

(19)  
(12)

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(B1)

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B23K 35/26

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10-2001-0111635  
2001 12 19

(30) 2000-180719 2000 06 12 (JP)  
2000-396905 2000 12 25 (JP)

(73) 가 가 가 4 6

(72) 가  
1 5-1 가 가  
1 5-1 가 가  
1 5-1 가 가  
가 1 5-1 가 가  
1 5-1 가 가  
1 5-1 가 가  
1 5-1 가 가

(74)

:

(54)

가 Cu

Sn

,

1

, , , ,

- 1
- 2
- 3
- 4
- 5
- 6
- 7 RF
- 8 RF
- 9 RF
- 10 RF
- 11 RF
- 12 RF
- 13 RF
- 14
- 15
- 16
- 17 Cu
- 18 Sn/Cu
- 19

CSP  
 BGA, CSP  
 Cu BGA, CSP

- 1 : Cu
- 2 :
- 4 :
- 6, 14 :
- 8 :
- 9 :
- 13 :
- 15 : 가
- 18 : Cu
- 19 :
- 20 :

Sn-Pb 330 350 , , Pb가 Pb-5Sn( : 314 310 ), Pb-10Sn( : 302 275 ) Sn-37Pb (183 ) , , , ,



, Cu Sn  
 Sn Cu  
 Cu Sn Cu Sn Cu Sn  
 1 2 1  
 3.5)mass%Ag-(0.5 1.0)mass%Cu  
 1 2  
 가  
 300  
 Cu( Ag, Au, Al, )  
 Sn 50%  
 Cu-Sn Cu<sub>6</sub>Sn<sub>5</sub><sub>2</sub>  
 50 (Sn ) 2  
 Sn  
 An-20Sn, Au-(50 55)Sn( : 309 370  
 ), An-12Ge( : 356 )  
 Sn, In  
 Sn In  
 RF  
 2  
 가  
 가  
 13( )  
 . Pb 3.6% [ Sn ; (河上  
 2 240 1.4% , Pb Cu  
 3.6% 1/2.5  
 Cu<sub>6</sub>Sn<sub>5</sub> 1( ) Sn Cu 가  
 Cu (antagorism) , Sn  
 1/2.5  
 가  
 RF  
 < 1 >  
 1  
 1  
 30μm Cu [1( Ag, Au, Al, Cu-Sn , Au , Ni/Au  
 Sn 가 )] 30μm Sn [2( : 232  
 )] Sn (4) Sn(3) Cu (1) , Cu (1)  
 Sn (2) . Cu 가

, Cu Sn 가 , Cu가 Cu 가 . Cu 가 Sn

, Cu 가 , Cu Sn 가

가 , Cu<sub>6</sub>Sn<sub>5</sub> , Cu<sub>6</sub>Sn<sub>5</sub> , Cu<sub>3</sub>Sn 630 Cu , Cu<sub>3</sub>Sn Cu<sub>3</sub>Sn

Cu (1) , Cu<sub>6</sub>Sn<sub>5</sub> 가 , Cu<sub>3</sub>Sn Cu<sub>3</sub>Sn

Sn Cu (1) (Cu<sub>6</sub>Sn<sub>5</sub>), Cu (1) 240 , Cu

(1) 가 (Cu<sub>6</sub>Sn<sub>5</sub>) μm , Sn

가 Cu (1) 가 , Sn

(4) Cu (1) μm Sn 가 Sn Sn , Cu

(1) Sn Cu Sn Sn(3) (voidless) Cu 가 Cu<sub>6</sub>Sn<sub>5</sub>

, Sn Bi 가(1 2%) , Sn Bi가

LSI , Sn-3Ag-0.5Cu( : 221 217 ) ( 가 )

LSI Sn-(2.0 3.5)mass%Ag-(0.5 1.0)mass%Cu , 240 Sn-Pb Pb가

Cu-Cu<sub>6</sub>Sn<sub>5</sub>

2 Sn-(2.0 3.5)mass%Ag-(0.5 1.0)mass%Cu RMA(Rosin Mild Activated) 가

2 RA(Rosin Activated) 가

(13) Al (14) Au-20Sn (7) (8) (10)

Fe-Ni Ni-Au 가

, RMA 가

가 (15) 가 (dispenser) , 가

(12) ( 2 (b)). Cu (1) Sn (2) (4) B-B'

A-A' 가 (15) 가 , 2 (c) , 1 1.5

( 50μm) (6), Cu (1) (9) 가 30μm Cu , Cu (

1) Cu<sub>6</sub>Sn<sub>5</sub> Ni<sub>3</sub>Sn<sub>4</sub> 가 Cu 350 Ni ,

, 1 1.5 가 250μm× 120μm , 가

가 (11) , 750μm Sn-0.75Cu ,

3Ag-0.5Cu( : 221 217 , : 250 ) , Sn-0.75Cu( : 228 , : 250 ) , Sn-

, Cu-Cu<sub>6</sub>Sn<sub>5</sub> 가 , Sn-Pb , Cu

270 ( : 50mm/min) , 0.3kgf  
 /mm<sup>2</sup> , 가  
 가 Ni-Au Al Fe-Ni , Ni 가 3μm , Ni-Sn  
 175 Cu-Sn ( , D. Olsen ; Reliability Physics, 13th  
 Annual Proc., pp80-86, 1975), Ni<sub>3</sub>Sn<sub>4</sub>  
 Cu<sub>6</sub>Sn<sub>5</sub> 가 Ni  
 Sn-40Pb Sn Sn-40Pb 가 , Ni  
 가 . Ni 280 Sn 10 1μm (170 , 8 1μm ),  
 가 , Sn-40Pb , Cu 170 , 6 1μm 가 ( , Cu  
 가 5μm Cu<sub>6</sub>Sn<sub>5</sub> 가 230 , 1 1μm ). 350 5  
 , Cu  
 , Sn-Ag Sn-07Cu , Sn-Cu , Sn-Ag Bi 가 , Sn-Bi  
 , In, Zn, Bi , Sn-Cu , Sn-Ag-Cu Sn  
 , 2 Sn  
 , 3  
 2 (7)  
 , Pb Pb-10Sn Au -20Sn  
 . Cu 5 10μm 가 , 가 . Si ( Cr-C  
 u-Au, Ni ) Cu , Cu (脆性) 가 Sn Cu, Sn Ni  
 4  
 , Cu Ni , 가 , 가  
 , 가 가  
 Sn (2) 가 . 3 (a) (19) Cu (18) (20) ,  
 (75) Cu Ni (20)  
 . 3 (b) 가 가  
 . 5  
 가 3 가 Au-Sn Au-20Sn  
 (280 ) , 280 Sn . Au-Sn 10 37% . Sn Au-20Sn  
 . Au가 , Sn 55 70%  
 252 (Hansen; Constitution of Binary Alloys, McGRAW-HILL 1958),  
 (1 ) 가 (2 ) 252 가  
 AuSn<sub>2</sub> A  
 % 309 , 370 252 Sn:50 55  
 ) Ni(2μm)-Au (0.1μm) , 가 , (19) , 가 Ni(2μm)22-Sn (25  
 3μm: 23) , Sn 가 Ni-Sn , 가 Au-Sn . Sn Sn  
 AuSn<sub>4</sub>가 (217 ) , Au-Sn Sn  
 Sn , AuSn<sub>2</sub> Sn 350 380 , 252

