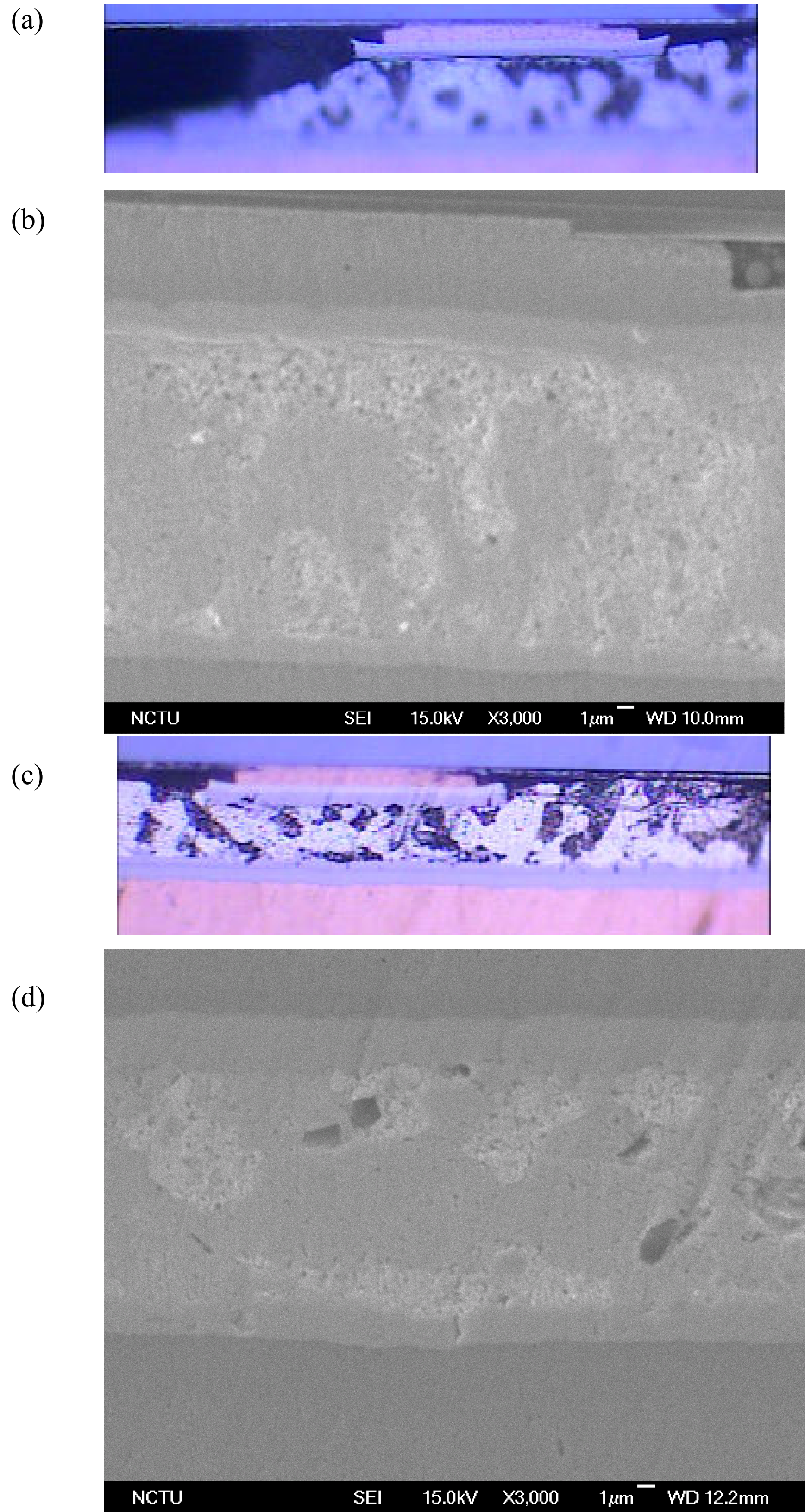
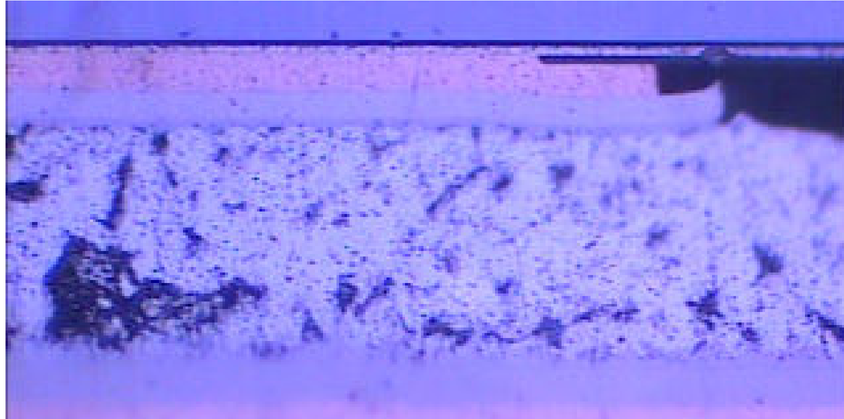
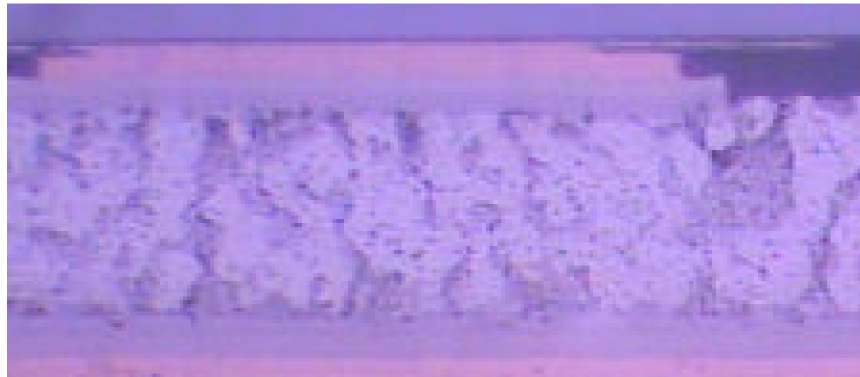


