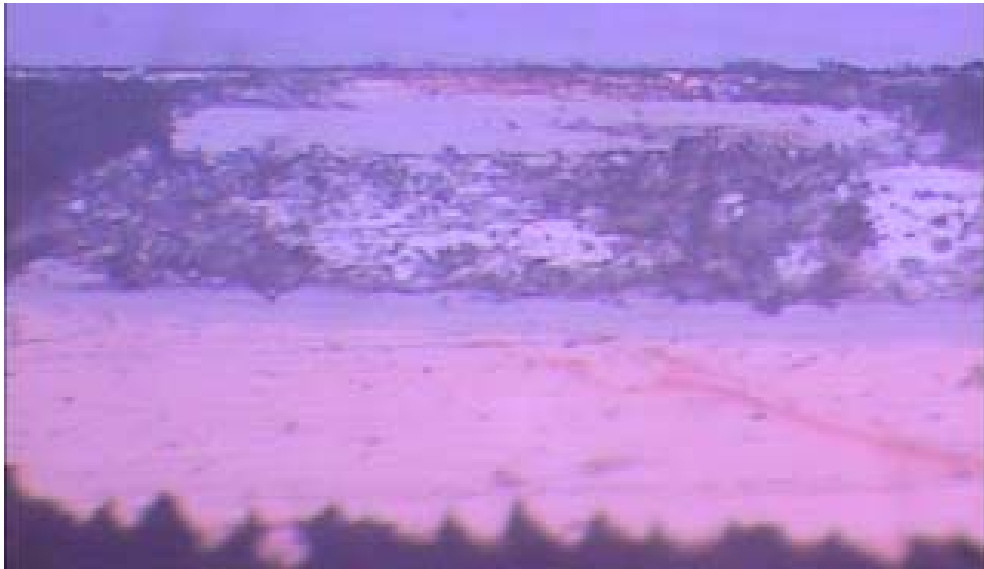


Fig. 4.19 Aging 50hr (failed at 701hr) SEM image of bump 1(a)OM image
(b)SEI image (c)BEI image

(a)



(b)