Sn 300 ( , Cu, Ag, Au, Al, Ni), ( , Cu , Cu-Sn , Ni  
-Sn ), ( , Cu<sub>6</sub>Sn<sub>5</sub> )  
Sn , 2 Au , Ni/Au , Sn  
u/Sn, Cu/Ni, Cu/Ni/Au Ni/ Au, Ni/Sn, Ni/C  
6 Al  
Ni/Au , Ni/Sn, Ni/Cu/Sn Al(99.99%) (Hv17), Sn  
Ag가 Sn Al Al-Ag  
Sn , Al Ag, Zn, Cu, Ni . Al . Al  
40μm Al Sn, Ni-Sn, Ag . Al 가 . 20  
7 , Au . Au Sn Au-Sn  
, Au , Sn , Ni, Ni-Au  
Au In . Au  
8 Au In 가  
, Ag . Ag Cu 가 , Ag<sub>3</sub>Sn . Cu 가  
9 Zn-Al , Au-Sn 가  
. Zn-Al 330 370 가 , Sn-Ag-Cu, Sn-Ag, Sn-Cu  
-Al-Mg-Ge, Sn, In, Ag, Cu, Au, Ni , Zn-Al , Zn-Al-Mg, Zn-Al-Mg-Ga, Zn-Al-Ge, Zn  
( (清水) : 「 Pb , Si Zn-Al-Mg-Ga Si Mate99, 1999-2),  
Zn-Al Ni/ , Ni/Cu/ , Ni/Ag/ Au  
Zn-Al Zn-Al 1μm . Zn-Al  
가 . Zn-Al 가 . Zn-Al  
가 400 , 가  
Zn-Al Cu Sn  
Sn, Cu Zn-Al . Sn Cu Ni/Au  
. 200 , Ni Sn (Ni<sub>3</sub>Sn<sub>4</sub>) Cu<sub>6</sub>Sn<sub>5</sub>  
, Sn 5 50% Zn-Al Sn 가 Zn-Al  
Sn-Zn Sn Sn , Sn, Sn-Zn  
가 , Zn-Al Sn 280  
, Zn-Al Sn Sn , Sn

$\mu\text{m}$   
 Zn-Al-Ge, Zn-Al-Mg-Ge, Zn-Al-Mg-Ga ) , Sn, In , Sn . Zn-Al (Zn-Al-Mg,  
 . Zn-Al , Sn , In ( Hv120 160), , Si 가 ,  
 10 15mm  
 5  
 가 . HIC(Hybrid IC), R, C MCM( . . )  
 가 가 AIN , MOSIC , Si 가 GaAs 가  
 $\text{Al}_2\text{O}_3$  (a) Si (35) Si Si (35) R, C  
 가 , Si (8) . Si (49)  
 Cu (29) Si (35) . Cu (29) QFP-LSI  
 (29) Si (35) 가 , 가 Ni/Pd, Ni/Pd/Au, Ni/Sn  
 가 , 가  
 Si Au, Cu (34) Si (35) Au Sn  
 Sn , Au-Sn, Cu-Sn 가 , Au Sn  
 , Au-Sn 250 (26),  
 , Si 가 , AIN ,  $\text{Al}_2\text{O}_3$  , R, C  
 가 , Si 가  
 R, C 5 (b) Si GaAs (8) ,  $\text{Al}_2\text{O}_3$  (19)  
 5 (a) 가 5 (a) 가  
 , , GaAs  $\text{Al}_2\text{O}_3$  가 Cu가 50% ,  
 Cu (thermal via) , (29)  $\text{Al}_2\text{O}_3$   
 가 (33) , , 가 , , Al  
 Al 가 , , 가 , , 가 , Al  
 가 Ni 가 가  
 $\text{N}_2$  5 (c) (39) Al (31) (39)  
 (13) LGA(Lead Grid Array) , (45) Ni/Au Ag-Pt/Ni/Au , Cu/Ni/Au  
 , (13) (36) (39) Cu 가  
 가 가 , (36) (36) (31)  
 , SAW( ) , RF , PA( ) , Li , ,  
 가 가 가 Pb



6 (54) , Pb가 (8) Sn (25) 42 Alloy (29) (53) (5) ; 183  
 Sn-37Pb 220 , Pb가 240 가  
 Sn-3Ag-0.5Cu( ; 217 221 ) 가 20 , Si (25) 42 Alloy (53) 290 , Pb가  
 , GullWing , Flat , J-Lead , Butt-Lead , Leadless  
 가  
 12 RF 7 (a) , 7 (b)  
 Al (31) 1x1.5mm (13) MOSFET 가 가 R, C (17)  
 , 1005, 0603 , 7x14  
 3) (13), (17) (43) (44), Si( GaAs) (1  
 가 (8) (46) (17) (45)  
 (44), (45) 가 (46) (44) , (13) (42)  
 가 ( ) . Cu  
 250 290 가 , Al (31) (43)  
 (46)  
 7 (c) (49) RF BGA (17)  
 (25) (25) (14) (14) 가 (8)  
 (25) (14) (14) 290 5 , (30)  
 , Sn-3Ag-0.5Cu , (49) (30)가 , TSOP-LSI (30)  
 가 , TSOP-LSI (49) (18) , Sn-3Ag-0.5Cu  
 , TSOP-LSI50 TSOP-LSI50  
 240 , 가  
 , 가  
 , 가  
 , 가 Cu , Sn  
 13 , RF  
 8 RF (a) 2 (b)  
 9 8 RF (a) Al<sub>2</sub>O<sub>3</sub> (62) Cu  
 (43) 100 150mm (43) Si (13) ( : 61)가 (Cu  
 , Al<sub>2</sub>O<sub>3</sub> /Ni/Au , Ag-Pt/Ni/Au가 (45) (49)  
 : 44)가 , (49) Al<sub>2</sub>O<sub>3</sub> Cu  
 [ 9 (d)]. , ( Al<sub>2</sub>O<sub>3</sub> ) , Al<sub>2</sub>O<sub>3</sub> /Ni/Au  
 (43) Ag-Pt ( Ag-Pt /Ni/Au  
 ( W-Ni, Ag-Pd 가 ) Ti/Ni/Au , Cr/  
 , Si , Cr/