Fig. 4.5 Aging at150℃(a)aging 1000hr OM(b)aging1000hr SEM(c)aging 1500hr OM(d)aging 1500hr SEM

(a)

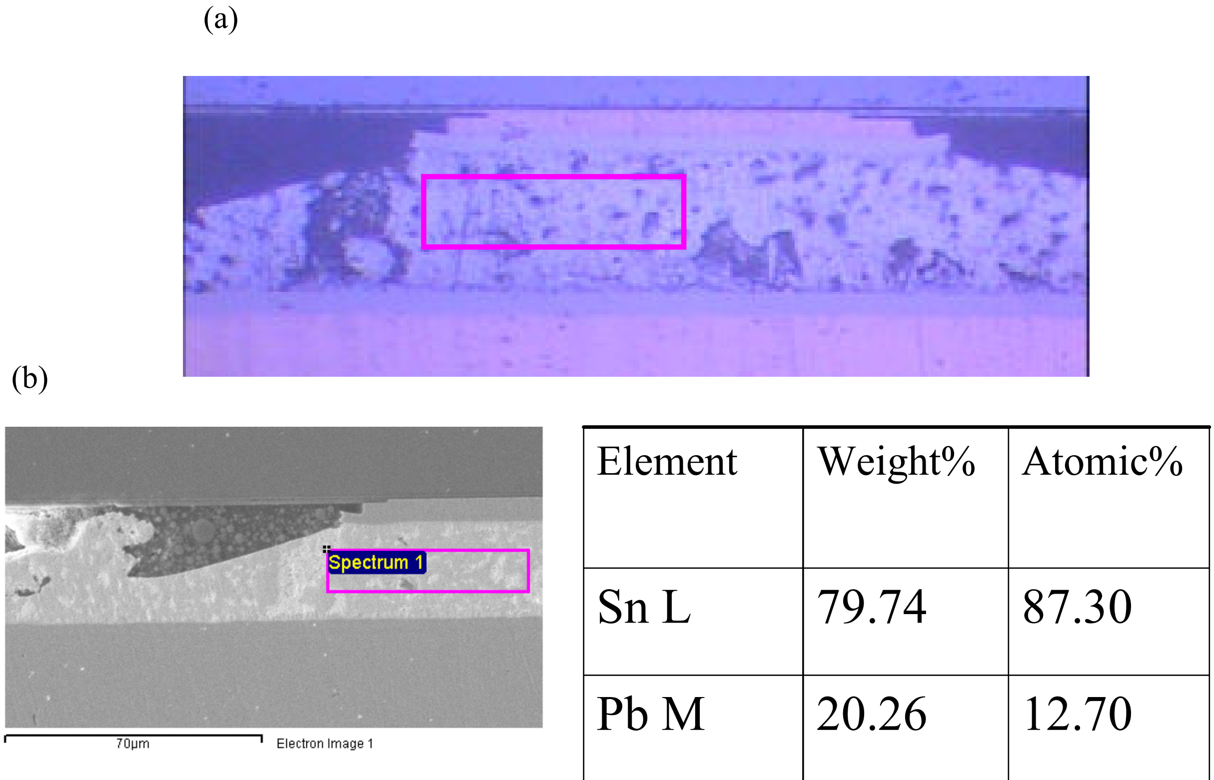


(b)