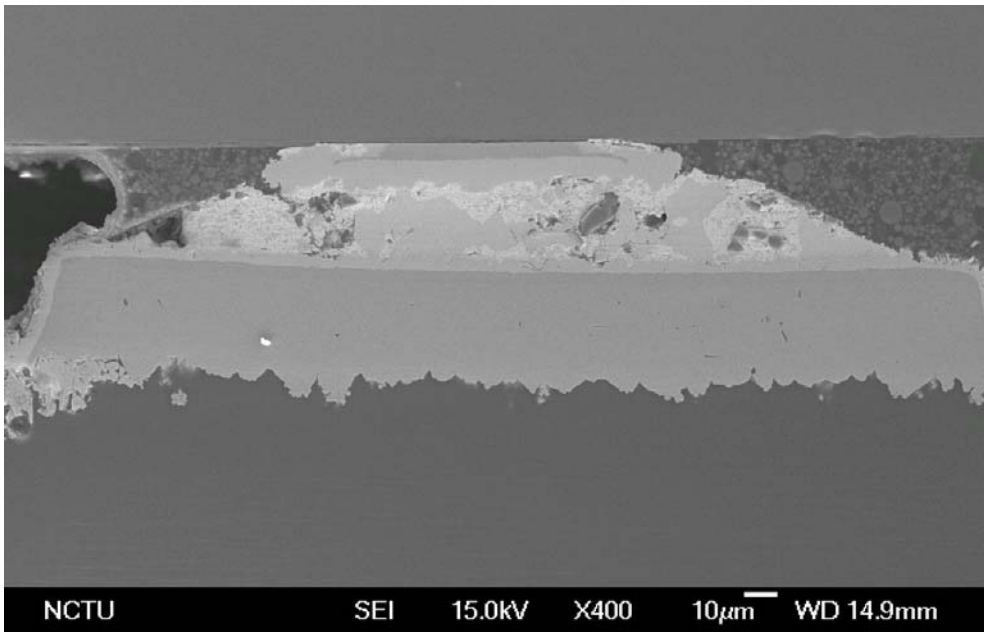


Fig. 4.20 Aging 50hr(failed at 701hr)SEM image of bump 4(a)OM image(b)SEI image

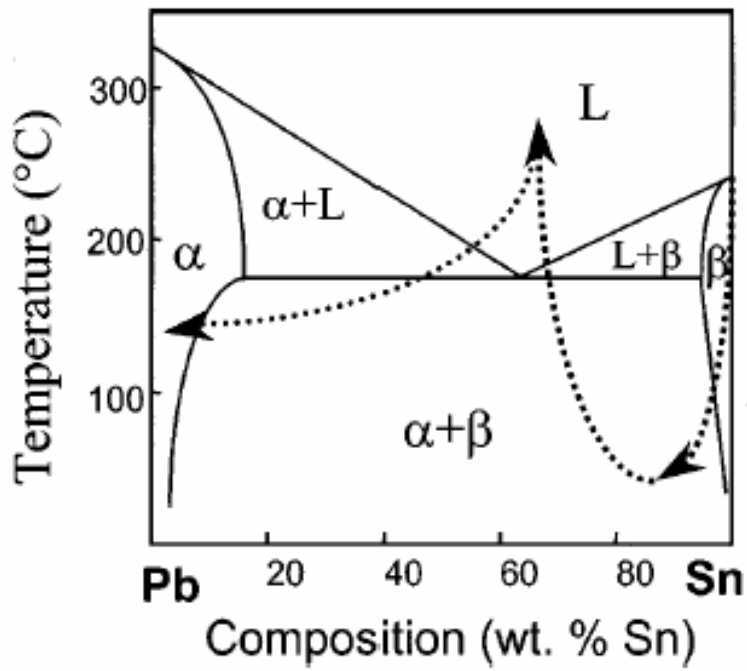


Fig. 4.21 The rate of electromigration as function of alloy composition

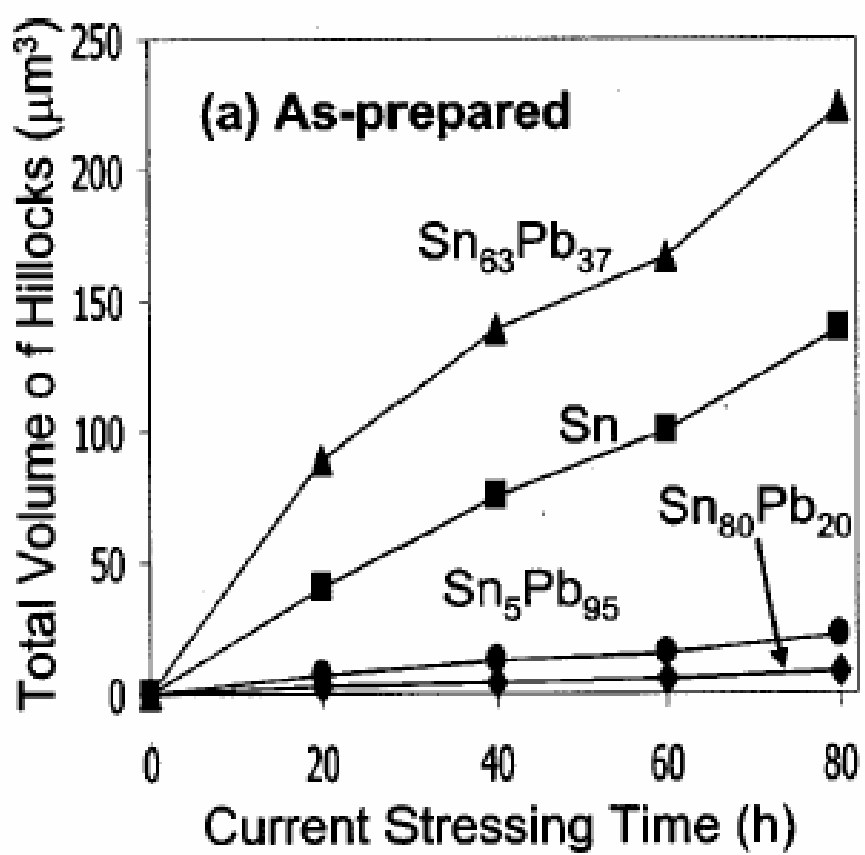


Fig. 4.22 Total volume of hillock vs the current stressing

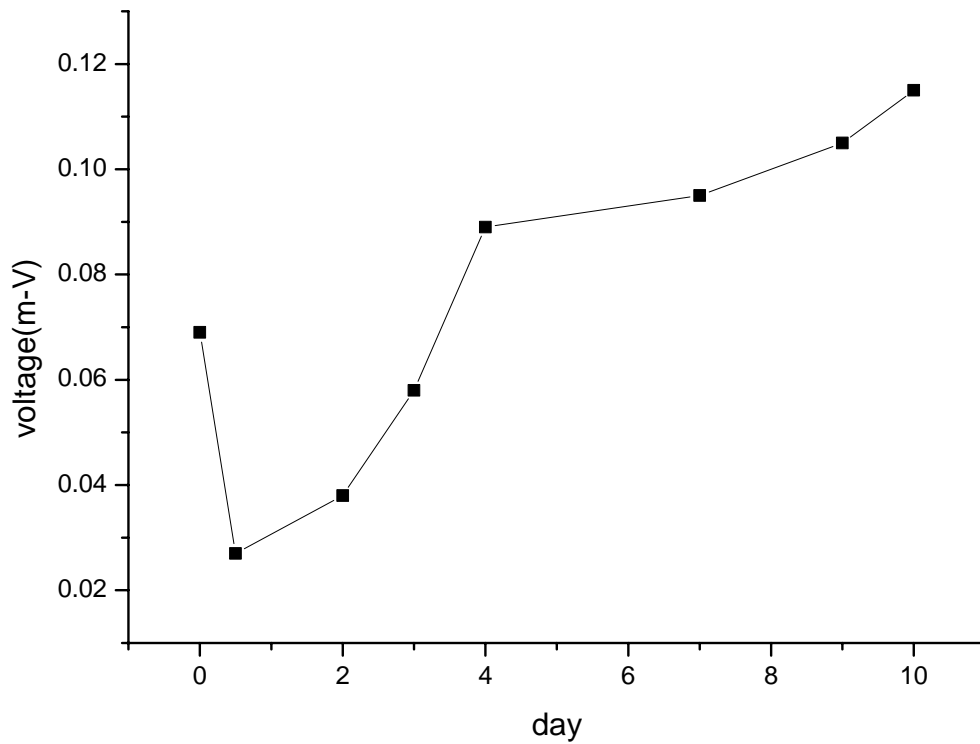


Fig. 4.23 Aging 0hr under 0.75A 243hr not fail bump resistance become 4.25times bump resistance change vs time(day) .

