Correlation Factors of Wire Sweep between Wire Bond and Mold to Establish Process Design Rule

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Abstract

The effects of wire sweep within the integrated circuit (IC) packaging process were studied in this research. Wire sweep is a major criteria that causes the shortage of wire between adjacent areas such as die and mold compound. It occur from the molding process after the wire bonding process in IC assembly. In experiment, the parameters of wire sweep were varied by wire size from 0.7 to 1.0 mil, wire height were varied from 3.0 to 5.0 mil, and in board bond wire length were varied from 10%, 30%, and 50% respectively. The results revealed that the wire height and the inboard wire length were showed directly proportional to wire sweep. In the opposite way, the wire size was showed inversely proportional to wire sweep. Therefore, these parameters of wire were played the important rule in IC packaging process. It should be selected properly for reducing the lot reject rate.

Methodology

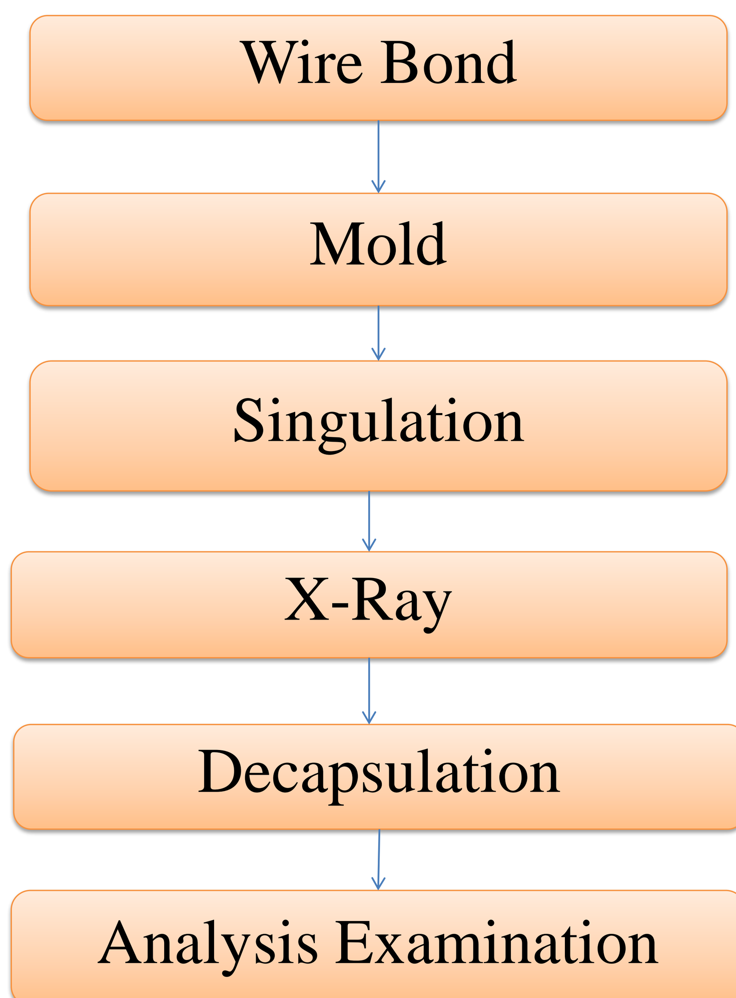

Figure. 1 Schematic representation of the experimental method

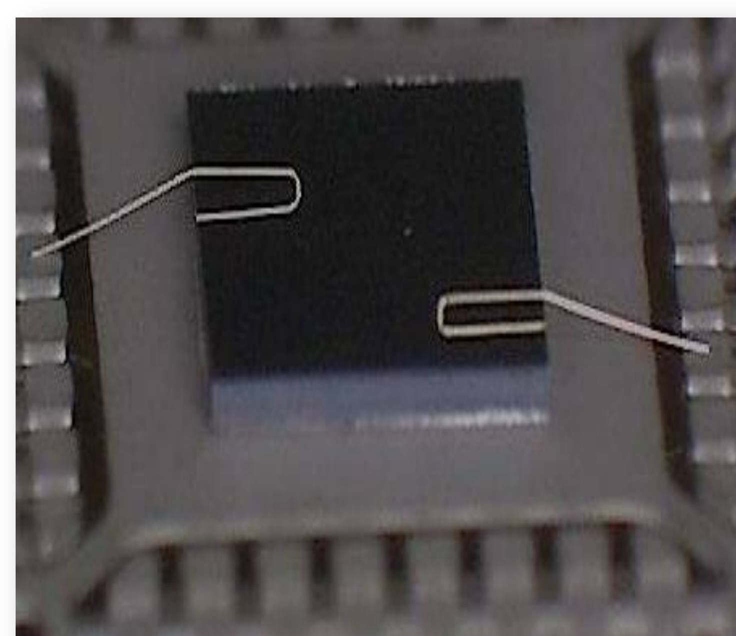

Figure. 2 Loop profile Au wire bonding

- Wire bond QFN package 5x5, Au wire
- x-ray to measure percent wire sweep
- chemical decapsulation to measure the gap between wire and die edge after mold process.

