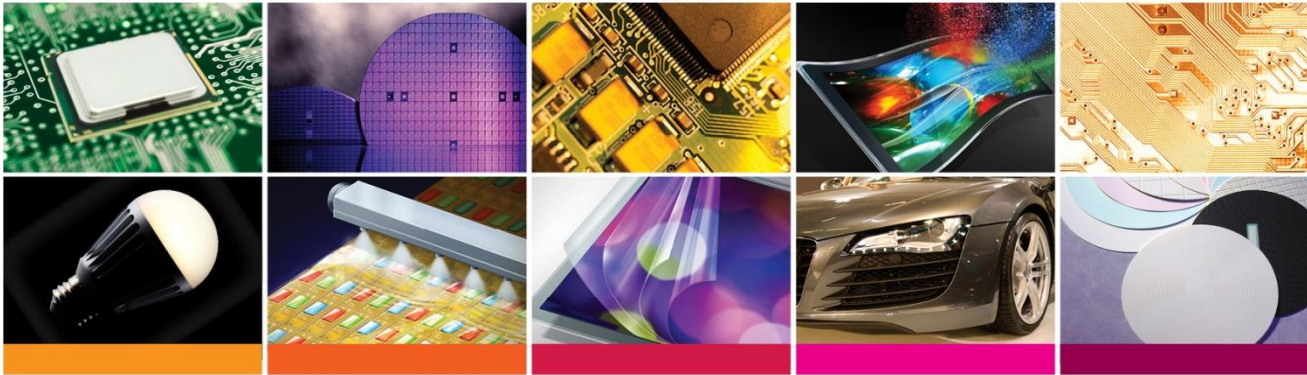




Electronic Materials



New Generation Via Fill Technology for HDI Application

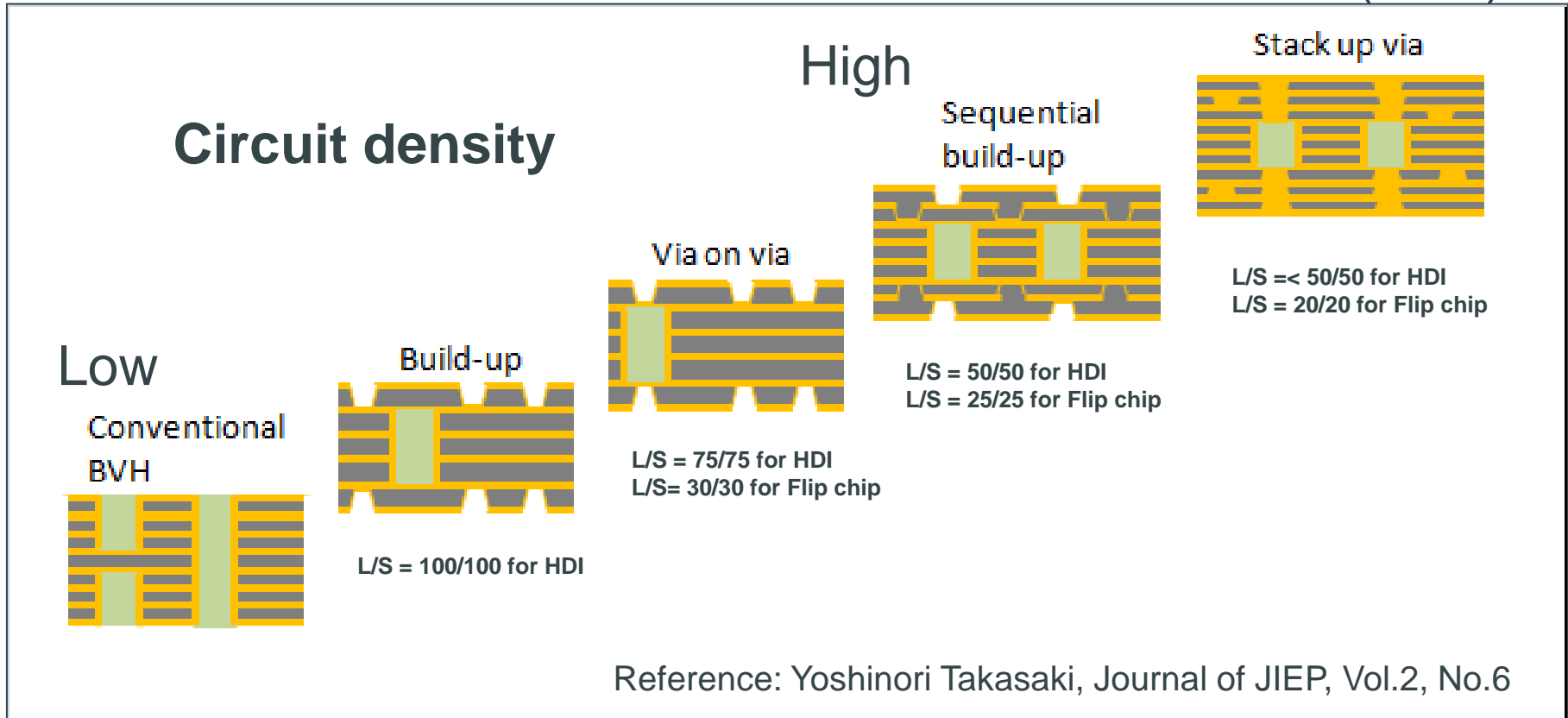
**Dow Electronic Materials
R&D Process Technology**

