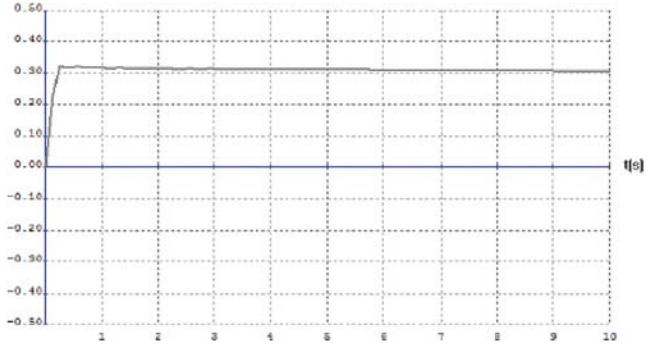

Figure 1. The average of 20 tests for baseline group, SnPb37 tested at 250°C.

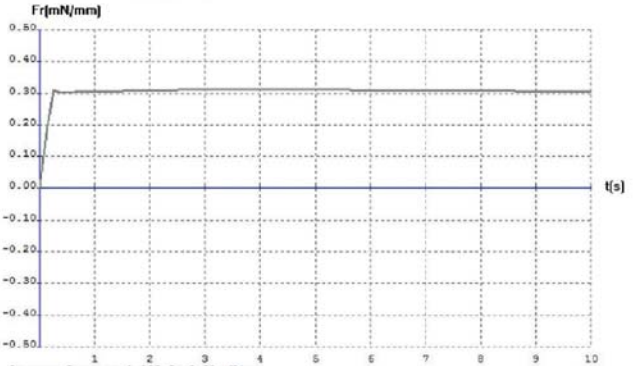

Figure 2. The average of 20 tests for Sn99.7Cu0.3CuCo at 265°C.

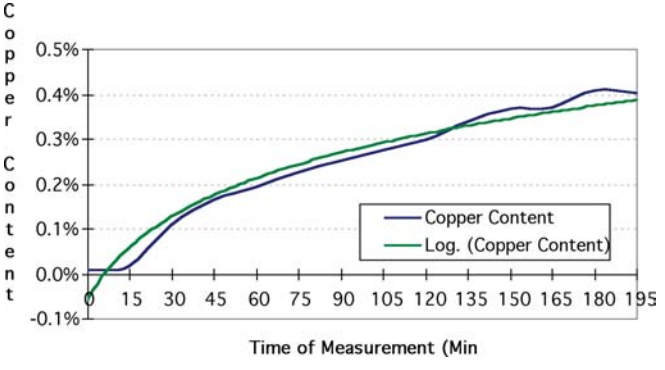

Figure 3. SnPb37 at 250°C.

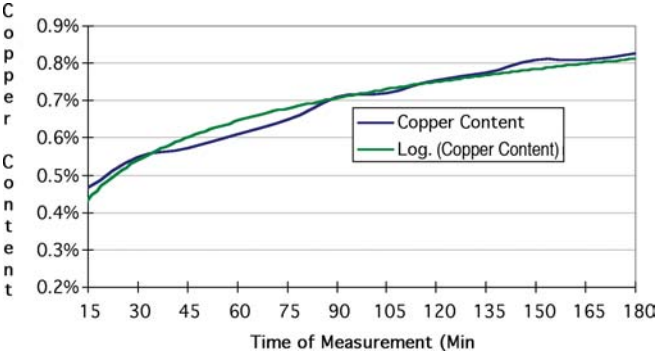

Figure 4. Sn99.5Cu0.5Co at 265°C.