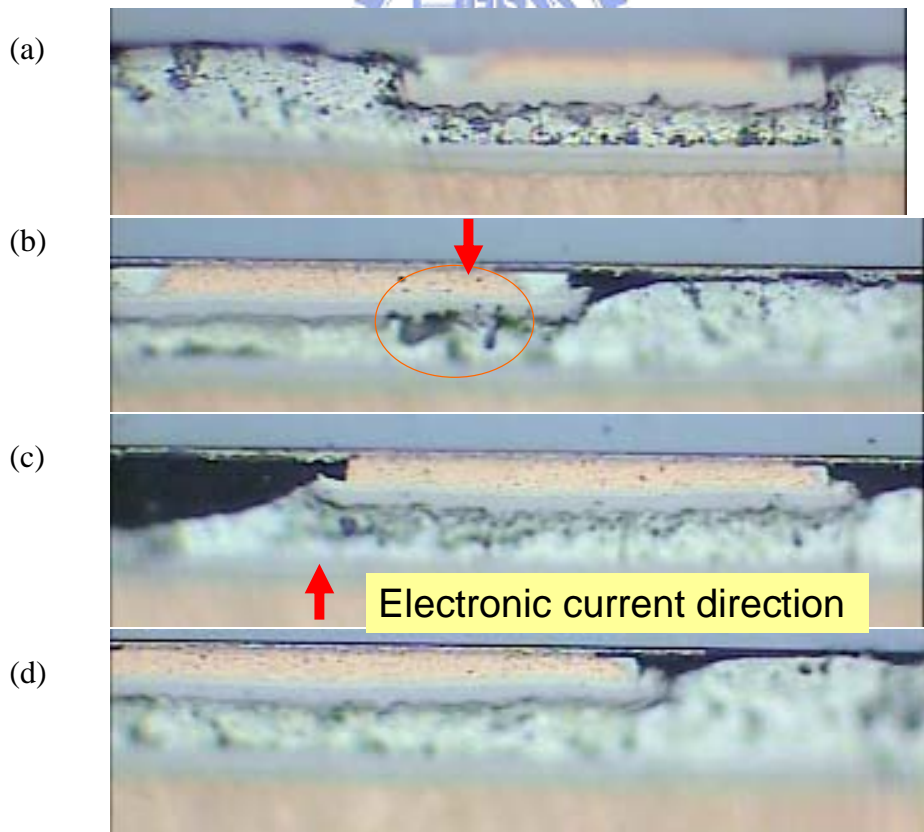


Fig. 4.24 OM image of aging 0hr under 0.75A 243hr bump resistance become 4.25 times(a)bump1(b)bump2(c)bump3(d)bump4.

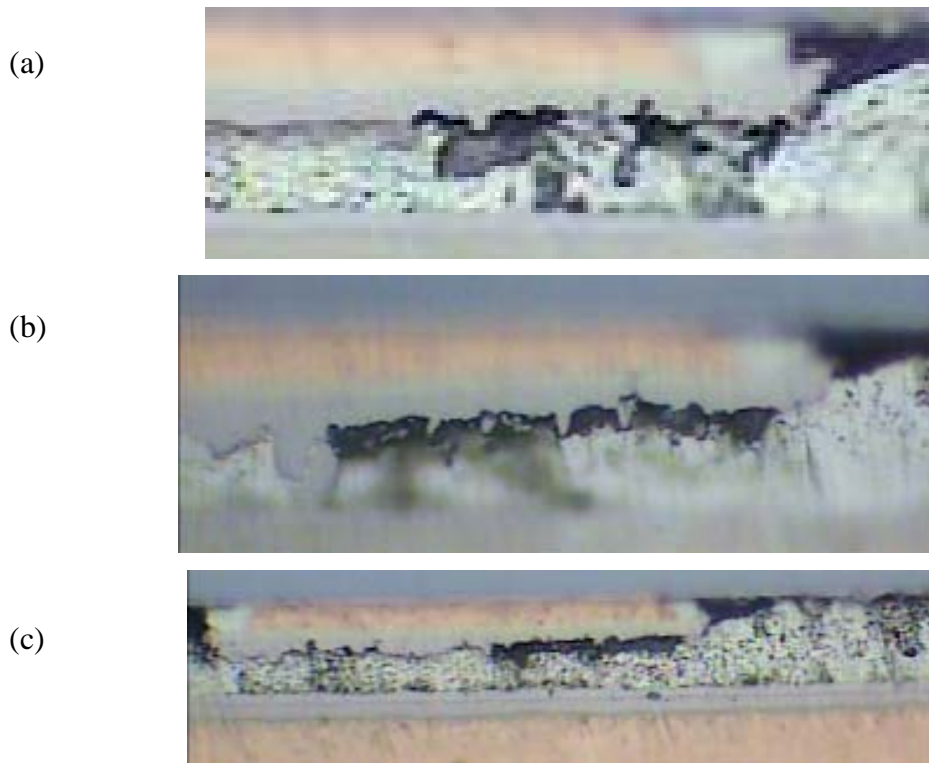


Fig. 4.25 Bump 2 aging 0hr under 0.75A 243hr bump resistance become 4.25 times
 (a) beginning find void (b) polish more deeper (c) void become smaller after more polish