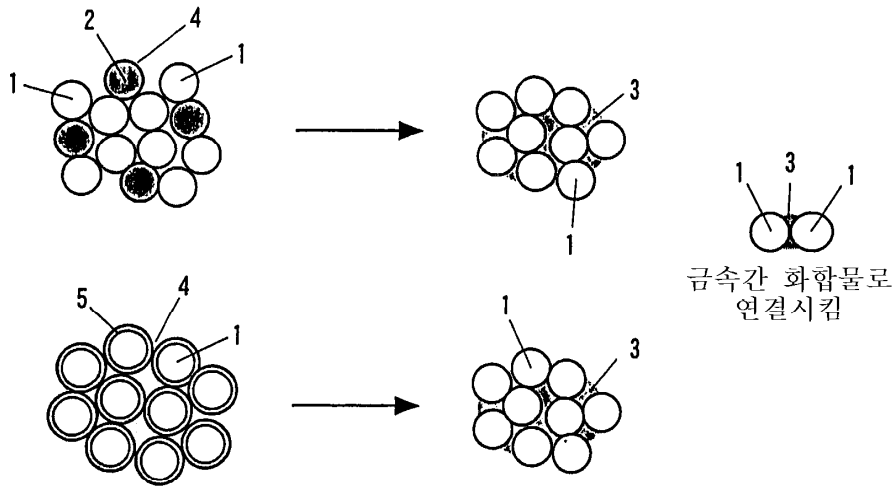
Ni/Au 가  
 Si (13) (17) ( ) , Al<sub>2</sub>O<sub>3</sub>  
 (8) [ 9 (b) ] . , 9 (c) .  
 , 3 (43) , 10 (65) Al<sub>2</sub>O<sub>3</sub>  
 , 11 (73) Al<sub>2</sub>O<sub>3</sub> 가 ,  
 LGA 가 .  
 8 (a) , 1x1.5mm (13) 가 290 가 , Si (17) (17) Al<sub>2</sub>O<sub>3</sub> . 290  
 가 Cu , Sn , Cu, Ni . Cu , Cu  
 Sn 2 250 , 2 , 2  
 , Si Sn Si 2 ,  
 250 , Pb (290 가 ) 가  
 12 Pb ( : 245 ) 가 ( Sn-Pb  
 Sn Sn-Pb , Sn-Pb 180  
 1000MPa : 68) , Sn-Pb 2 (22  
 0 ) [ 11 가 가 , (30) Sn-Pb Sn-Pb ],  
 (17) (71) 가 , Pb 245 , 18  
 0 , Sn-Pb , 2 (220 ) , Au . Pb , Pb (76)  
 , 3.6% (70) (69) (70%)  
 (180 ) , , , 180  
 MPa 10MPa 가 , , 180 , 180 200  
 가 2% 가 , 180 200MPa  
 , , Sn 1/2.6 , Sn 13  
 , 13 Cu 1.4%가 , Pb 가 Sn  
 , Sn Cu 가 , 13  
 가 가 가 , 가 500MPa  
 , Cu 가 , 가 ,  
 , , MOSIC, , ,  
 14 , IC , 14 (a) (51)  
 ) (52) , 14 (b) , 14 (c)  
 , (51) (25) (8) ( : 52) (25)  
 , Cu (25) (51) (52)  
 15 (52) , (36) (51) (52) (25)

(25) , Sn , (51) (8) , Si ,  
 Cr-Ni-Au, Cr-Cu-Au, Ti-Pt-Au 가 Au가  
 , Au-Sn Au , 1kgf, 300 5 ,  
 Zn-Al , ,  
 15  
 16 BGA, CSP , (25) (14) 270 Cu (80) Pb가  
 , Pb가 , Sn Pb-(5 10)Sn  
 , 16 (a) BGA, CSP , , (b) , (c)  
 , (d) Cu (b) Cu Ni/Au (83)  
 16 (a) Sn-Ag-Cu (30) (82) Sn ,  
 , Si (25) Cu, Ag, Au Al Au (80),  
 (Cu, Ni, Ag ) (84) Sn  
 (84) (Sn, Sn-Ag, Sn-Ag-Cu, Sn-Cu In, Bi, Zn 가 )  
 (Al<sub>2</sub>O<sub>3</sub>, AlN, )  
 가 (83) Sn (84) , 280 가 ,  
 가 Si : 50 1500OMpa, : 10 60  
 ×10<sup>-6</sup> / (無溶劑) (81) BGA, CSP  
 , 16 (b), (c), (d)  
 17 16 (b) Cu (80) Si (25) (14)  
 . Si (20) (82) Ti/Pt/Au ,  
 (85) (82) Sn , Sn-Ag-Cu ,  
 . Pt Sn 0.1μm 가 , (80)  
 (85) Pt<sub>3</sub>Sn, PtSn<sub>2</sub> 가 ,  
 17 (a) Sn (23) (4) , 150μm (Cu : 80) 가  
 가 290 , 5 가 (82) Cu ,  
 가 Sn 가 ,  
 가 (34) , Cu  
 Cu  
 17 (b)가 , Cu (84) Pt-Sn, Cu-Sn  
 , Sn , Cu 가 , 가  
 ( , ) , 가  
 (14) (83) (36)  
 , 290 5 가  
 17 (c) 가 , Si (82) , (83)  
 , (41) ,  
 16 (c) Si (Cr/Ni/Au : 48) Cu, Ag, Au (86)  
 ( 가 ) , 가 , Cu Sn  
 , Sn , Au, Ag, Cu, Al  
 . Al , Al 가 16 (b) 가 ,  
 가 , 280 , 가 Sn (41) , 16 (b)