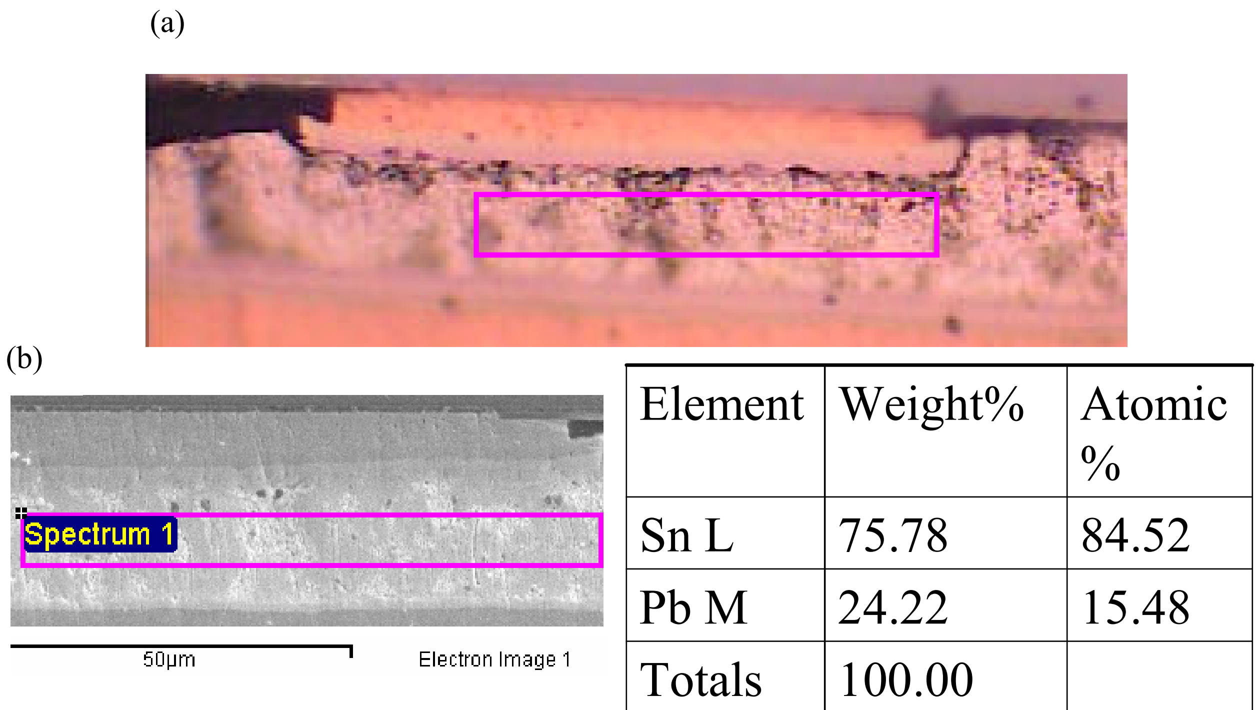
(c)

Fig. 4.6 Thick-film bump IMC thickness and aging time under 170℃(a)0hr(b) 25hr(c)50hr



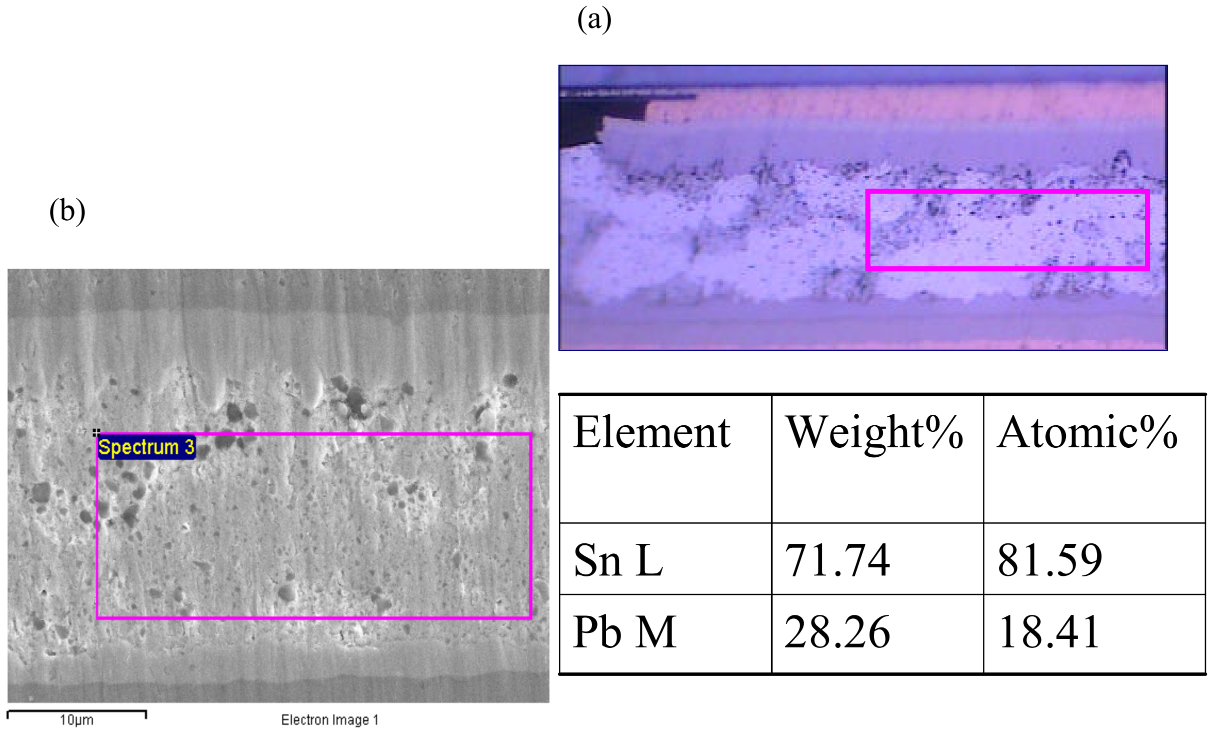
Element	Weight%	Atomic%
Sn L	79.74	87.30
Pb M	20.26	12.70