Table 1. Physical Properties of Studied Solders

	SAC 305	SnCuCo	SnPb37
Melting point (°C)	217°	227°	183°
Density (g/cm3)	7.4	7.3	8.4
Operating temperature (°C)	265°	265°	245°
Tensile strength (M Pa)	52	28	31
Elongation	27	27	35
Thermal conductivity (J/m•s •K)	64	64	50
Electrical Resistance (μΩm)	0.15	0.13	0.17
Thermal shock (-40°/+80°C each 1 hr.)	›1000 cycles	›1000 cycles	500 cycles

Table 2. Sn63/Pb37 vs. SnCuCo Copper Dissolution

	SnPb37				SnCuCo				
Time (Min.)	Temp. 225°C	Temp. 250°C	Temp. 260°C	Temp. 270°C	Temp. 255°C	Temp. 260°C	Temp. 265°C	Temp. 270°C	Temp. 275°C
0	0.005%	0.007%	0.007%	0.008%	0.383%	0.466%	0.383%	0.374%	0.397%
15	0.011%	0.016%	0.018%	0.099%	0.465%	0.546%	0.464%	0.449%	0.458%
30	0.013%	0.108%	0.127%	0.159%	0.490%	0.575%	0.548%	0.528%	0.514%
45	0.017%	0.163%	0.168%	0.217%	0.543%	0.627%	0.570%	0.582%	0.587%
60	0.017%	0.194%	0.215%	0.277%	0.534%	0.654%	0.610%	0.658%	0.693%
75	0.018%	0.224%	0.251%	0.314%	0.607%	0.668%	0.646%	0.701%	0.779%
90	0.141%	0.252%	0.279%	0.344%	0.633%	0.693%	0.708%	0.711%	0.826%
105	0.161%	0.275%	0.338%	0.365%	0.655%	0.714%	0.718%	0.741%	0.875%
120	0.174%	0.296%	0.343%	0.403%	0.683%	0.743%	0.751%	0.751%	0.918%
135	0.182%	0.338%	0.391%	0.412%	0.695%	0.761%	0.773%	0.806%	0.946%
150	0.196%	0.367%	0.398%	0.437%	0.703%	0.780%	0.807%	0.844%	0.974%
165	0.195%	0.370%	0.408%	0.455%	0.693%	0.782%	0.809%	0.893%	1.017%
180	0.206%	0.408%	0.445%	0.460%	0.702%	0.787%	0.824%	0.881%	-
195	0.211%	0.402%	0.444%	0.468%	0.707%	0.800%	0.838%	0.887%	-

Table 3. Copper Thickness Reduction Data

No. of HAL Cycles	Copper Thickness	
	SnCuCo	SnPb
0	0.8 mils	1.0 mils
1	0.8 mils	0.9 mils
2	0.7 mils	0.9 mils
3	0.6 mils	0.8 mils
Thickness Reduction	$\frac{0.8 - 0.6}{0.8} = 25\%$	$\frac{1.0 - 0.8}{1.0} = 20\%$

Table 4. HAL Coating Thickness Data

	SnPb37 Panels	SnCuCo Panels
Panels measured	44	44
Mean	169.6 µin	166.7 µin
Standard deviation	65.6 µin	49.1 µin
Minimum	109.0 µin.	102.0 µin
Maximum	486.7 µin	270.2 µin
Range	377.7 µin	168.2 µin

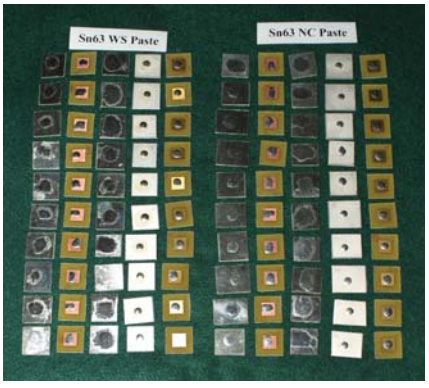

Figure 5. Wettability of various SnPb37 pastes on different board finishes.

Figure 6. Pastes diffused through immersion tin.

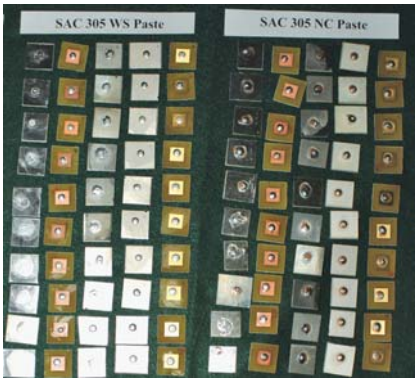

Figure 7. Wetting characteristics of SAC305 water-soluble and no-clean pastes.