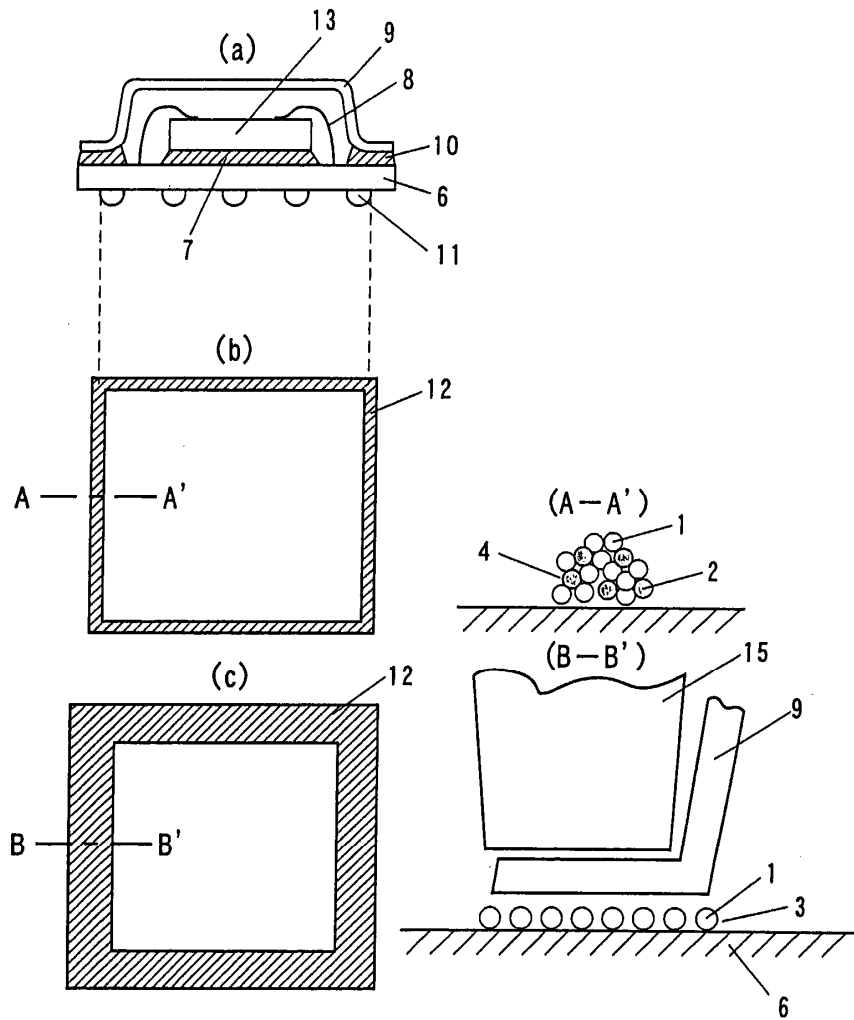


8. In, Zn Bi 가
- 4 6 , , , AIN SiC
9. 4 6 , , , AIN SiC
10. , 가 1 , 1 2
- Cu<sub>1</sub> Cu<sub>6</sub>Sn<sub>5</sub> 1 Cu Cu<sub>6</sub>Sn<sub>5</sub> 2 , Sn-Ag , Sn-Ag-Cu , Sn-Cu Sn-Z
11. 10 , 1 Sn Sn Cu
12. 10 , 1 Sn , Sn-Cu , Sn-Ag
- Sn-Ag-Cu , Cu
13. 12 Cu , 0.6 1.4
14. 11 13 In, Zn Bi 가
15. 11 13 , , , AIN SiC
16. 11 13 , , , AIN SiC
17. 10 1 13 2 , Sn-Ag , Sn-Ag-Cu , Sn-Cu Sn-Z
18. 17 1 , 2 Sn-(2.0 3.5)mass%Ag-(0.5 1.0) mass%Cu
19. , , , Cu Cu<sub>6</sub>Sn<sub>5</sub> , Cu Cu
20. 19 , , Sn-Ag-Cu , Sn-Cu Sn-Zn , Sn-Ag

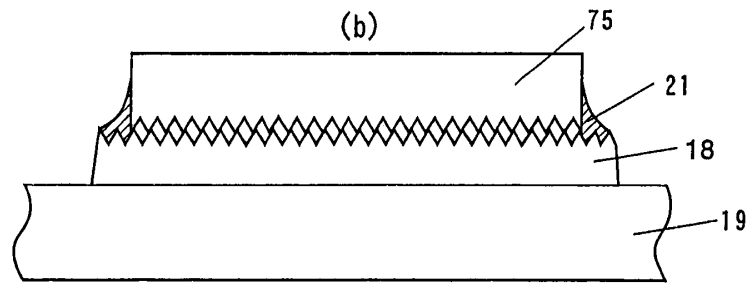
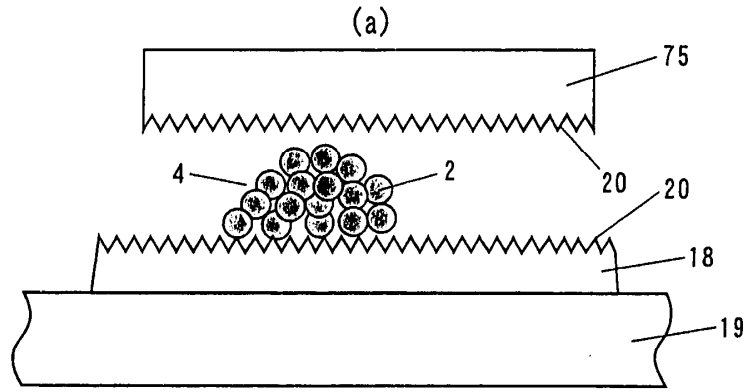
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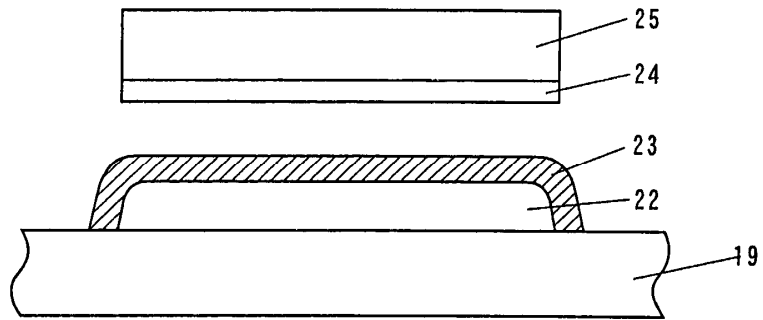
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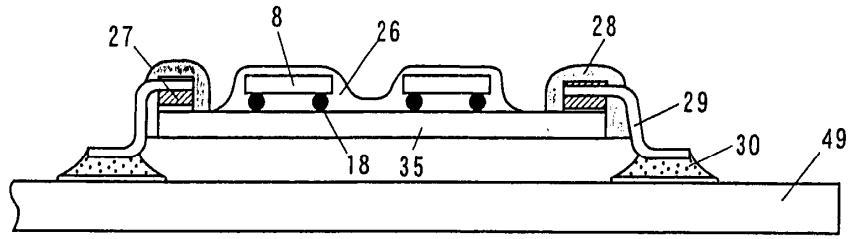
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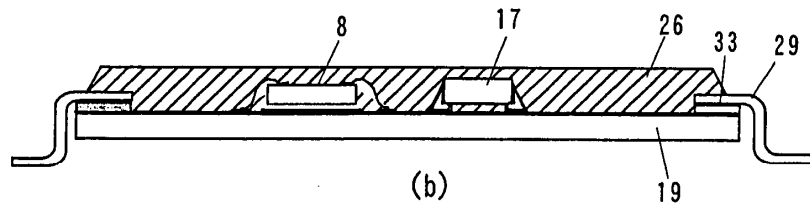
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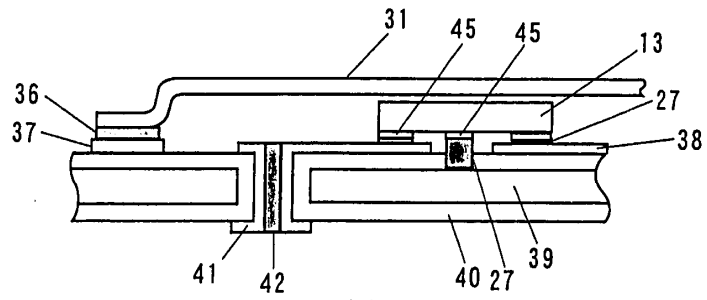
5



(a)

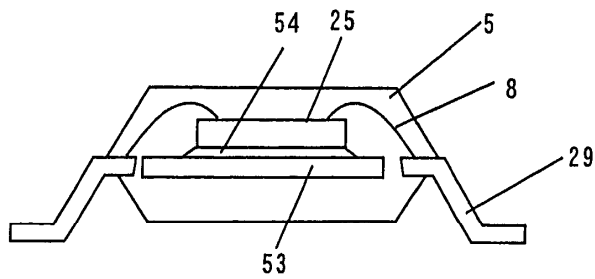


(b)



