Applications of Alternative SR Materials to Improve the Reliability

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(LG전자)

Applications of Alternative SR Materials to Improve the Reliability

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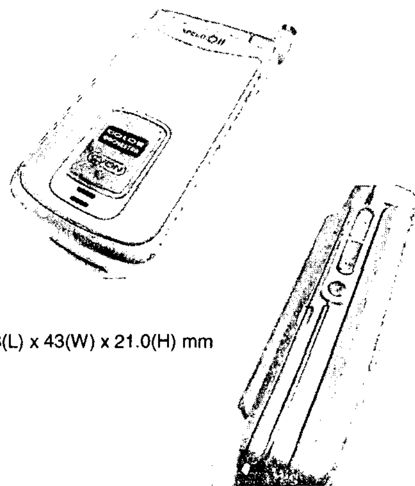
1. Introduction

❑ 정보기기의 첨단화

• Mobile product의 고밀도, 초 Slim, 초 경량화로 High Technology PCB 에 대한 요구 증대

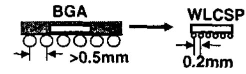
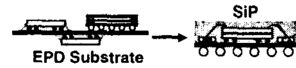


83(L) x 43(W) x 21.0(H) mm

•98.6×50.6×13.8 ㎜
•1G 메모리 내장

PCB Number 1.
Different Thinking & Action

❑ 개발 과제

❑고밀도 실장 공법 개발	• Flip Chip 실장 확대 적용	
❑고집적 Flexible PCB 개발	• 박형 FPCB 생산 대응	
❑Embedded Passive 개발	• EPD 설계 기술 (Embedded Passive device)	
❑3D Packaging	• Packaging 설계기술 개발	

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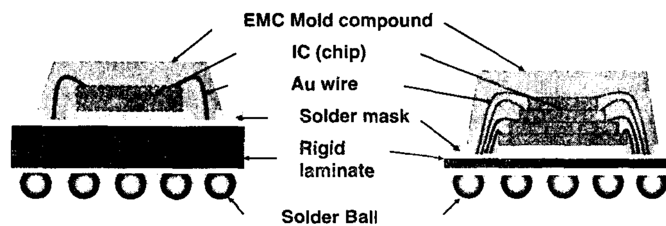
❑ IC Package Structure



- *Increasing the multi-stacking package*
- The trend of thin package
- The problem of thermal and mechanical reliability

→ Needs to the whole improvements

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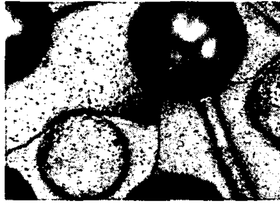
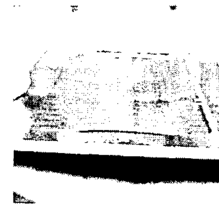
❑ Conventional thin PCB Issue

- Thin PCB Issue
  - Low reliability (PCB crack by different CTE of materials)
  - Limitation of PCB thickness (Current thickness 130um)
  - Workability & Cost Issue (need the carrier frame process)





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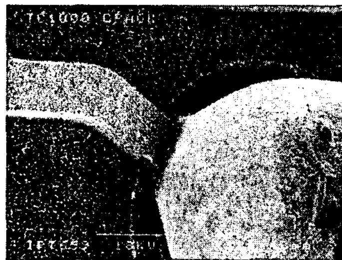
❑ 인입선 Crack 발생



-> PSR를 제거한 후

PSR Mask Line을 따라서 Crack발생

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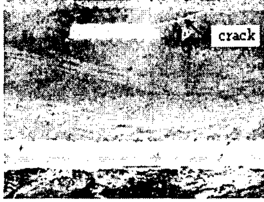
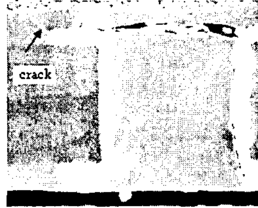
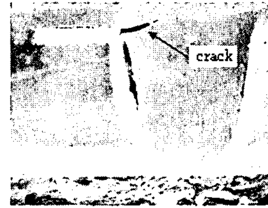
❑ Leakage failure parts after PCT 168 hrs