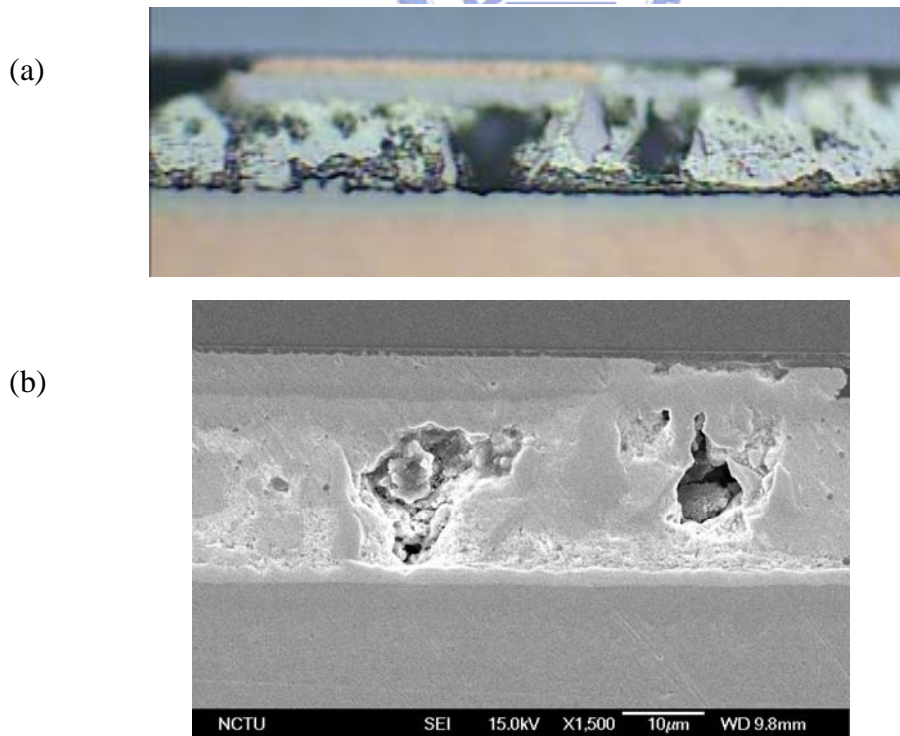


Fig. 4.26 Bump 2 aging 25hr under 0.75A 130hr bump resistance become 1.26 times
 (a) OM image (b) SEM image

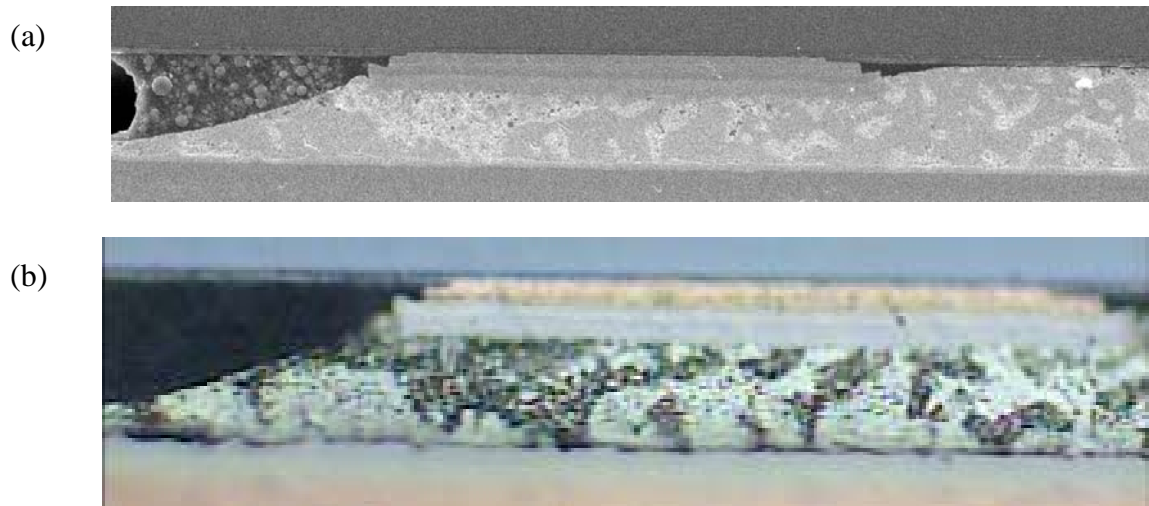


Fig. 4.27 Bump 3 aging 25hr under 0.75A 130hr not fail bump resistance become 1.26times(a)SEM image(b) OM image