Figure 8. Wetting characteristics of SnCuCo were similar to those of SAC305.

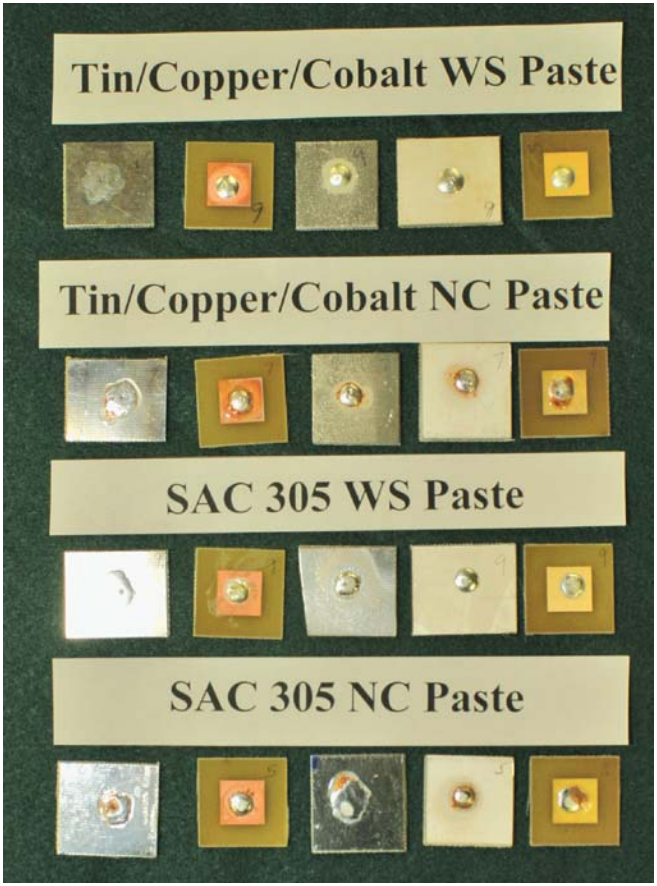

Figure 9. Wetting characteristics of SnCuCo and SAC305, compared.

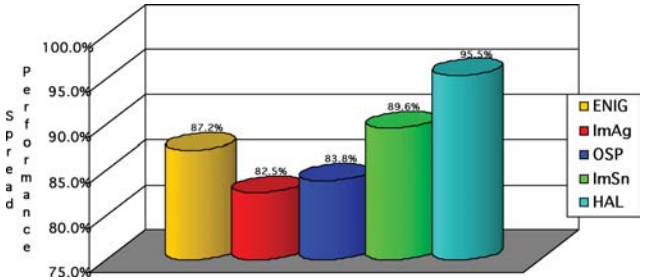

Figure 10. Surface finish comparison.

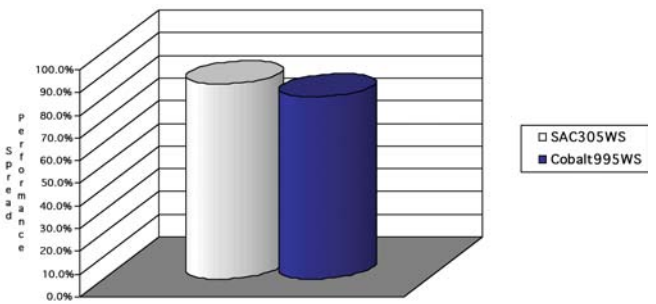

Figure 11. Pb-free water-soluble comparison.

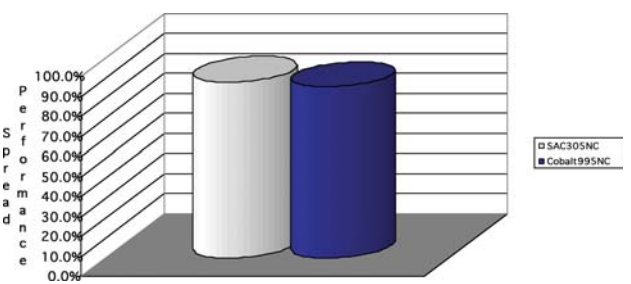

Figure 12. Pb-free no-clean comparison.