Agenda

- **Introduction**
- *Surface Appearance, Via Filling and Through Hole TP% Performance*
- *Mass Production Status and Deposit Physical Properties*
- *Summary*
- *Q & A*

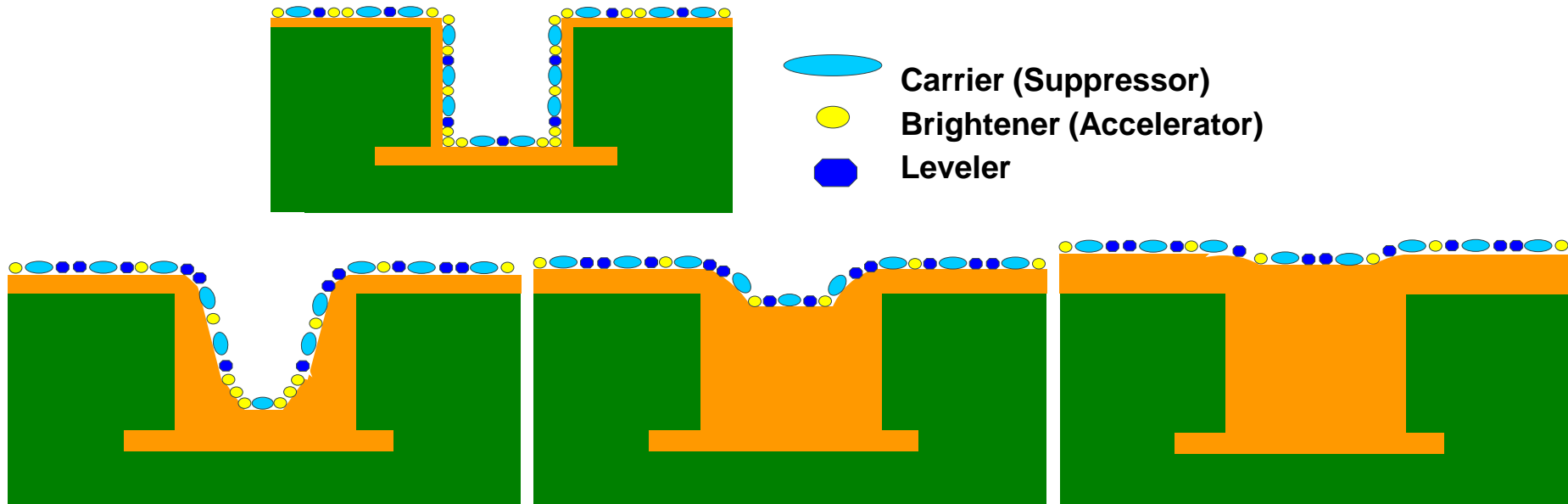
Technology Trend on HDI

(Year)



- HDI-board is required to perform higher reliability, finer traces, smaller via holes, multilayers and higher densities
- Key challenge: Electrical performance, Low cost, High density

Microvia Filling Mechanism



- Additives used for bright acid copper plating are divided into 3 categories:
 - (1) Carrier: make deposit a tighter grain structure, improve plating distribution & TP.
 - (2) Brightener: direct enhance physical properties of the deposit, ex: tensile strength & elongation.
 - (3) Leveler: adsorb preferentially at high points in the plating topography, allow low current-density areas to catch up with high area.