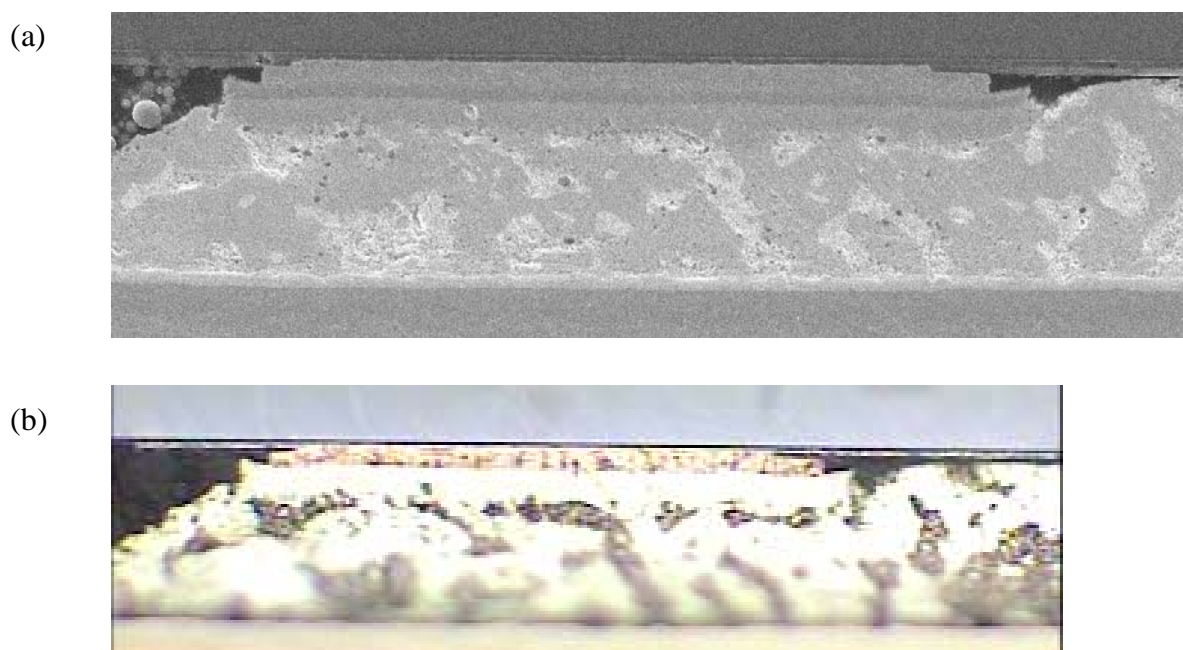


Fig. 4.28 Bump 1 aging 25hr under 0.75A 130hr bump resistance become 1.26 times(a) SEM image(b)OM image

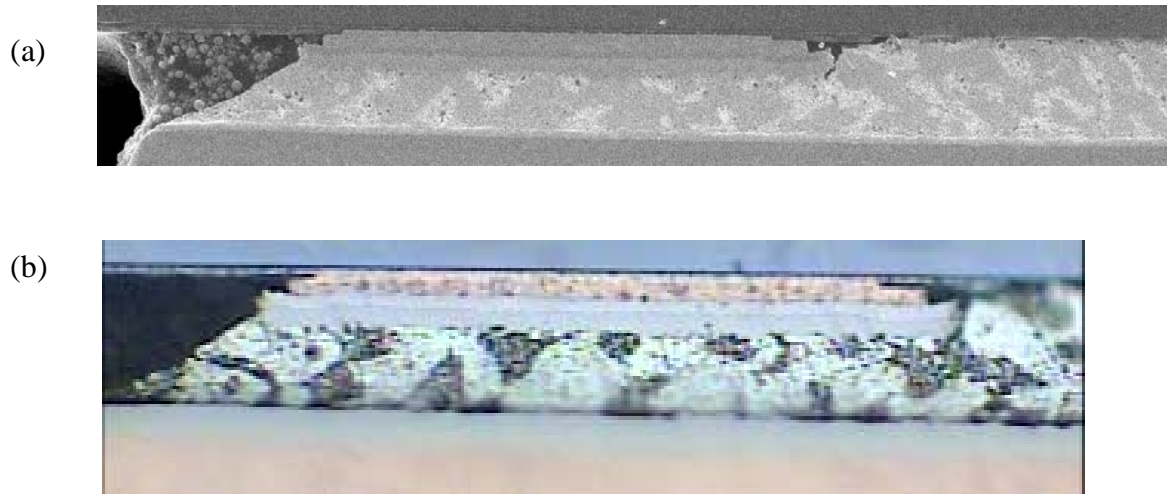


Fig. 4.29 Bump 4 aging 25hr under 0.75A 130hr bump resistance become 1.26times(a) SEM image(b)OM image

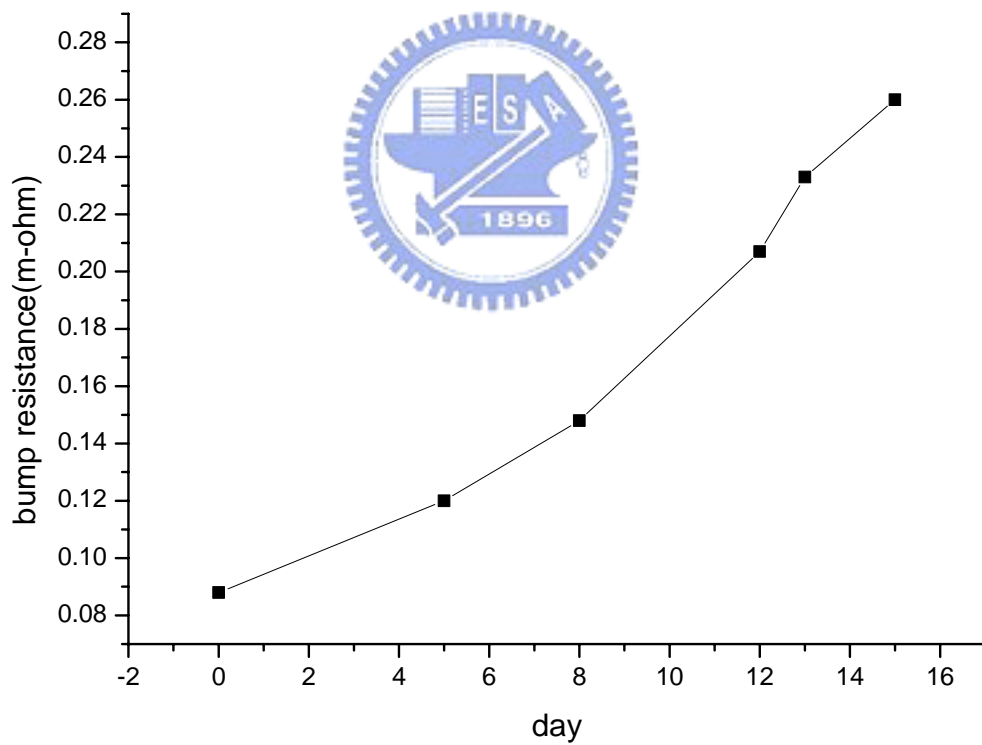


Fig. 4.30 Aging 25hr under 0.75A 360hr current stress not fail bump resistance change vs time(day), 3 times of original bump resistance