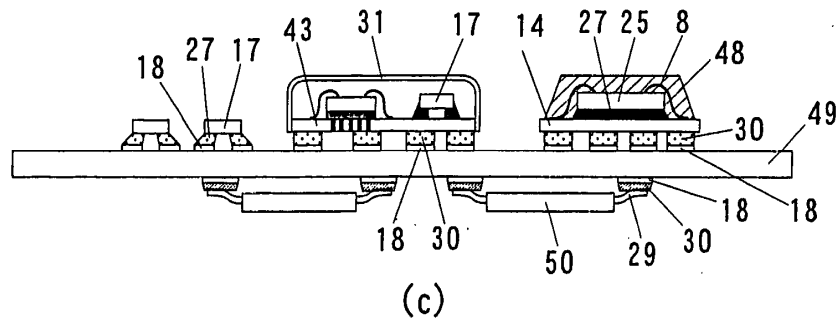
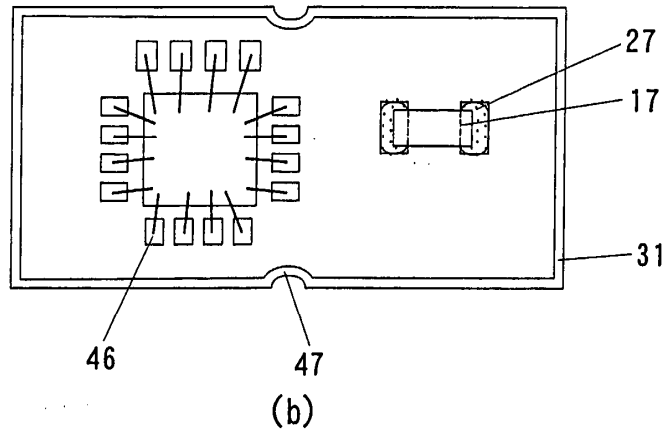
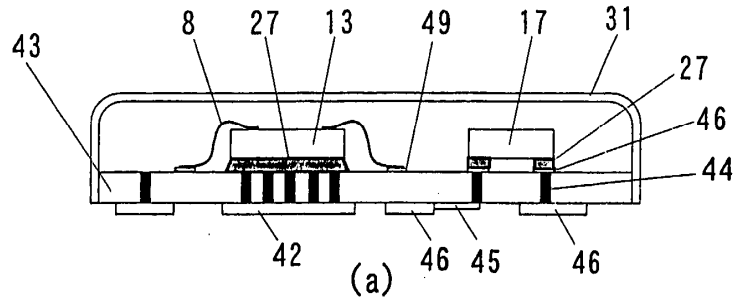
(c)

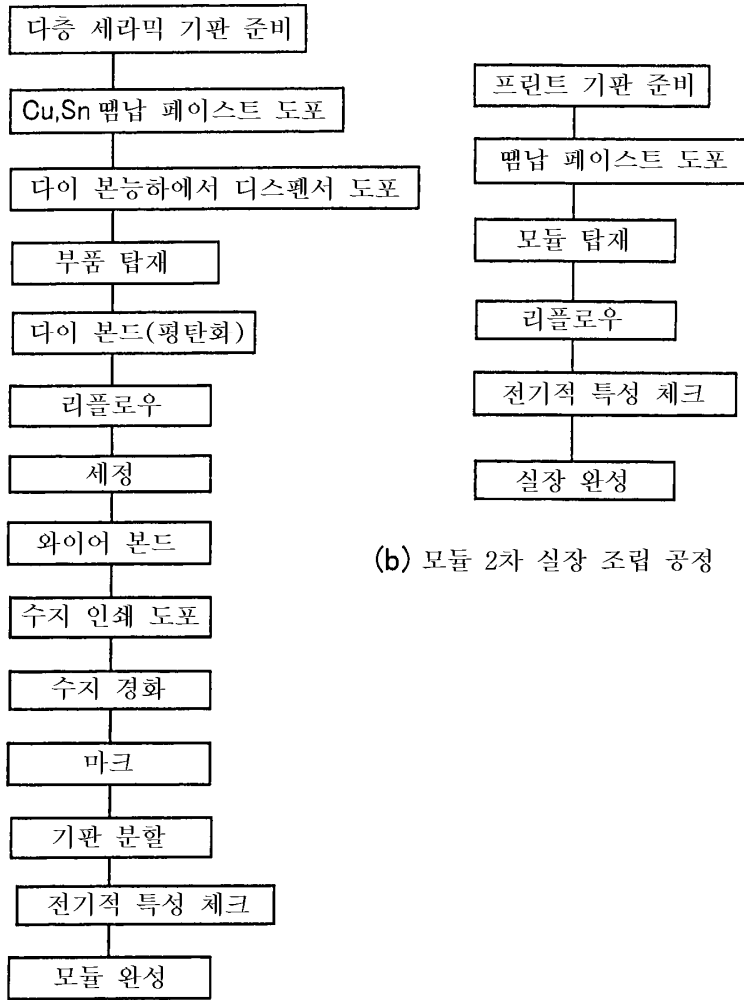
6





7

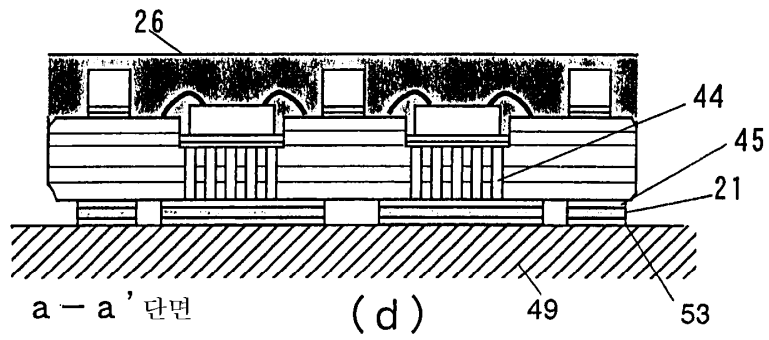
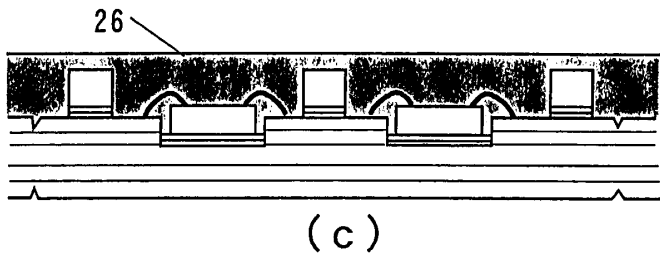
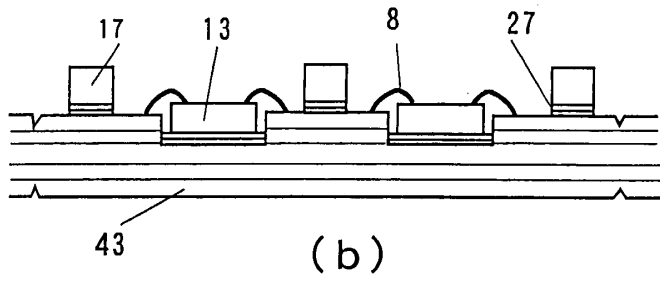
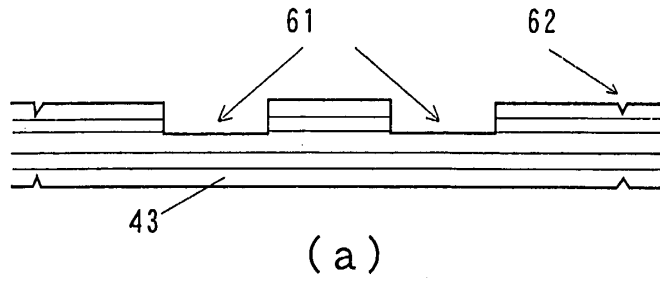