Fig. 4.7 No aging solder bump composition(a)OM image(b) SEI image



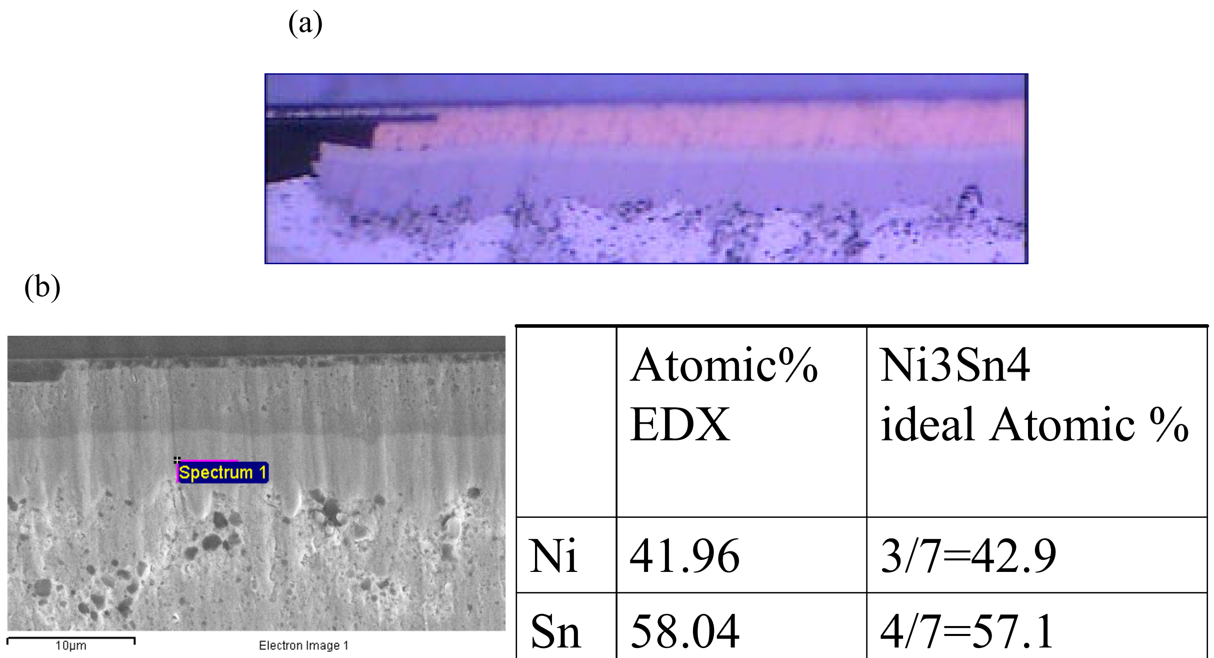
Element	Weight%	Atomic %
Sn L	75.78	84.52
Pb M	24.22	15.48
Totals	100.00	

Fig. 4.8 Aging 25hr solder bump composition (a)OM image(b) SEI image



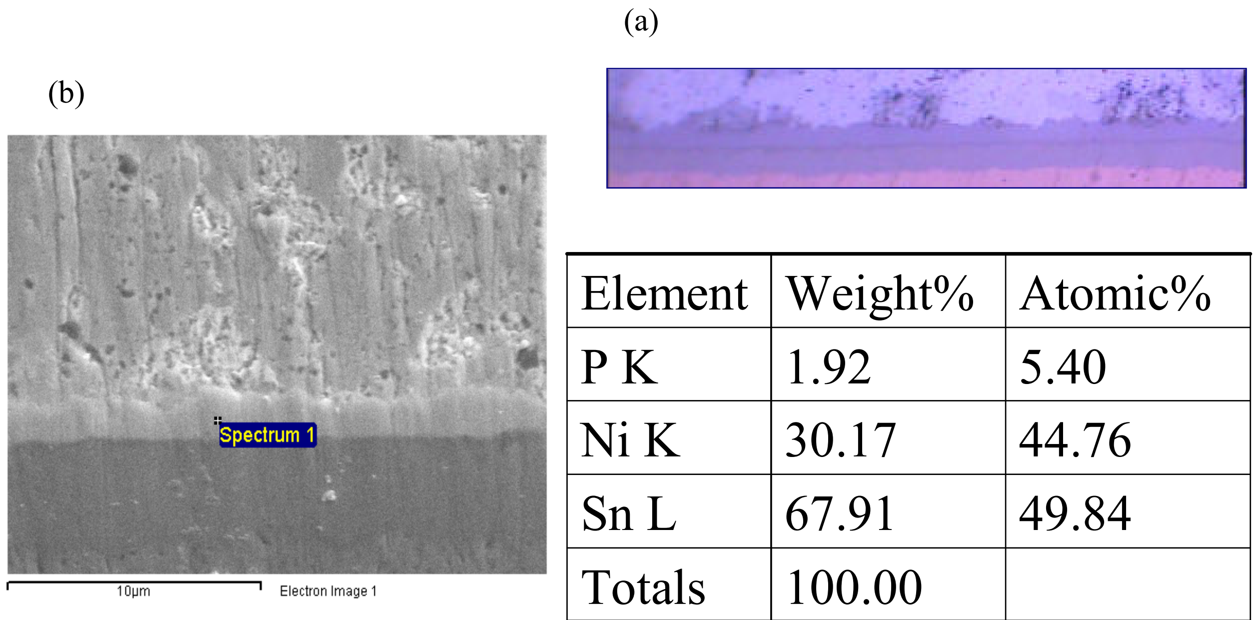
Element	Weight%	Atomic%
Sn L	71.74	81.59
Pb M	28.26	18.41