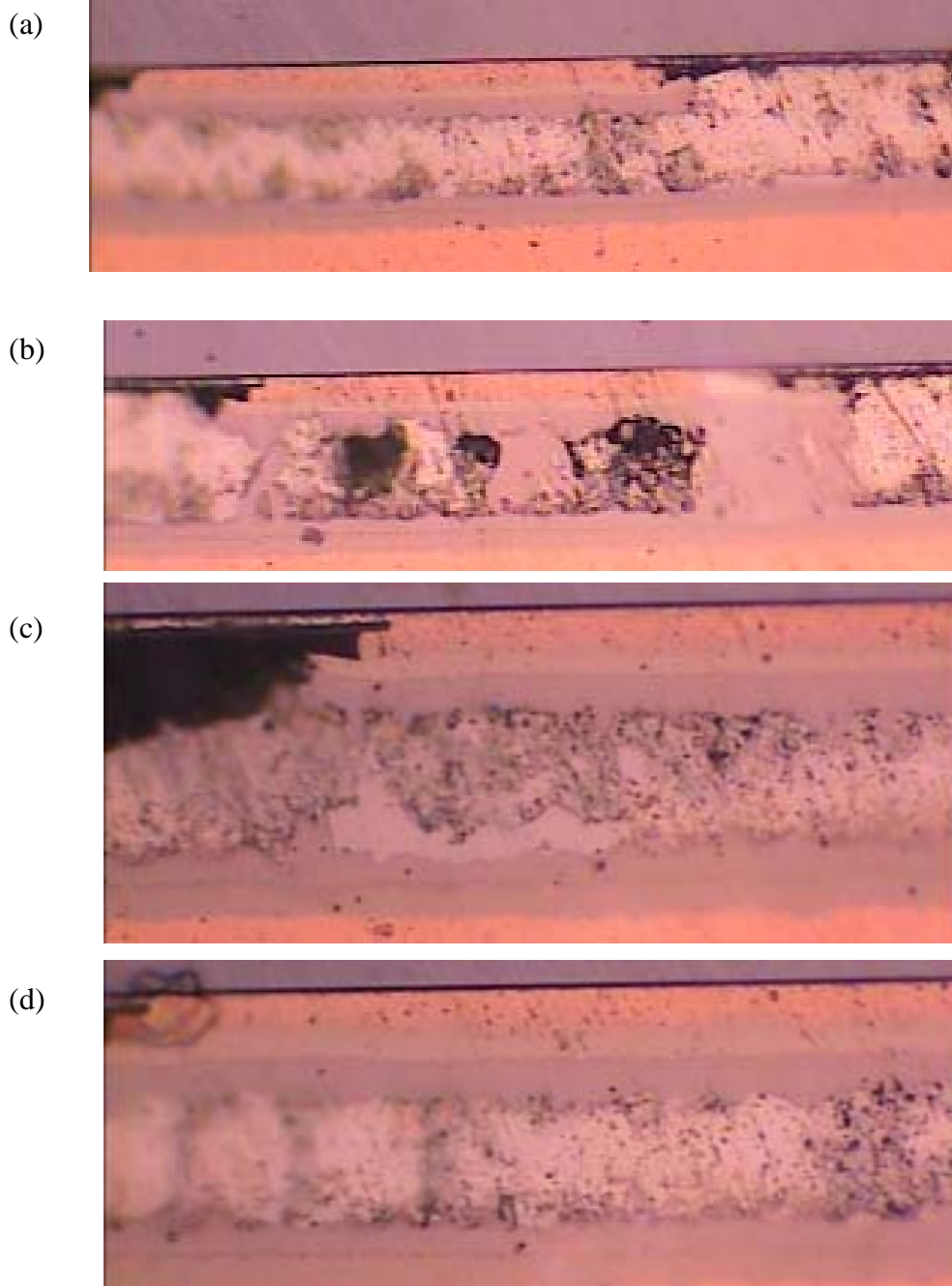


Fig. 4.31 OM imaging of 25hr under 0.75A 360hr current stress not fail bump resistance to 3 times of original bump resistance(a)bump1 (b) bump2(c)bump3(d)bump4

