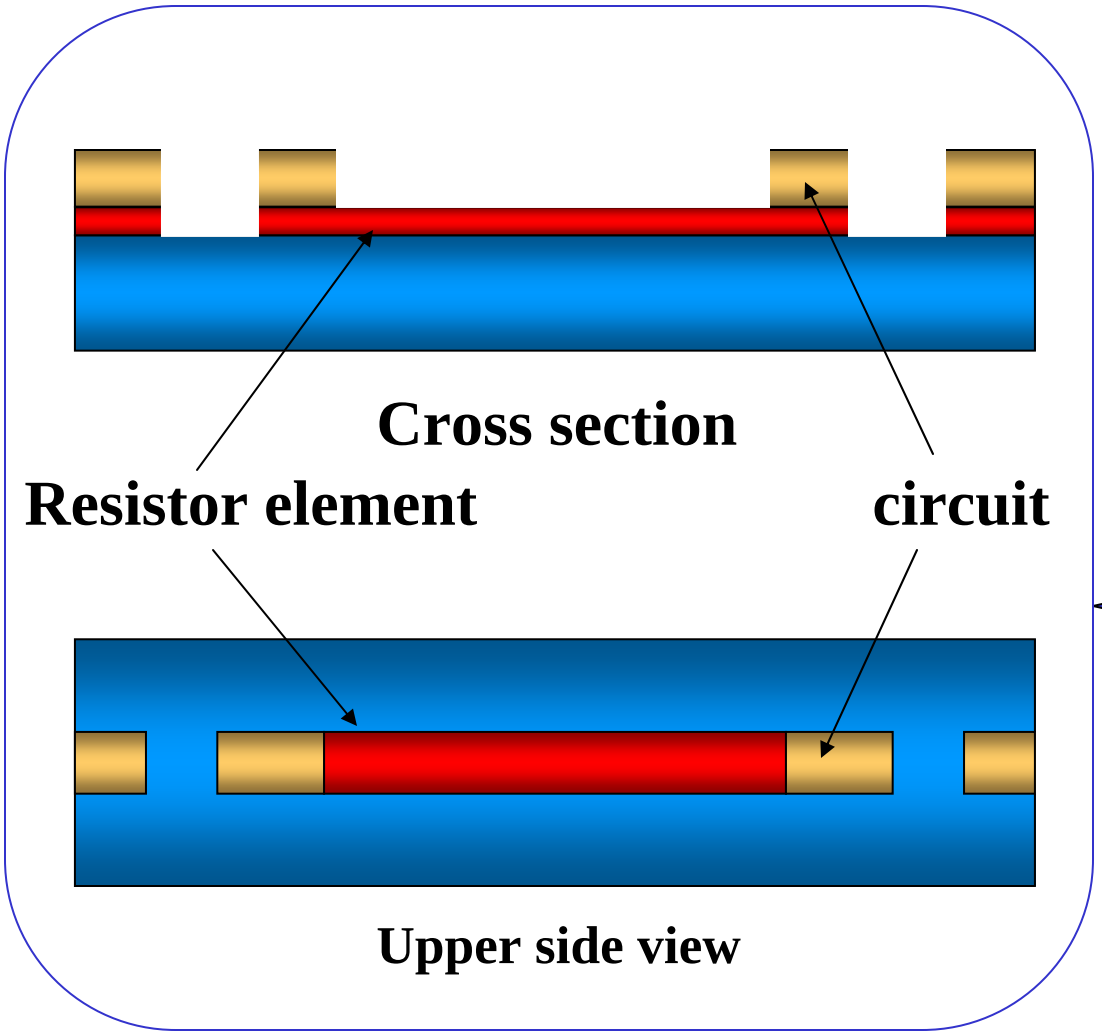


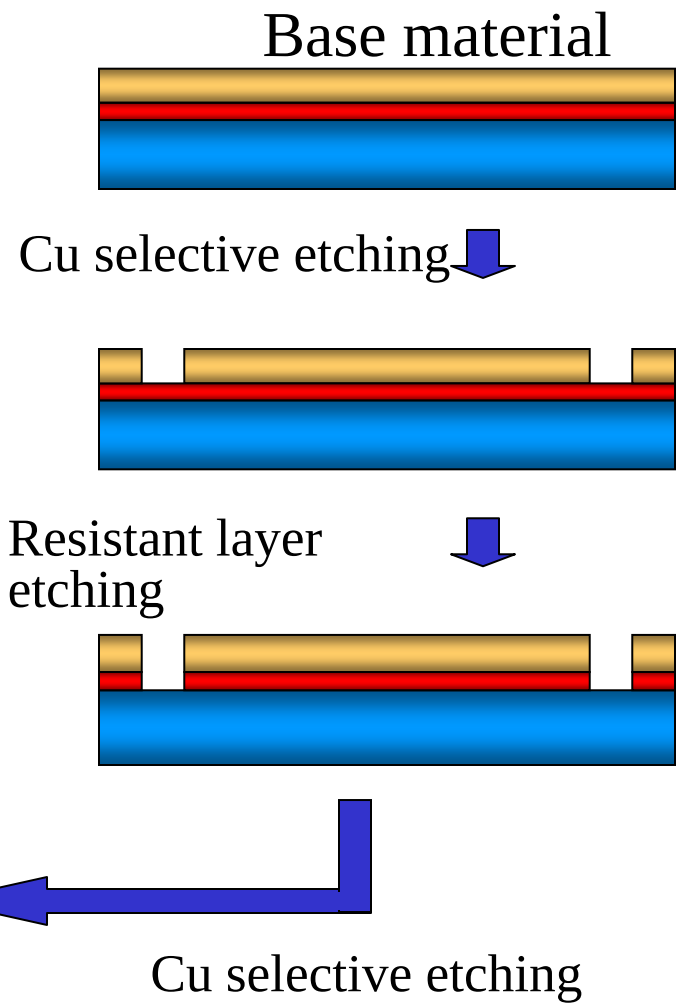
Rolled Cu foil (flat interface)
(10 ~ 35μm thickness)

Resistant layer
(Ni-Cr etc.)

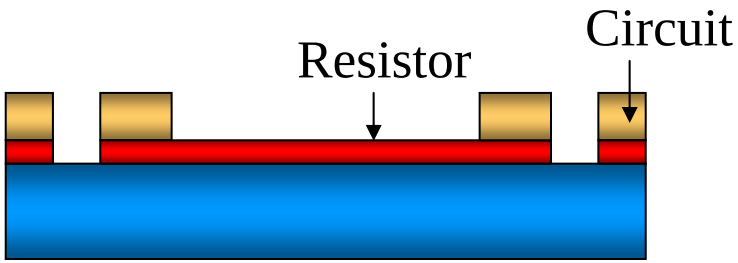
Low dielectric constant resin sheet
(25 ~ 100μm thickness)
(Liquid crystal polymer : LCP)