Fig. 4.9 Aging 50hr solder bump composition (a)OM image(b) SEI image



	Atomic% EDX	Ni3Sn4 ideal Atomic %
Ni	41.96	3/7=42.9
Sn	58.04	4/7=57.1

Fig. 4.10 Chip side IMC (a)OM image(b) SEI image



Element	Weight%	Atomic%
P K	1.92	5.40
Ni K	30.17	44.76
Sn L	67.91	49.84
Totals	100.00	

Fig. 4.11 board side IMC (a)OM image(b) SEI image

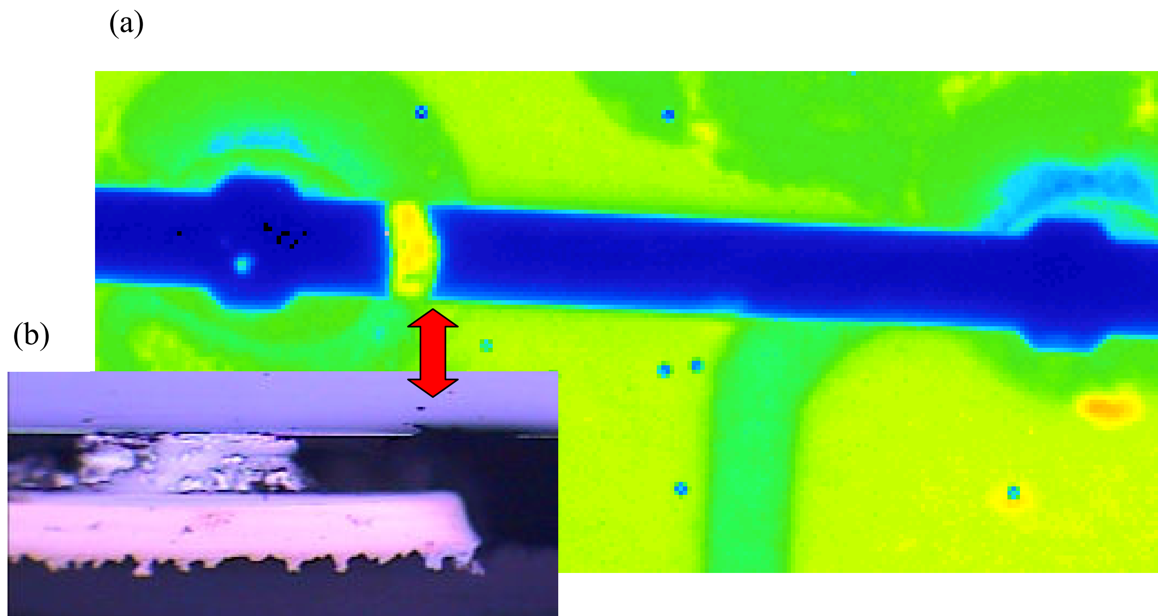


Fig. 4.12 Electromigration test fail at Al line instead of solder bump(a)IR image(b)OM image