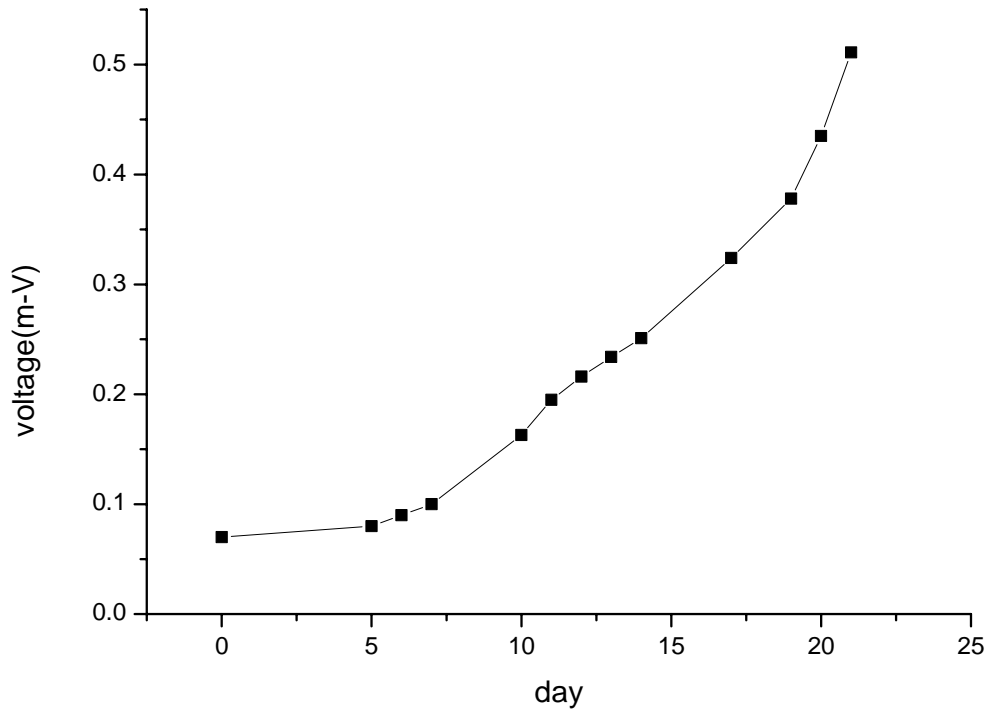


Fig. 4.32 Aging 50hr under 500hr current stress not fail under 0.75A, voltage change vs time(day), 7.3 times of original bump resistance

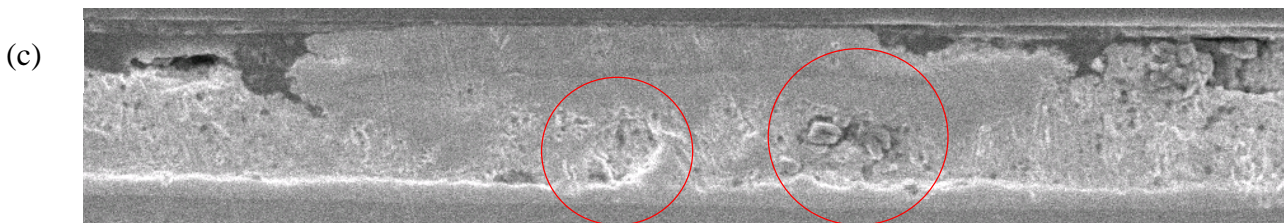


Fig. 4.33 Aging 50hr under 500hr current stress not fail bump 2(a)OM image solder clear(b)OM image UBM clear (c) SEM image

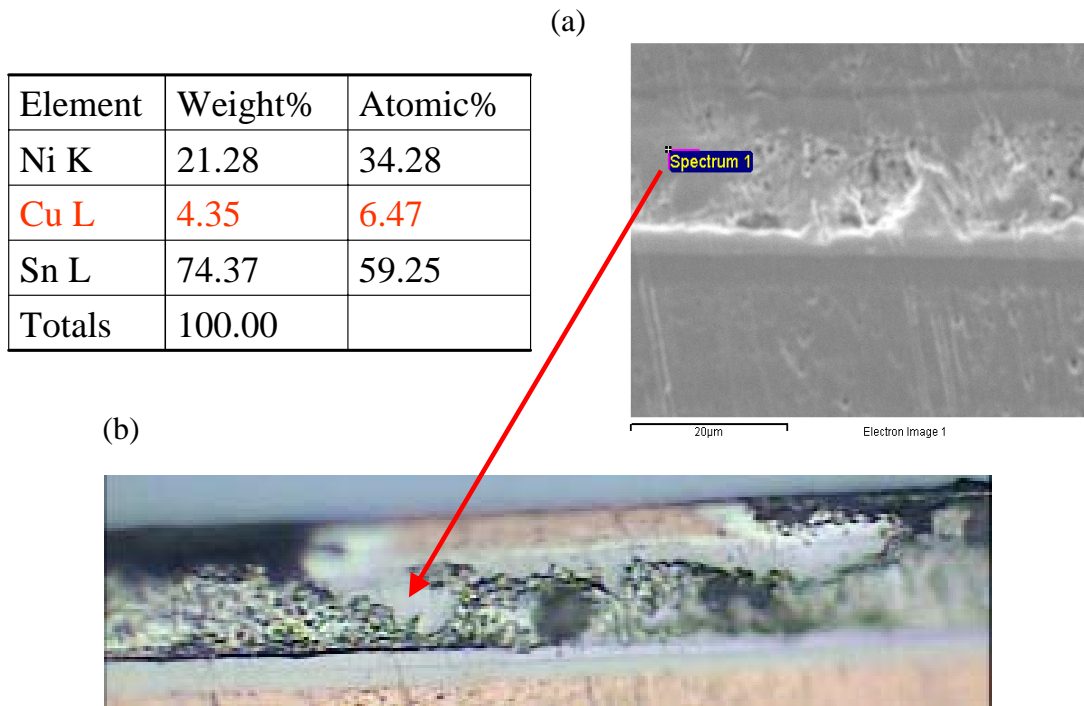


Fig. 4.34 Aging 50hr under 500hr current stress not fail bump 2 IMC(a)SEM image(b)OM image