Why This Product Produce ?

Good Surface Appearance

Good Blind Via Filling Performance


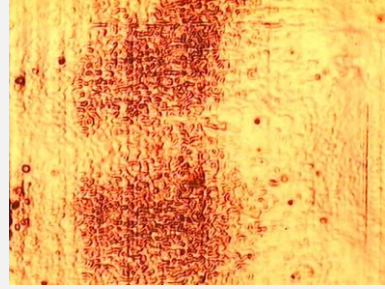


No Bump Issue

Good Through Hole TP% and Knee TP% performance

Agenda

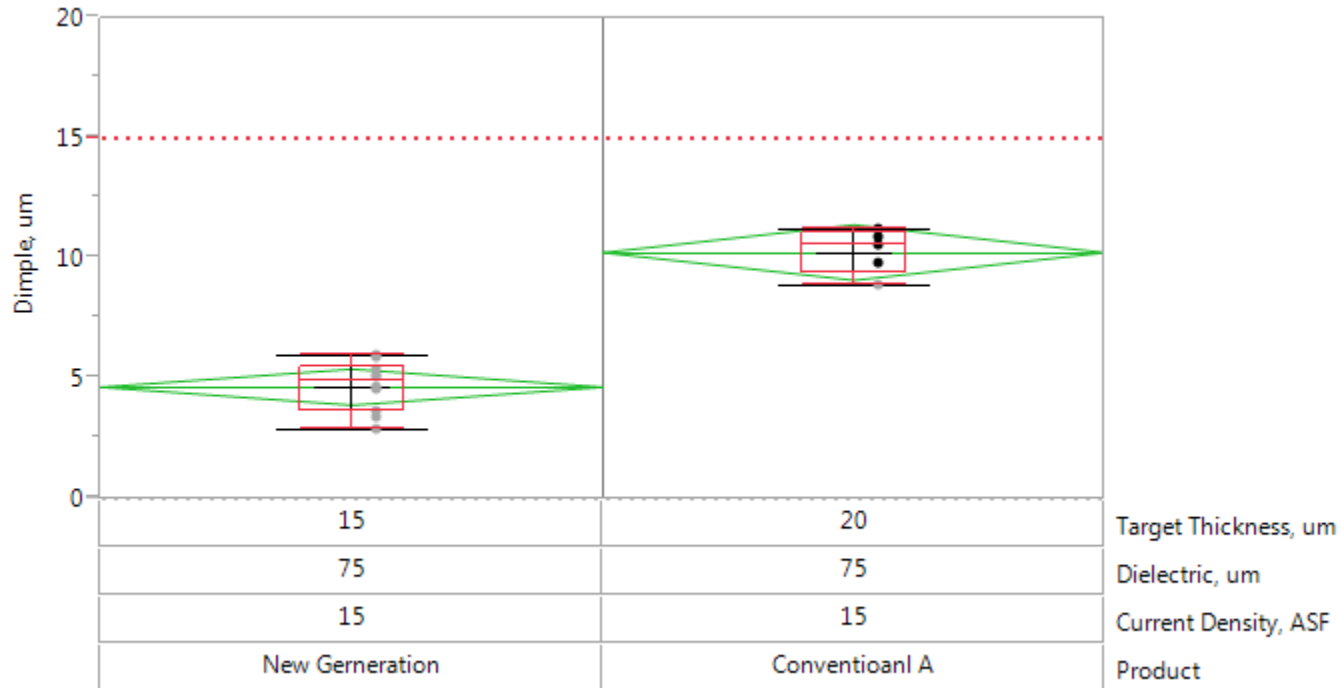
- *Introduction*
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Surface Appearance Performance Compared with Conventional Product

Product	New Generation	Conventional
Haring Cell		
Mass Production		

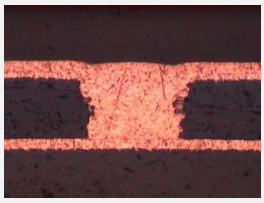
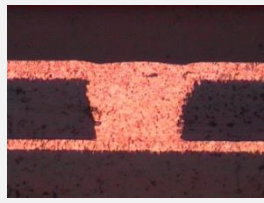