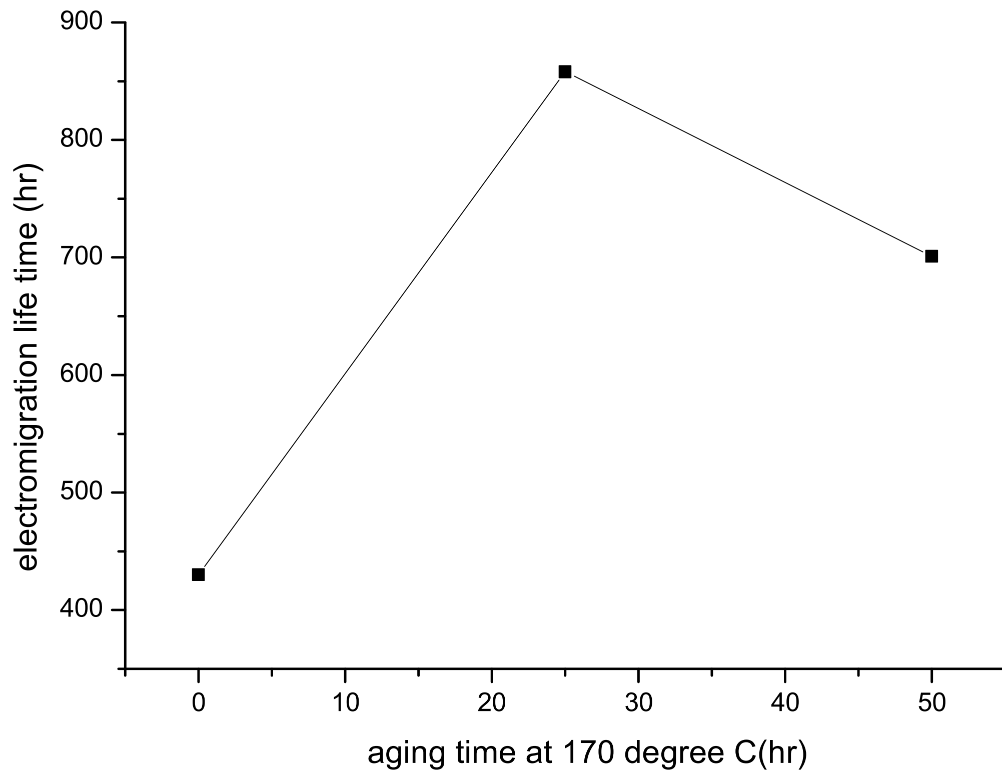


Fig. 4.13 Electromigration life time and under 170℃ aging time in thick-film UBM

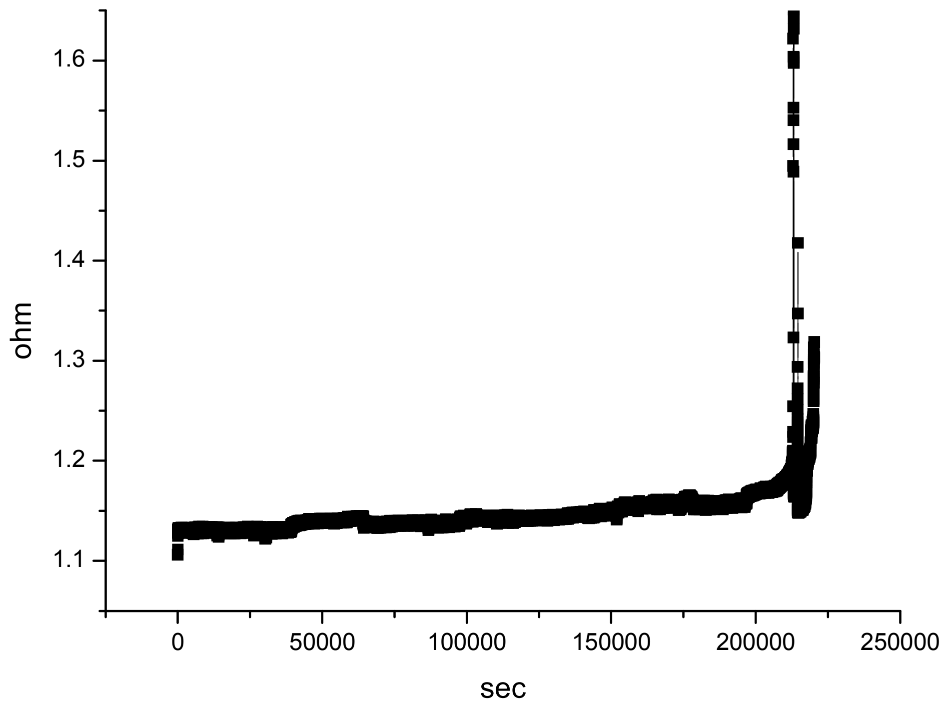


Fig. 4.14 All resistance of sample change before fail 61hr(total life time 385hr)