Process for resistor element





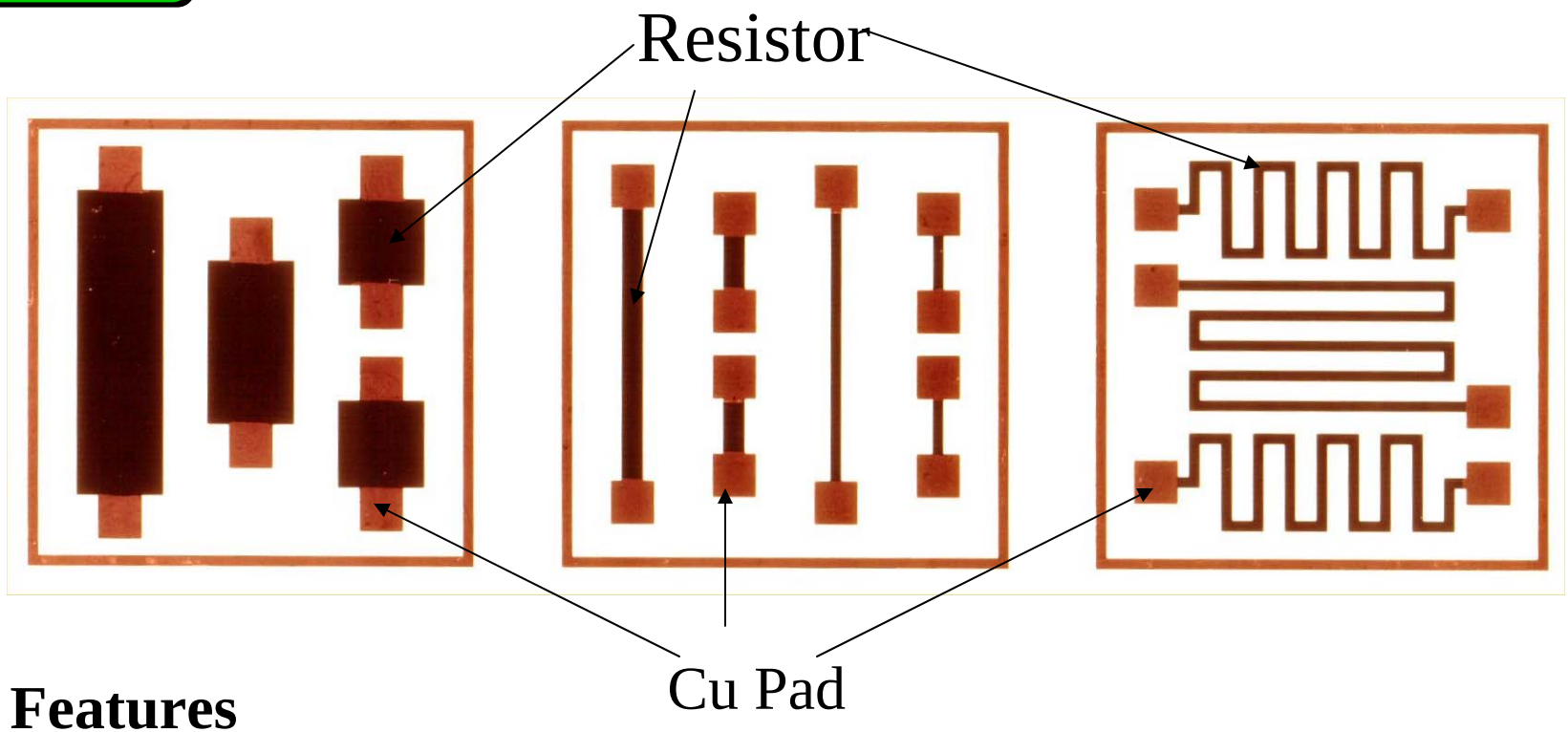
Specifications



Specifications

Resistive material	Ni-Cr
Thickness of layer	10 ~ 200nm
Sheet resistance	25, 50, 100Ω/□

Features



Features

① Low TCR material is used.

② Resistor can be formed only by etching process.

③ Flat thin film enables to improve the accuracy of etching.

Feature 2 Materials combinations

Manufacturing range

Material thickness	10μm ~ 1mm
Product thickness	30μm ~ 1mm
Product width	2.5 ~ 600mm×Coil

Materials combinations

	Al	Cu	Ni	Ag	Au	Pd	Pb	Sn
Al	●	●	●	—	—	—	●	●
Cu	●	●	●	●	●	—	—	●
Ni	●	●	●	—	—	—	—	●
Ag	—	●	—	—	—	●	—	—
Au	—	●	—	—	—	—	—	—
Pd	—	—	—	●	—	—	—	—
Pb	●	—	—	—	—	—	—	—
Sn	●	●	●	—	—	—	—	—
Steel	●	●	●	●	—	●	●	●
Ti	●	●	—	●	●	—	●	—
Mo	●	●	—	—	—	—	—	—

Al :Including 1000, 2000, 3000,4000,5000 alloy
Cu :Including 1020, 1100, 1201, 5210 alloy
Steel :Including SUS304, SUS316,SUS430, Invar, 42alloy etc.
— :Bonding has not been verified.

Mechanical properties of clad before and after cladding

	Material	Thickness (mm)	Hardness (Hv)	Tensile strength(N/mm^2)
Before cladding	SUS304 Al	0.201 0.056	170 24	703 59
After cladding	SUS304 Al	0.200 0.055	173 25	572*
Before cladding	steel Al	0.271 0.030	137 25	343 59
After cladding	steel Al	0.270 0.029	139 26	316*
Conventional clad	SUS304 Al	0.243 0.051	287 24	744*

* Strength of clad material

Mechanical properties of raw material have hardly changes before and after cladding.