Experimental Result

wire size = 0.7

leg	H	%inboard bond	L	% wire sweep max	% wire sweep average	Gap min	Gap average
1	3	10%	8.88	7.9	4.4	0.3	1.36
2	4		8.9	9.45	5.69	0.58	1.28
3	5		8.91	13.99	10.02	1.73	2.73
4	3	30%	24.22	7.2	5.37	0.22	0.83
5	4		24.2	8.48	6.59	x	x
6	5		24.22	8.95	7.68	x	x
7	4	50%	43.41	7.32	6.48	x	x
8	5		43.41	9.99	7.96	x	x
9	6		43.4	9.48	8.53	x	x

Table.1 The experimental Result in QFN package5X5

H = Loop High
L = wire length
Gap = gap between wire and die edge after mold
X = found wire touching die surface or die edge

wire size = 0.8

leg	H	%inboard bond	L	% wire sweep max	% wire sweep average	Gap min	Gap average
1	3	10%	8.82	4.99	2.7	1.71	2.04
2	4		8.83	7.31	4.18	1.49	2.22
3	5		8.8	10.38	6.4	1.32	2.86
4	3	30%	25.91	10.56	6.51	0.75	0.93
5	4		25.92	6.25	4.3	1.24	1.98
6	5		25.94	8.97	7.46	0.62	1.23
7	4	50%	43.51	8.08	5.88	0.8	1.76
8	5		43.46	8.33	7.42	1.27	1.68
9	6		43.42	9.88	8.13	1.92	1.41

Table. 2 The experimental Result in QFN package5X5 wire size 0.8

wire size = 1.0

leg	H	%inboard bond	L	% wire sweep max	% wire sweep average	Gap min	Gap average
1	3	10%	8.62	2.53	1.42	2.22	2.49
2	4		8.77	2.74	1.1	1.92	2.22
3	5		8.67	3.7	1.38	3.48	3.92
4	3	30%	24.11	5.41	2.52	0.79	1.99
5	4		24.12	4.68	2.53	1.73	2.16
6	5		24.16	4.34	2.7	1.29	1.81
7	4	50%	43.81	5.16	3.92	0.69	1.71
8	5		43.81	7.04	5.22	0.54	1.43
9	6		43.83	9.01	6.25	0.37	1.6