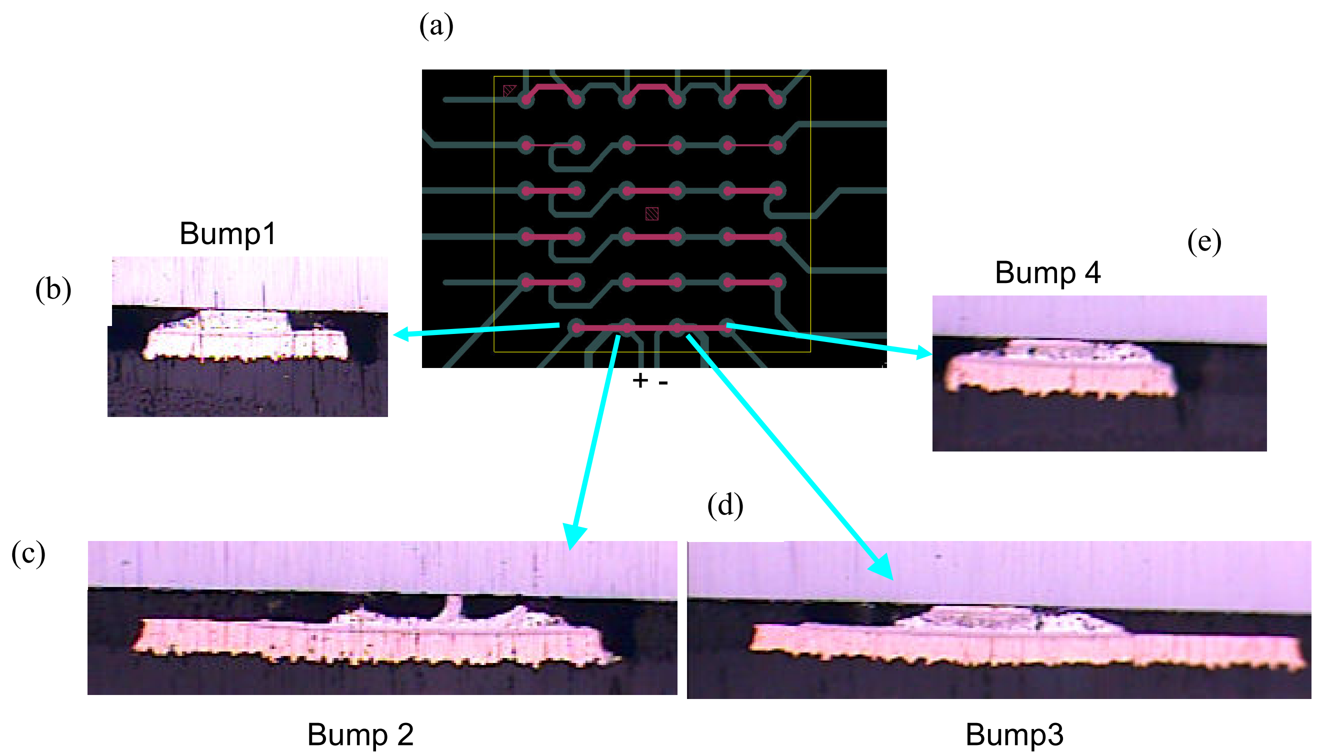


Fig. 4.15 Aging 0hr (failed at 385hr) OM image (a)chip side bump and Al distribution (b) bump1 (c)bump2 (d)bump3 (e)bump4