Drawing and ironing of FINE CLAD

Feature 3 Pattern roll bonding

Pattern roll bonding 1

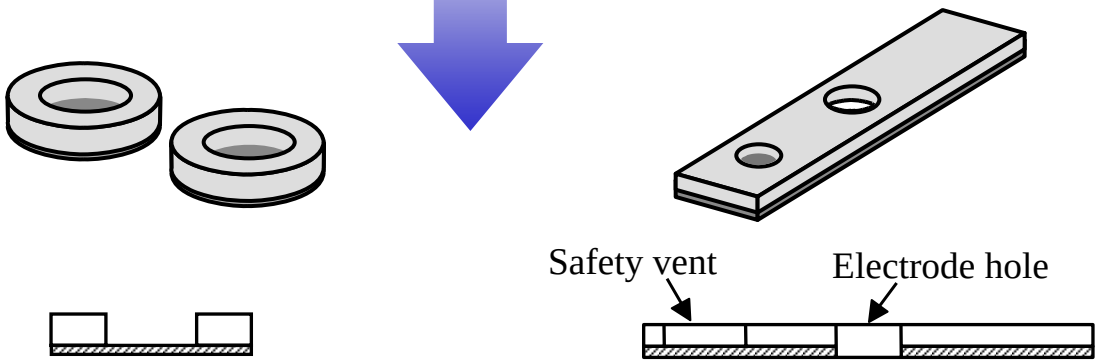
~ safety vent ~

Process of safety vent

Punched metal
(0.4 ~ 1mm thickness)

Metal foil
(20 ~ 30μm thickness)