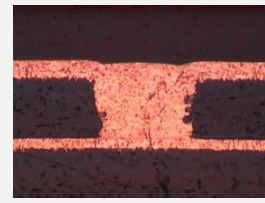


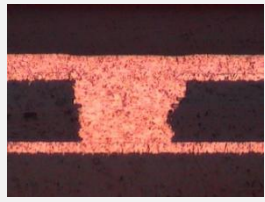
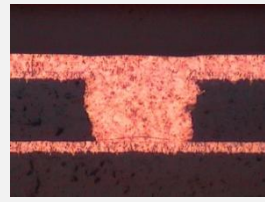
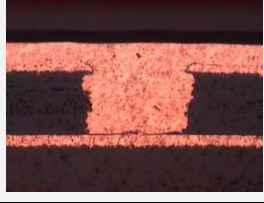
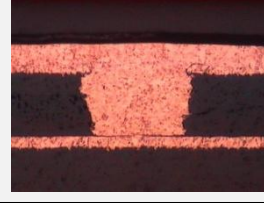
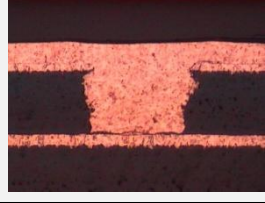
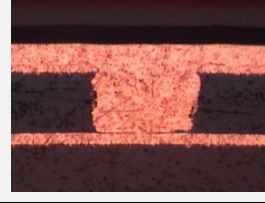
Parameter	Value
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	230g/L
H_2SO_4	60g/l
Chloride	50ppm
Current density	15 ASF
Temperature	23°C

Via Filling Performance as Function of Plating Thickness, Via Depth, and Current Density Compared with Conventional Product



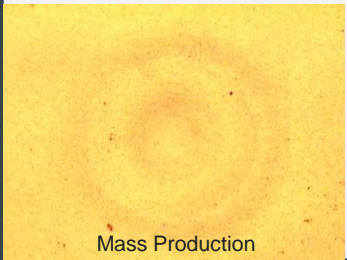

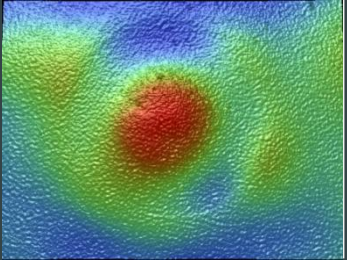
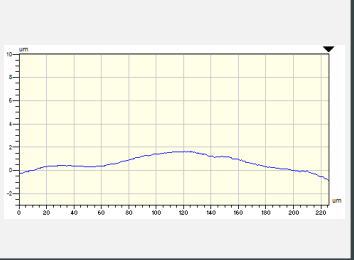
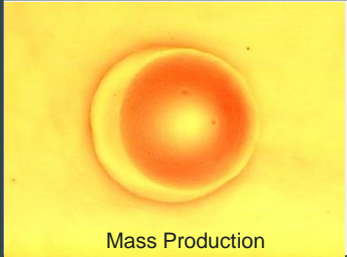
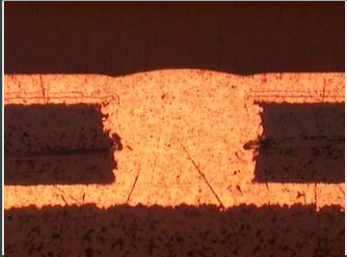
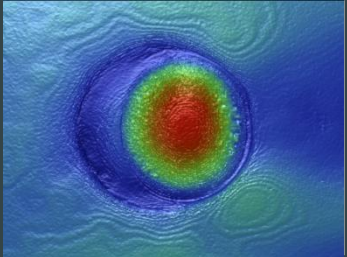
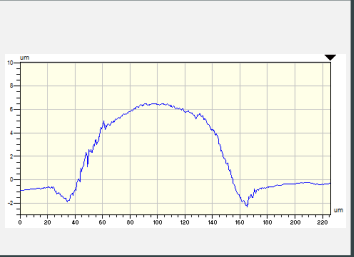
Blind via diameter : 125 um