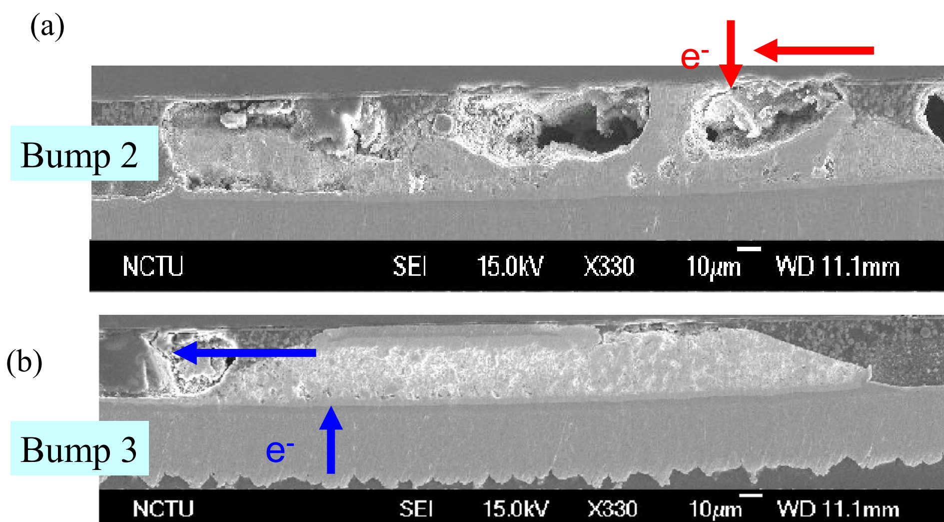


Fig. 4.16 Aging 0hr (failed at 385hr) SEM image(a)bump2 (b)bump3

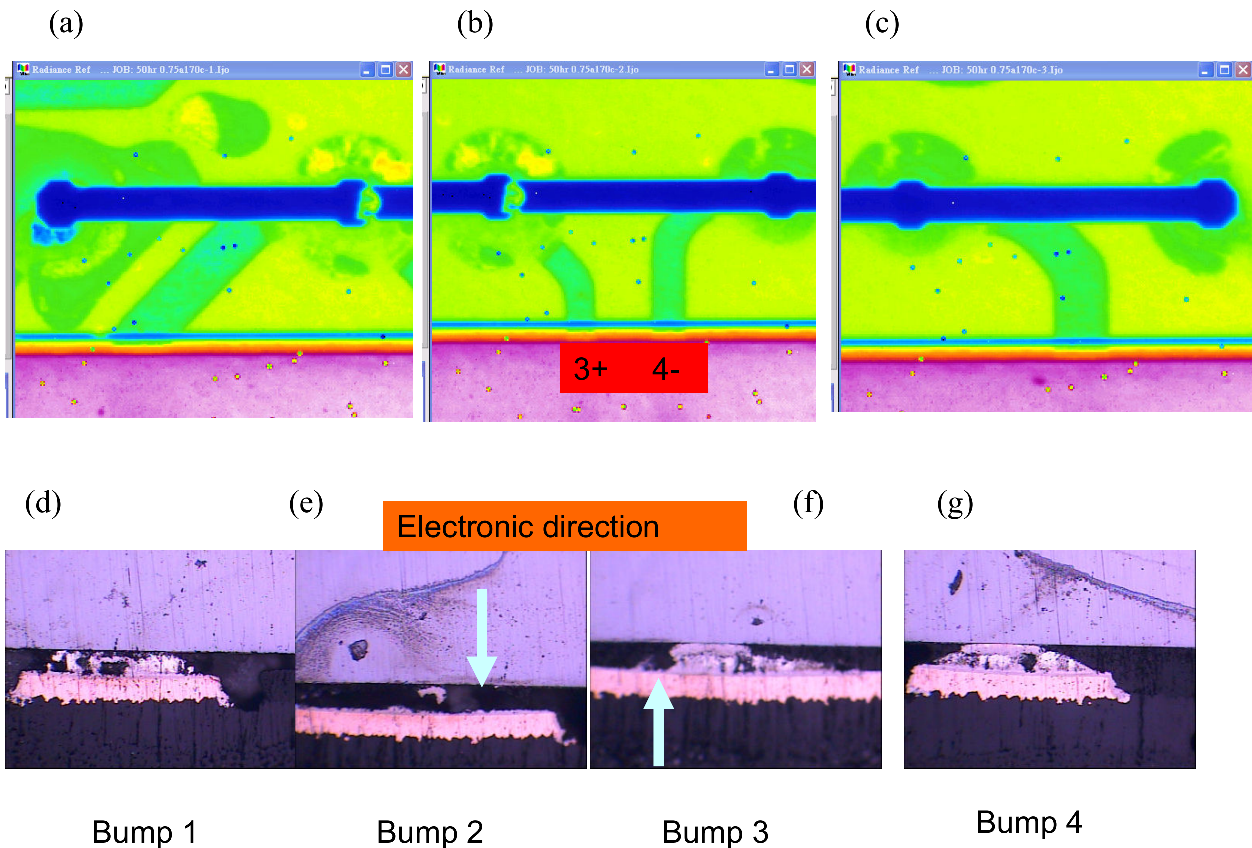


Fig. 4.17 Aging50hr (failed at 701hr) IR result and OM image(a)IR image of bump1 and bump 2(b) IR image of bump 2 and bump 3(c) IR image of bump 3 and bump 4(d)OM image of bump1(e) OM image of bump 2 (f) OM image of bump 3 (g) OM image of bump 4

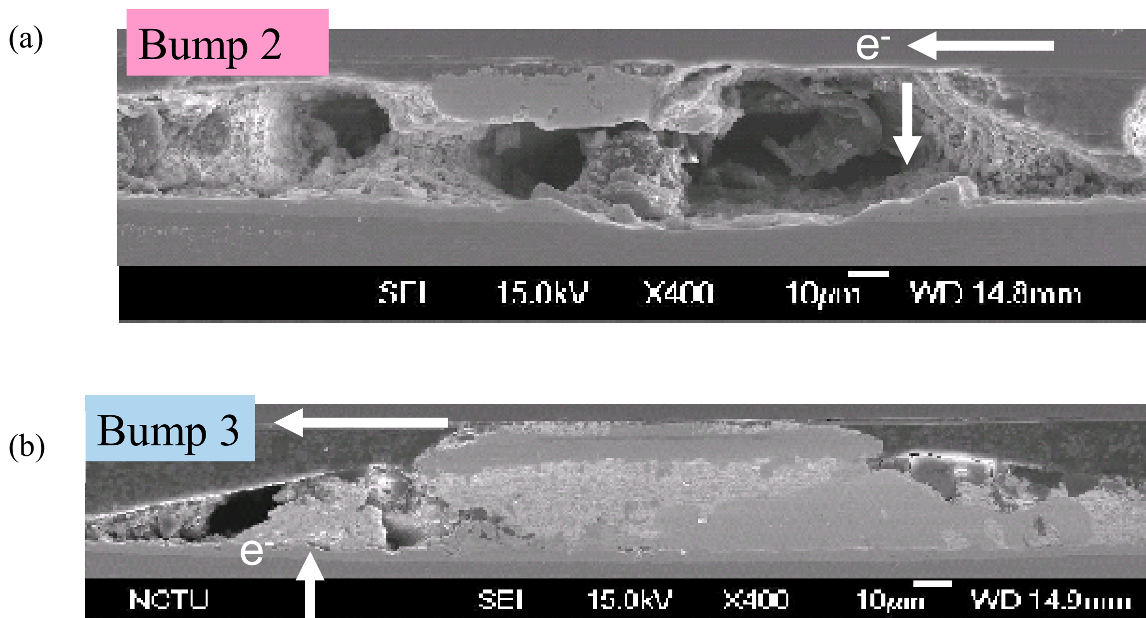


Fig. 4.18 Aging 50hr (failed at 701hr) SEM image(a) bump 2(b) bump 3