Cladding

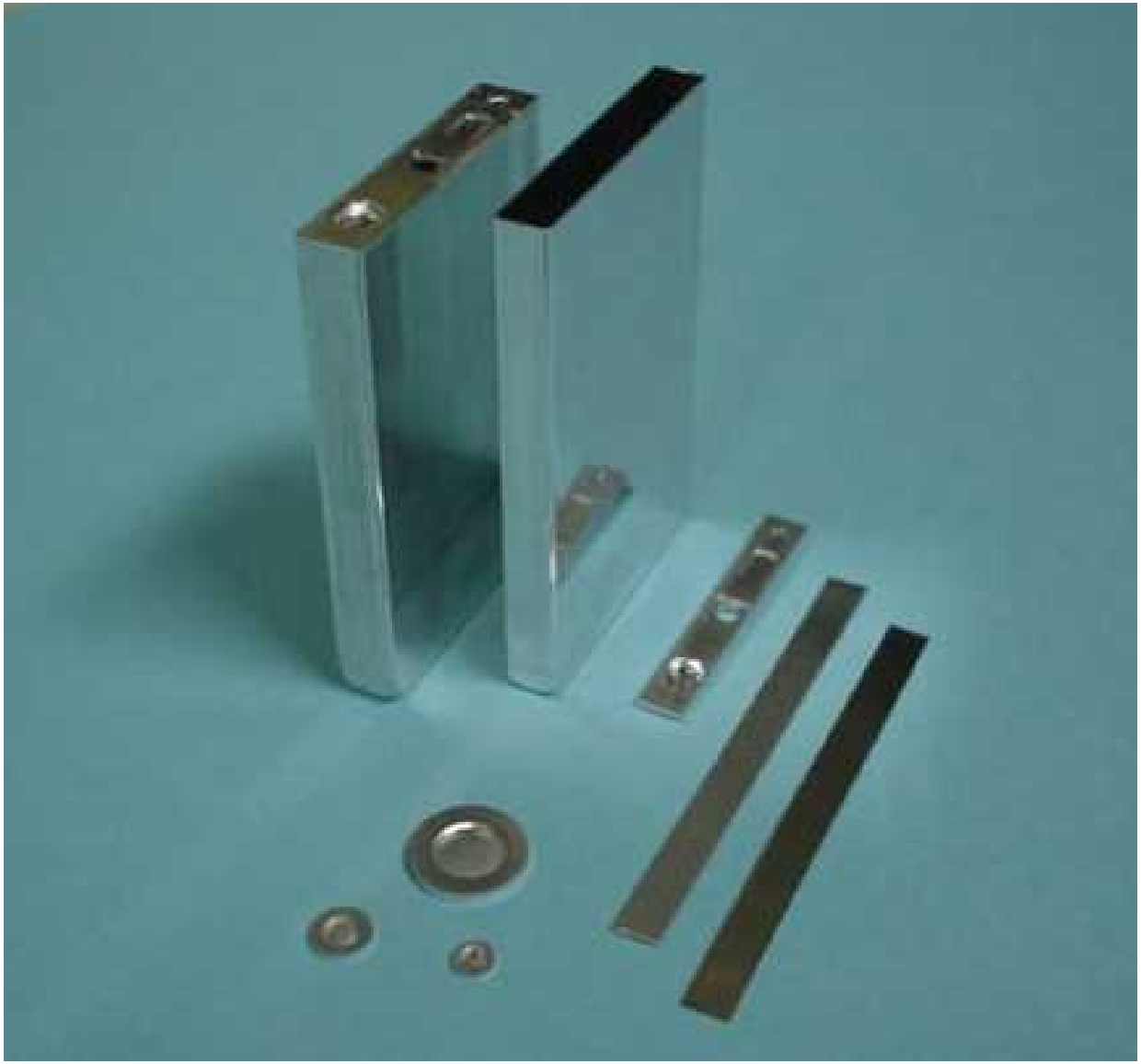


Chip type

Cap type

Manufacturing process of safety vent for
Li ion secondary battery

Parts for Li ion secondary batteries

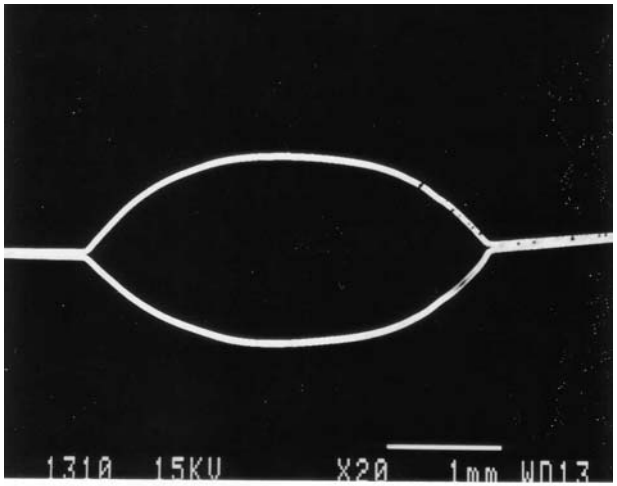


Pattern roll bonding 2

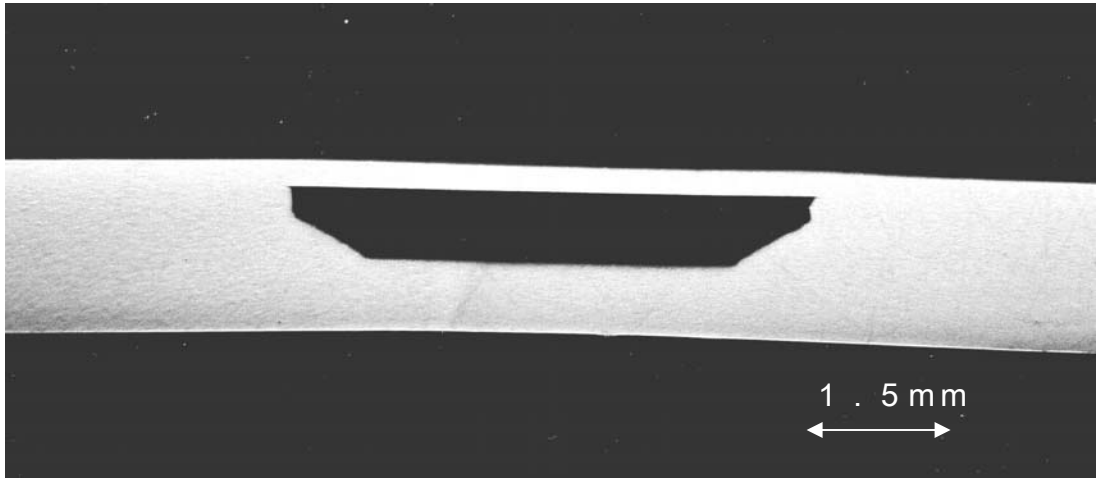
~ Plate type tube ~

Trial sample of plate type tube

① Pattern bonding by paint patterning (BN paint)



② Pattern bonding by cladding sheet with stamped substrate



Example of pattern bonding after expansion treatment

FINE CLAD is a solution for high density, low cost PWB.