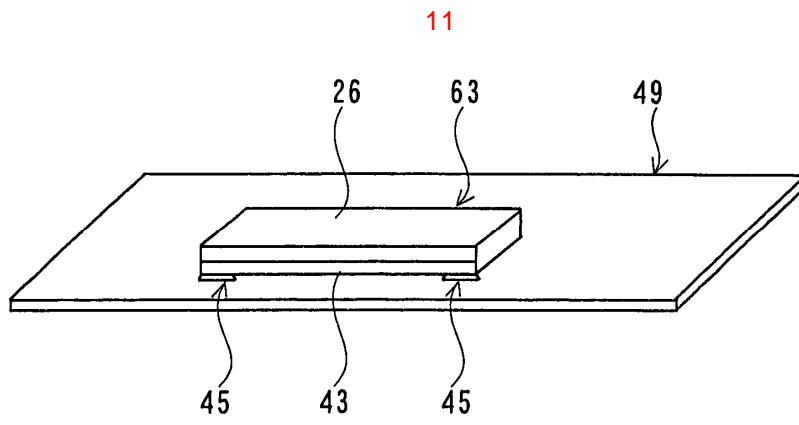
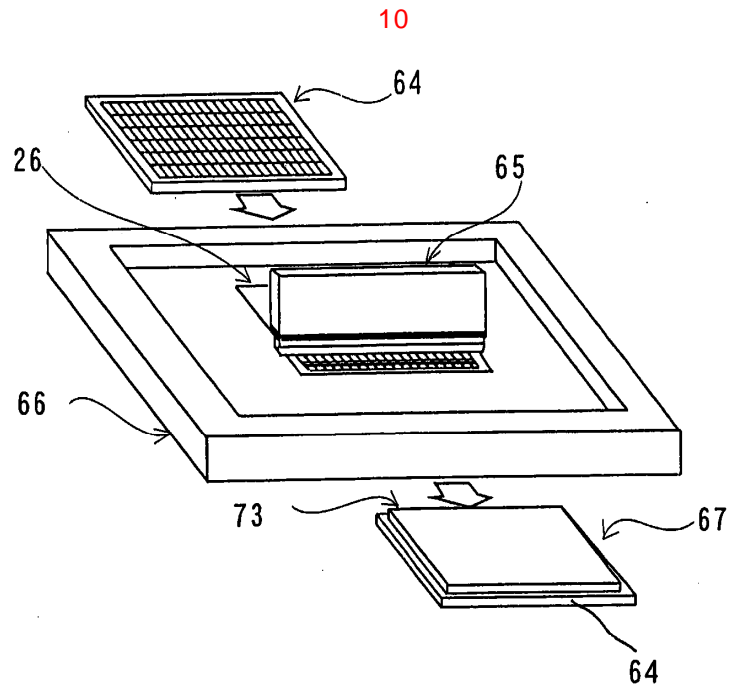


(a) 모듈 조립 공정

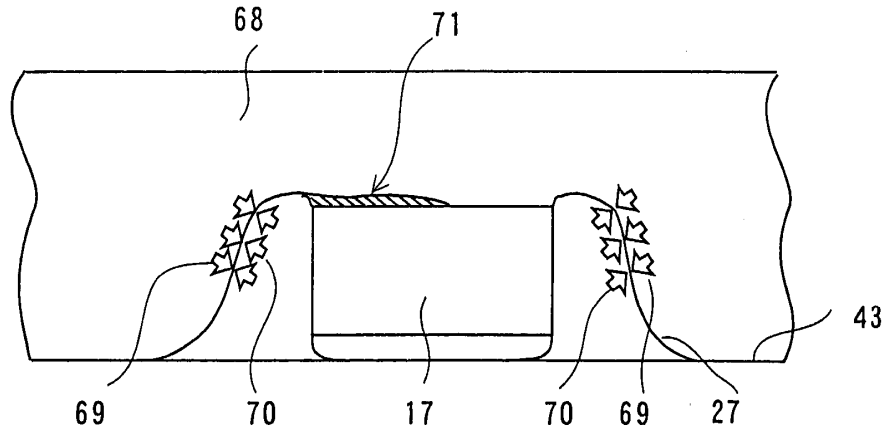
(b) 모듈 2차 실장 조립 공정

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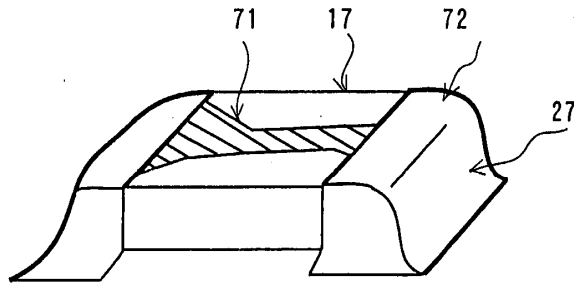




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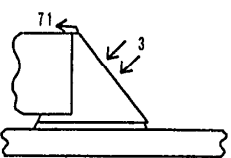
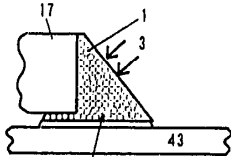
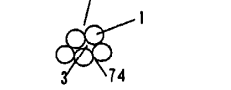


(a)