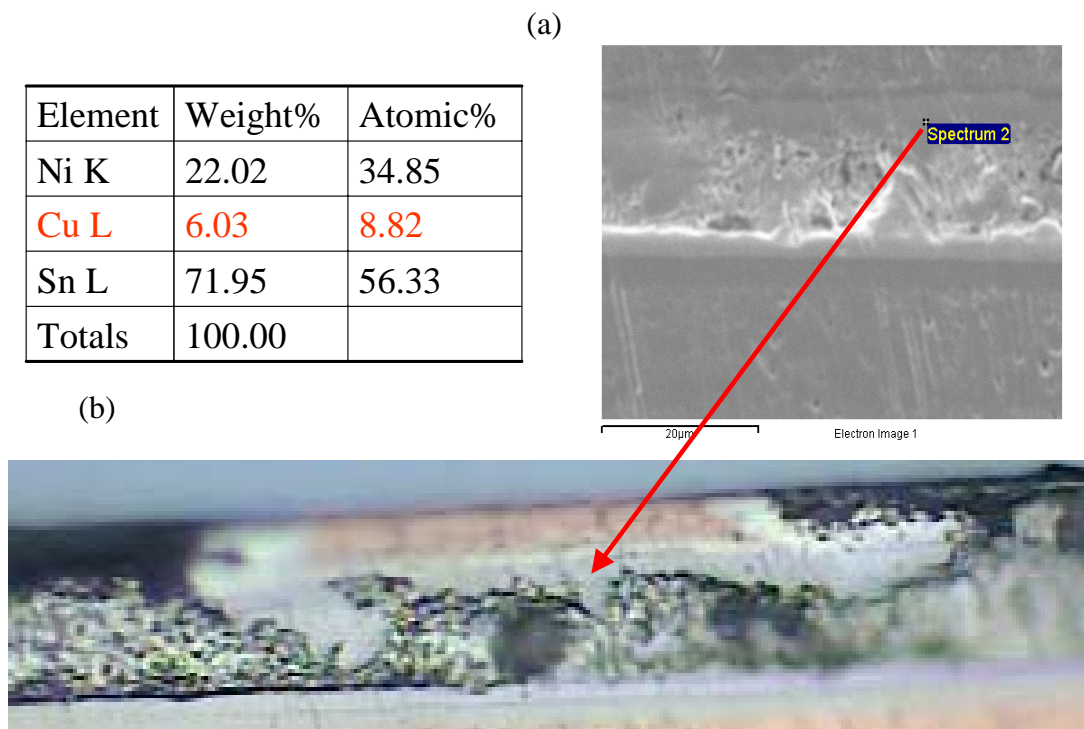
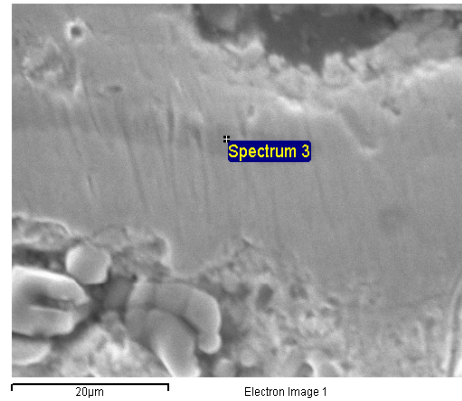


Fig. 4.35 Aging 50hr under 500hr current stress not fail bump 2 IMC(a)SEM image(b)OM image

Element	Weight%	Atomic%
Ni K	100.00	100.00
Totals	100.00	

(a)



(b)

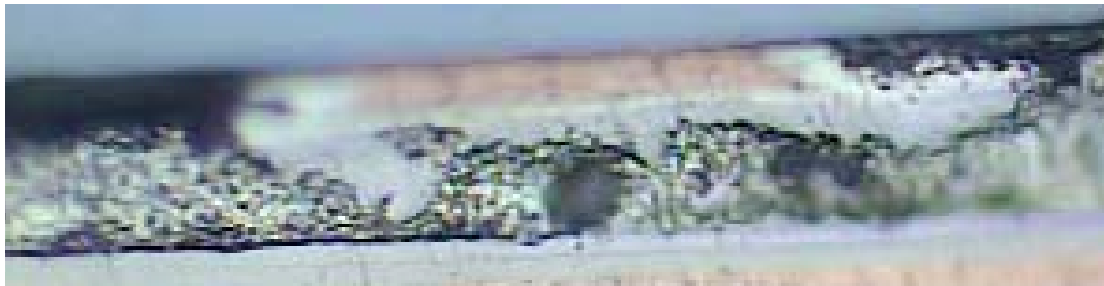
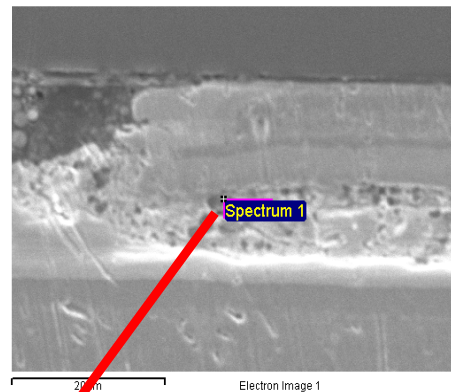


Fig. 4.36 Aging 50hr under 500hr current stress not fail bump 2 color of Ni (a)SEM image(b)OM image



Element	Weight%	Atomic%
Sn L	35.22	48.69
Pb M	64.78	51.31
Totals	100.00	

(a)



(b)



Fig. 4.37 Aging 50hr under 500hr current stress not fail bump 3(a)SEM image(b)OM image