Via Filling Performance as Functions of Plating Thickness

Seed layer	Electroless copper				Void rate
Dimple (um)	4.5	3.6	4.6	5.1	0%
15 um					
Dimple (um)	2.2	1.4	1.3	2.9	0%
20 um					
Dimple (um)	0.5	-2.9	-2.4	0.5	0%
25 um					

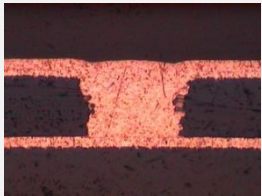



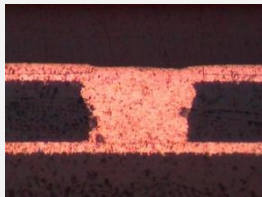
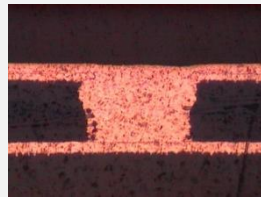
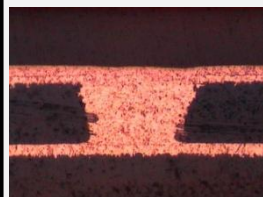

Blind via diameter : 125 um ; Dielectric : 75um ; C.D. : 15 ASF

Bump Issue Compared with Conventional Product

Item	OM Top View	Cross Section	Wyko		Rt
<p>New Generation</p>	 <p>Mass Production</p>				<p>1.89 um</p>
<p>Conventional B</p>	 <p>Mass Production</p>				<p>6.79 um</p>

Blind via diameter : 125 um ; Dielectric : 75 um ; C.D. : 15 ASF

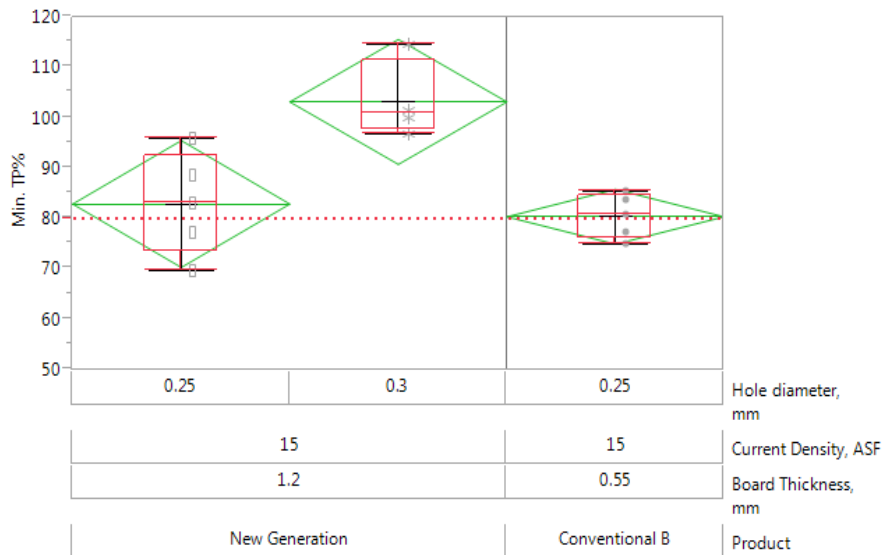
Via Filling Performance as Functions of Current Density

Seed layer	Electroless copper				Void rate
Dimple (um)	4.5	3.6	4.6	5.1	0%
15 ASF					
Dimple (um)	5.7	3.4	3.4	4.8	0%
20 ASF					