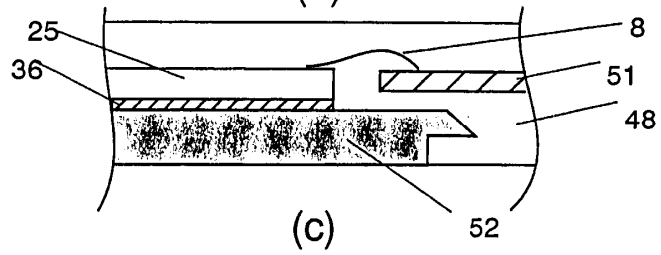
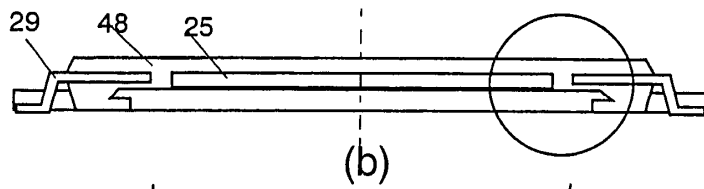
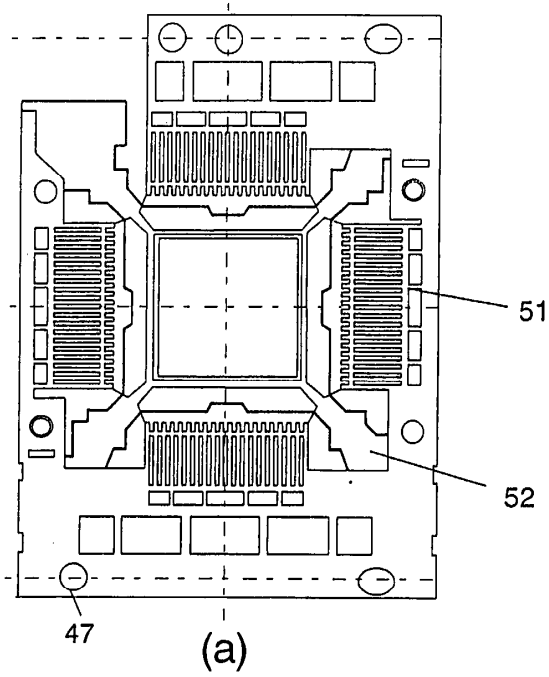


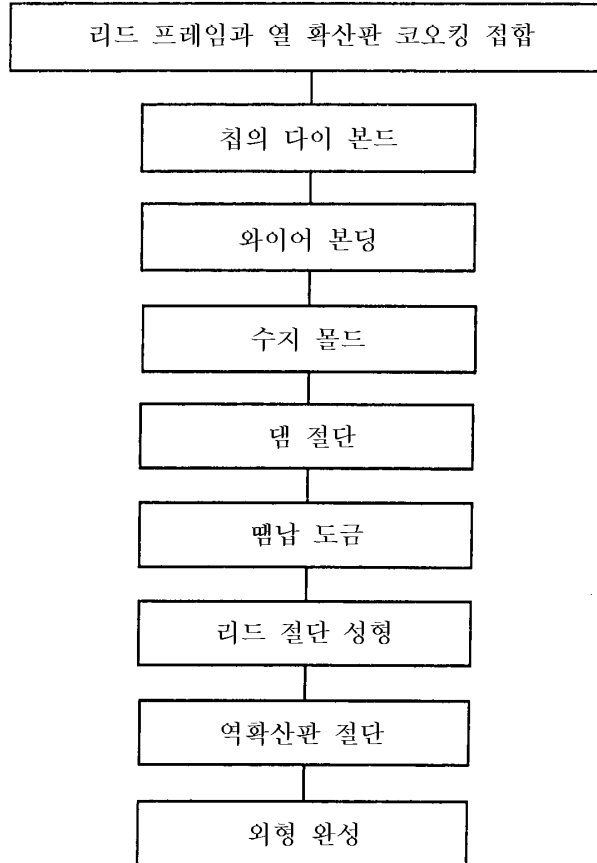
(b)

13

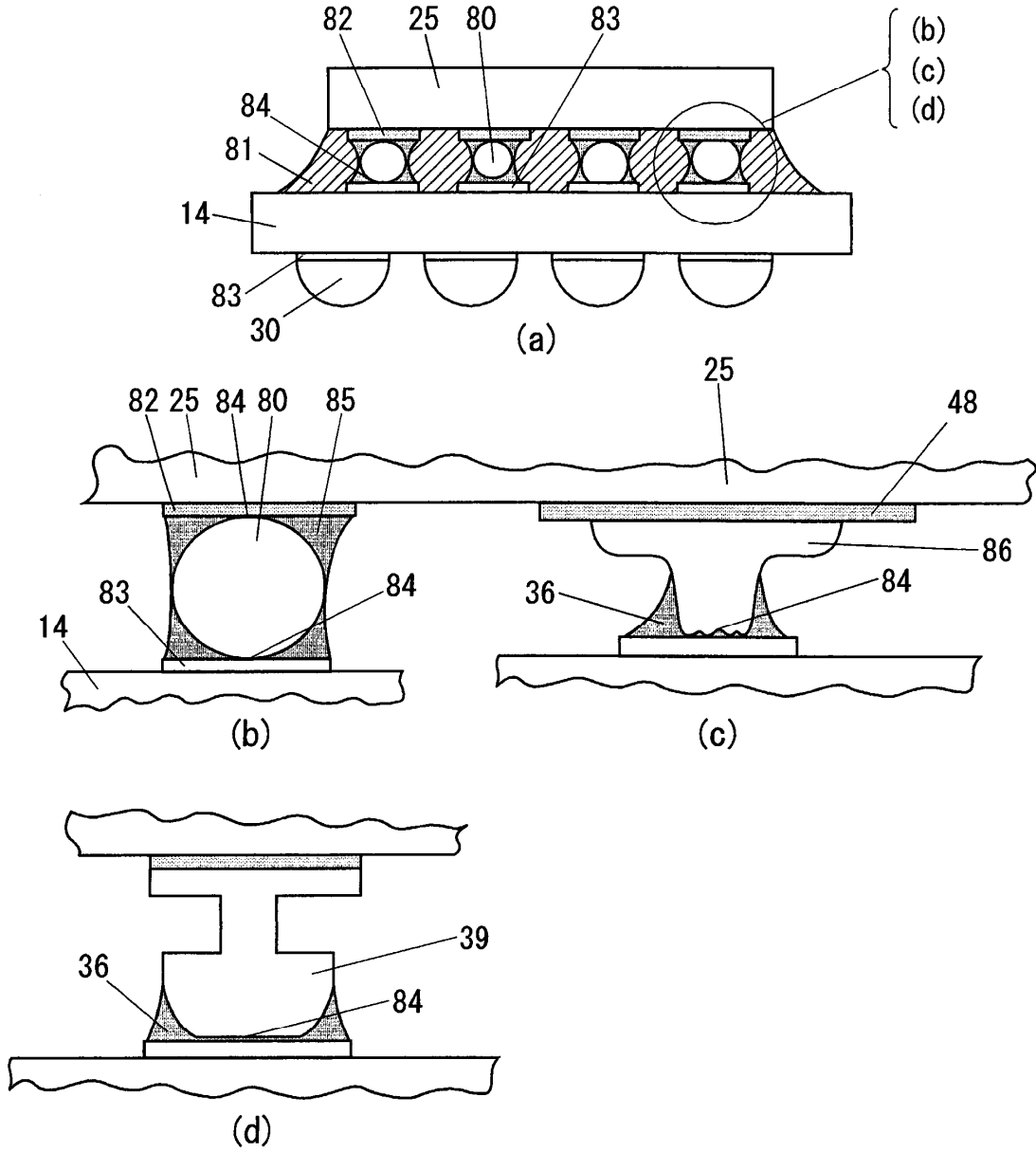
	체적 팽창(%) (비율)	수지에 요구되는 종탄성율	현상	
현용 (Pb계)	3.6 (2.6)	180°C에서 200MPa >	재용융시에 액체(고상 있음)의 클리프 타임	
본인 (Cu50/Sn50)	1.4* (1)	180°C에서 500MPa >*	Cu 입자가 고정되어 있기 때문에, 접합부는 움직이지 않는다고 예상됨	
가정	* Sn의 1/2로함	*단순히 현용의 현재 사용하는 것의 1.5배한 값		