SEM x 230_ Cu trace
Note) SR Thickness 29.964 micron



SEM x250_Via hole
SR crack in via hole and land edge
Note) SR Thickness 30.194 micron



SEM x230_Via hole
SR crack in via hole and land edge
Note) SR Thickness 32.837 micron

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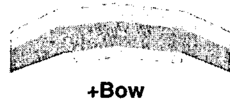
2. Reliability issues

❑ Warpage Issue

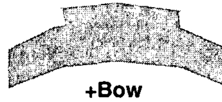
• **Shrinkage Difference between Cu area and SR area**

●Copper area



+Bow

●SR area



+Bow

Shrinkage Difference between Cu area and SR area makes warpage issues

❑ IC Package Issue

• **Tensile strength**

> SR ink : 50Mpa / Core material : 260Mpa
→ SR is lower than core material

• **Tg Temp.**

> SR ink : 98 ℃ / Core material : 190 ℃
→ Different Tg is cause of low workability & low reliability in Ass'y process

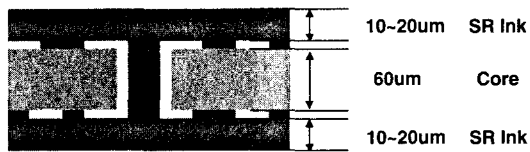
• **Reference (material properties)**

- **Core material : Tg 190℃**
  CTE α1 : 30ppm, α2 : 130ppm
- **SR ink(Solder Resist) : Tg 98℃**
  CTE α1 : 50ppm, α2 : 150ppm
- **EMC mold : Tg 150℃**
  CTE α1 : 10ppm, α2 : 30ppm

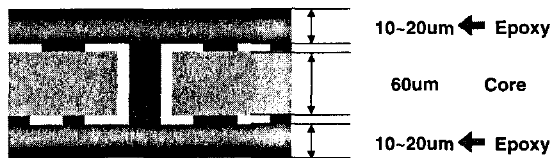
3. Improvement

❑ Structure comparison – 0.13T PCB Material SET

• **Normal PSR**



•**Epoxy SR**



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❑ Process comparison – 0.13T PCB Material SET

• Normal PSR	•Epoxy SR
표면 처리	
Ink 인쇄	Epoxy 밀착
Pre-curing	Chemical 에칭
노광	Mask 제거
현상	
최종 경화	

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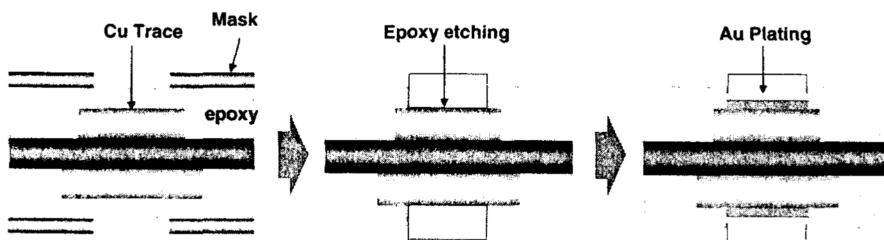
❑ Epoxy SR PCB structure

• Process



• It's possible to change the epoxy color by pigment

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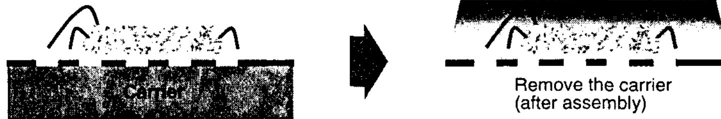
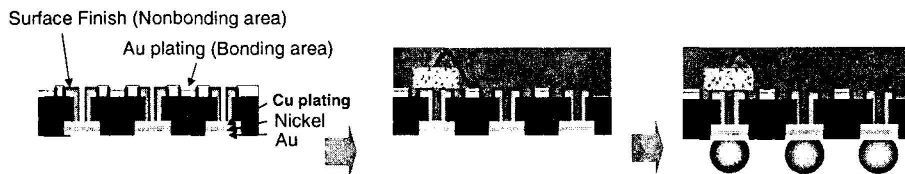
❑ Extremely Thin Product PCB using Carrier