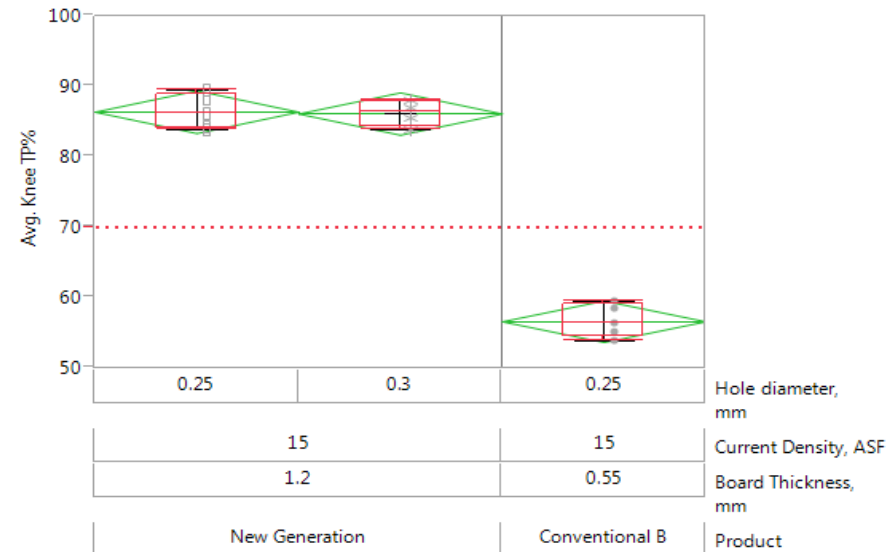
Blind via diameter : 125 um ; Dielectric : 75um ; C.D. : 15 ASF

Result of Through Hole and Knee TP% Performance compared with Conventional Product

Through Hole TP% Performance



Knee TP% Performance

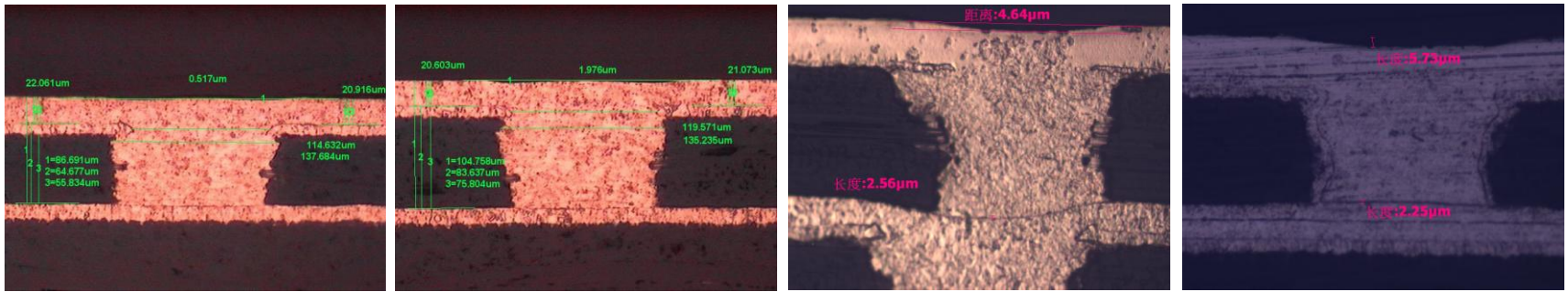


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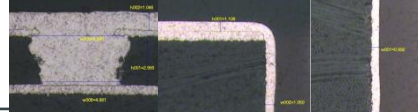
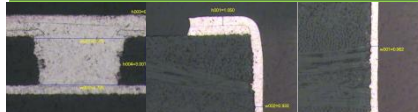
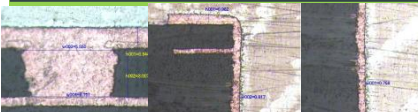
Mass Production Status in Customer Site

Cross-section



Overall Ahr	Additives	Brightener, Ahr/Lt	Carrier, Ahr/Lt	Leveler, Ahr/Lt
3,128,757	Consumption	6,874	10,311	6,874

Result of Reliability Test

Reliability Test			
Item	Method	Quality	Result
Elongation & Tensile strength	Plating Thickness 2mil-4mil 25 samples	Elongation $\geq 15\%$	Pass
		Tensile strength $\geq 248(N/mm^2)$	Pass
IR Test	1.5m/min x 3cycles	Without current open	Pass 
Thermal shock	-50° C~125° C Qualification : 100 cycles	Without current open	Pass 
Thermal Stress	288° C Solder immersion for 10 second Qualification : 3 cycles	Without crack issue	Pass 

Summary

- **Good surface appearance.**
- **Exceptional microvia filling performance (no bump/skip plating/void).**
- **Simultaneous microvia filling and through-hole plating at low surface thickness.**
- **Excellent deposit physical properties and interconnect reliability.**
- **All bath additive components can be monitored by CVS.**

Q & A



**Thank
You**

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