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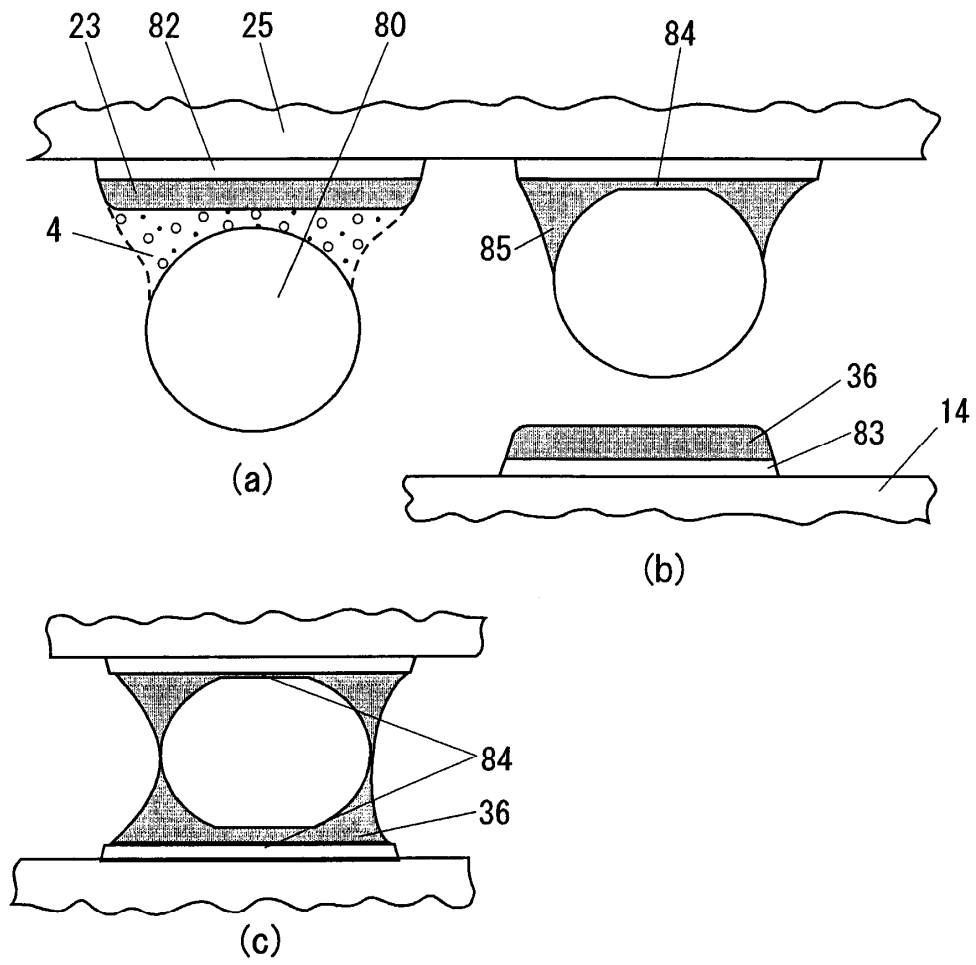


16

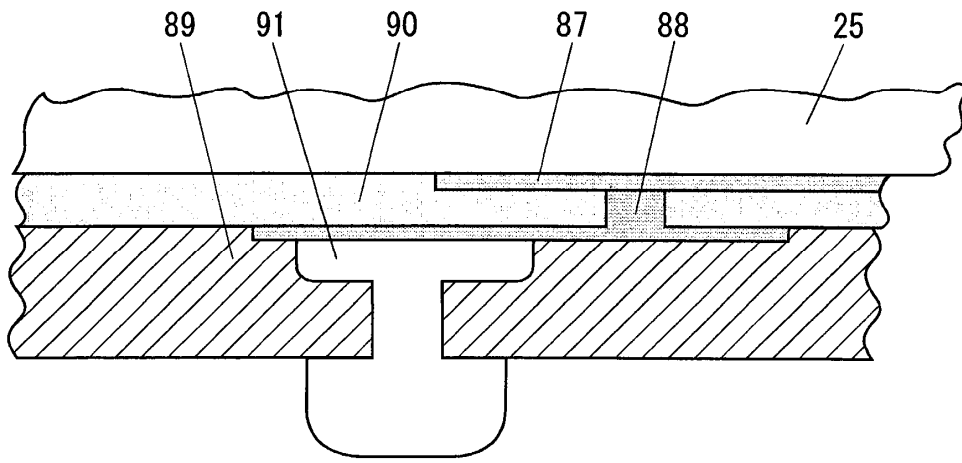




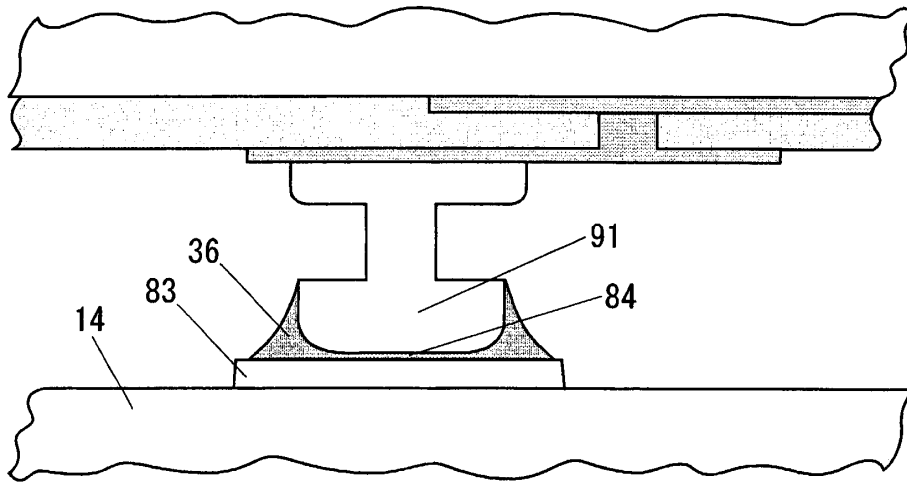
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(a)



(b)

Sn/Cu 비율	평가 판정	판정 이유
10/4	×	↑
10/5	×	Sn이 많다
10/7 (1.43)	△	적정 범위
10/8 (1.25)	△~○	
10/10	○	
10/12.5 (0.8)	○	
10/15	△~○	
10/16.7 (0.6)	△	
10/25	×	Sn 부족
10/50	×	↓
10/100	×	↓

판정 기준 : ○ : 적정      △ : 대체로 적정  
 × : Sn 부족(과다)

압축 범위