- **What is One layer PCB?**



Provide the extremely thin PCB (total 50um) by carrier solution

- **Concept**



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❑ Extremely Thin Product PCB using Carrier

- **Why One layer PCB?**
  - **One layer PCB can provide the merit of multi stack package by thin PCB (50㎛)**
    - **- Customer can assemble the thin product without frame attachment**
  - **High reliability & Best workability**
    - **- composed material : Cu trace + core (without SR)**
    - **- No dimension change & warpage by carrier**
  - **High density design without plating bus-line**
    - **- Bus-less Soft Au plating is possible by electrolytic carrier**

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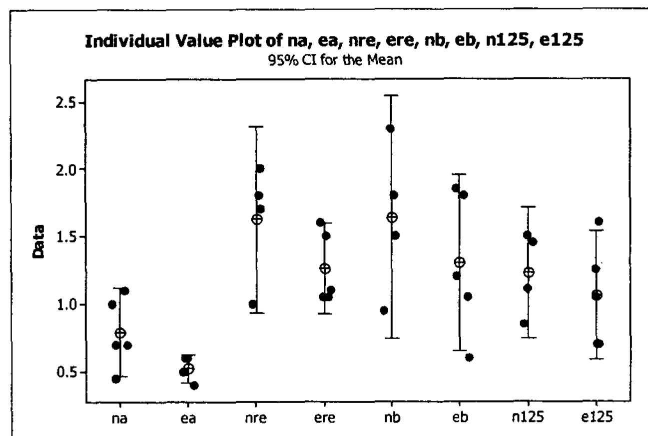
4. Reliability data

❑ Warpage data – PSR vs ESR



* na : normal - A state
* nre : normal – after reflow
* nb: normal – B state
* n125 : normal - 125℃ heating
* ea : Epoxy SR - A state
* ere : Epoxy SR – after reflow
* eb: Epoxy SR – B state
* e125 : Epoxy SR - 125℃ heating

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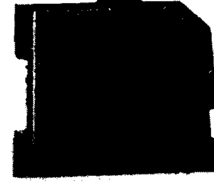
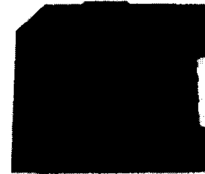
❑ Extremely Thin Product PCB using Carrier

❑ Test result

Station		color	dimension	condition	Machine
SMT	Substrate Pre-bake	No Change	No Change	30min/125℃,120min/125℃,30 min/25℃	v
	Re-flow	No Change	No Change	245℃, 5min	v
	Flux clean	No Change	No Change		v
Die Bond	Substrate Pre-bake	No Change	No Change	30min/125℃,120min/125℃,30 min/25℃	v
	Die Bond(ALPHASEM)	No Change	No Change		v
	Die Bond(RENESAS)	No Change	No Change		modify sensor
	Epoxy Cure	No Change	No Change	60min/50℃,90min/150℃,30min/25℃	v
Wire Bond	Plasma before WB	Change(a little white)	No Change	Oxygen 250mil/minute,Argon 1750mil/minute,800MW,4minute	v
	Wire bond(K&S)	No Change	No Change		modify sensor
	Wire bond(ASM)	No Change	No Change		v
Molding	Plasma before MD	Change(a little white)	No Change	Oxygen 490mil/minute,Argon 1200mil/minute,800MW,1minute	v
	Molding	No Change	No Change		v
Marking	Marking	No Change	No Change		
Singulation	Singulation	No Change	No Change	punch life < 500K by the metal	modify sensor





- **Carrier PCB can provide the merit of multi stack package by thin PCB (50㎛)**
  - **Customer can assemble the thin product without frame attachment**

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