Table. 3 The experimental Result in QFN package5X5 wire size 1.0

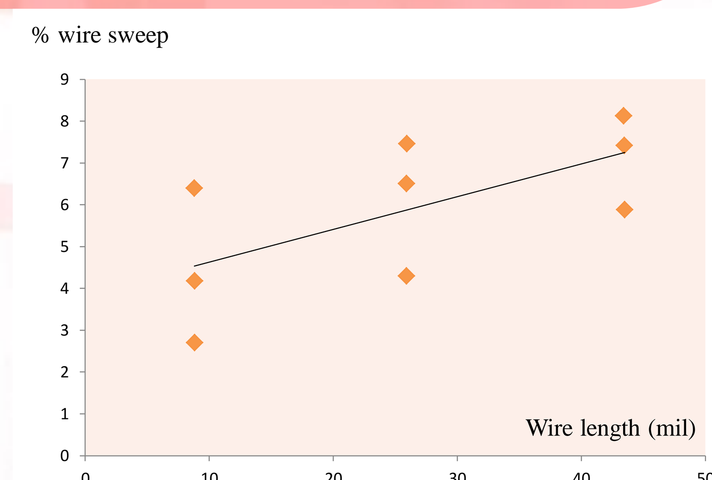

Figure. 3 Correlation factor between %wire sweep and % inboard bond

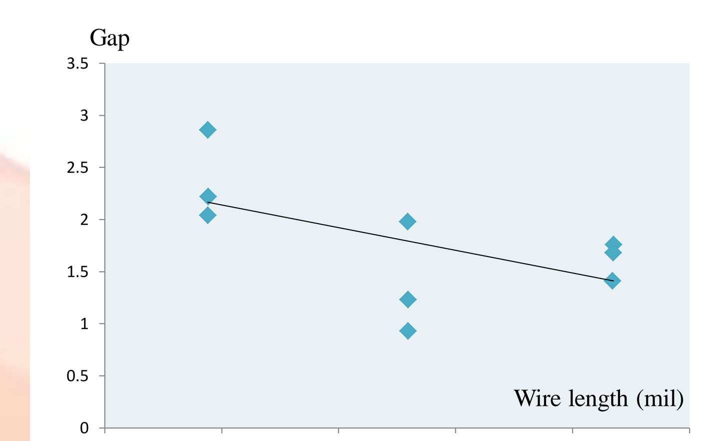

Figure. 4 Correlation factor between gap and % inboard bond

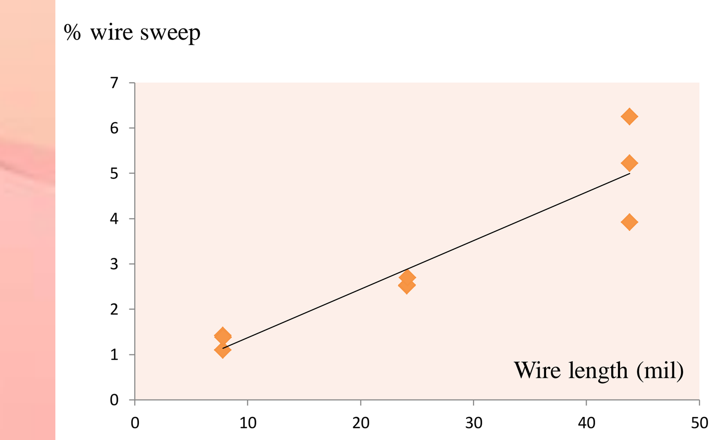

Figure. 5 Correlation factor between %wire sweep and % inboard bond

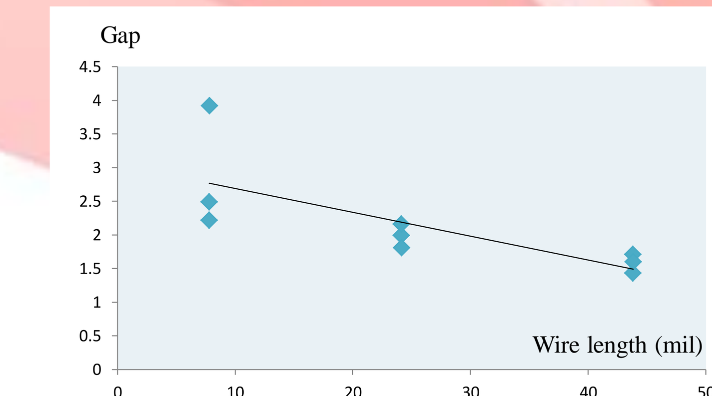

Figure. 6 Correlation factor between gap and % inboard bond

Wire diameter

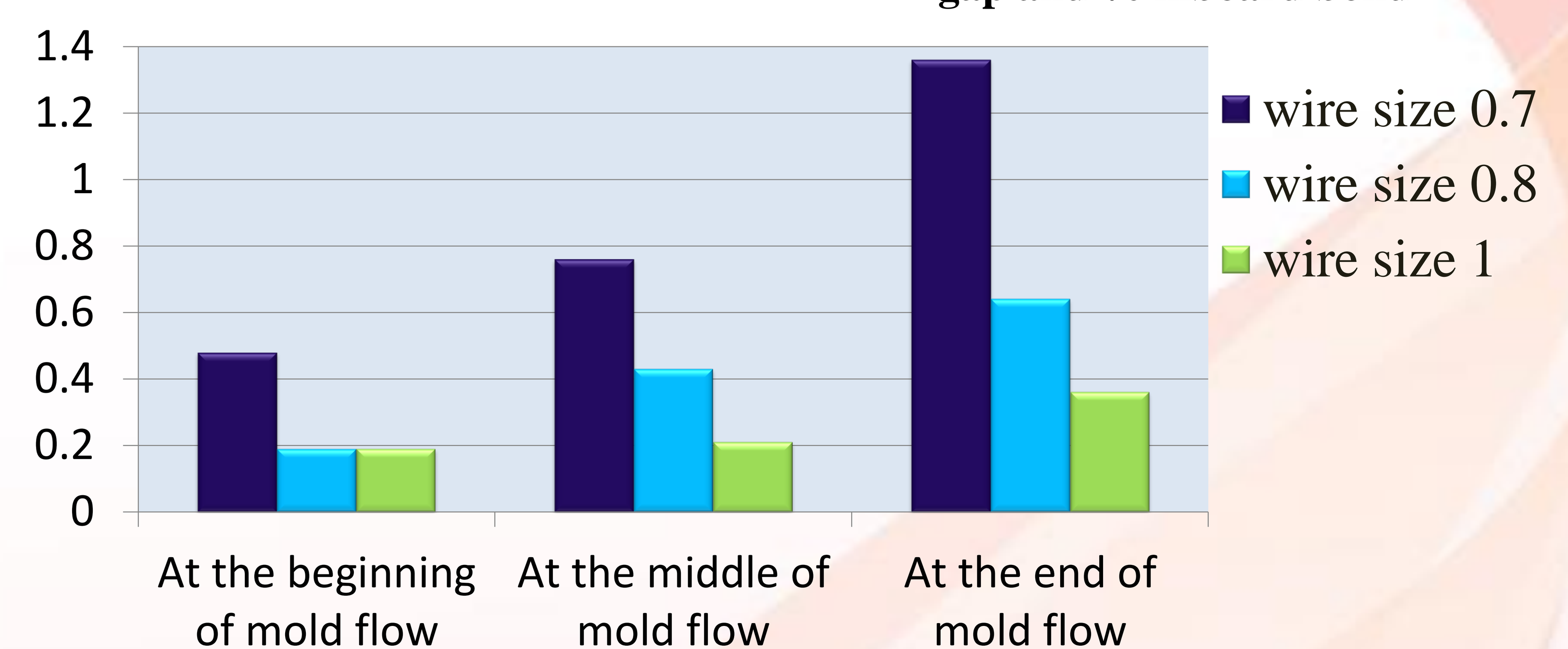

Figure. 7 The difference value of gap before and after mold

Conclusion

- wire length varies according to the percent wire sweep but inversely proportional to the value of the gap between wire and die edge after mold.
- The bigger size of the wire can resist the wire sweep the wire better.
- The difference value of gap before mold and after mold at the end of mold flow is higher than at the middle of mold flow and the beginning of mold flow respectively.

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Acknowledgement

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