

Appendix G

GLM Results for the Condensing Atmosphere and Thermal Cycling Test Environments

Table G.1 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HCLV PTH	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	6.885	0.008	0.021	0.008	0.040	0.036	0.044	-0.029
Benzimidazole Immersion Ag Immersion Au/Pd	0.080							
Parylene Silicone Urethane	0.192	-0.077		0.144		-0.087		0.103
Flux								
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene								
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone	0.099			-0.240			-0.140	
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane				-0.144				
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux	0.072							
Parylene*Flux Silicone*Flux Urethane*Flux				-0.139				
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux	0.155			-0.240		-0.124	-0.236	
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux			0.203		0.270			
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux				-0.232				
Model R ²	30.3%	2.4%	2.6%	18.0%	3.7%	1.1%	5.7%	4.2%
Standard Deviation	0.141	0.216	0.216	0.182	0.194	0.204	0.214	0.215

Table G.2 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HCLV SMT	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	7.206	-0.006	-0.061	-0.016	-0.048	0.036	0.089	0.029
Benzimidazole	-0.094	0.142	0.157					
Immersion Ag							-0.059	
Immersion Au/Pd	0.055						-0.079	
Parylene			0.122					
Silicone	-0.055							
Urethane		-0.083		-0.122		-0.067	-0.073	
Flux								
Benzi*Parylene	0.124	-0.164	-0.238				-0.121	
Imm Ag*Parylene								
Imm Au/Pd*Parylene								
Benzi*Silicone	0.191	-0.168	-0.148					
Imm Ag*Silicone	0.110							
Imm Au/Pd*Silicone								
Benzi*Urethane	0.108		-0.168	0.126				
Imm Ag* Urethane				0.138				
Imm Au/Pd* Urethane								
Benzi*Flux								
Imm Ag*Flux								
Imm Au/Pd*Flux								
Parylene*Flux								
Silicone*Flux								
Urethane*Flux								
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux					0.184			
Imm Au/Pd*Parylene*Flux			-0.221					
Benzi*Silicone*Flux								
Imm Ag*Silicone*Flux								0.403
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux							0.158	
Model R ²	15.2%	12.8%	14.8%	6.3%	4.2%	4.6%	12.9%	17.6%
Standard Deviation	0.0964	0.140	0.145	0.160	0.155	0.134	0.123	0.152

Table G.3 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HVLC PTH	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	0.704	1.095	1.053	1.236	1.252	0.703	0.703	0.703
Benzimidazole		-0.392		-0.273	-0.468			
Immersion Ag		-0.053						
Immersion Au/Pd						-0.001	-0.001	-0.001
Parylene		-0.379	-0.327	-0.441	-0.517			0.001
Silicone		-0.375	-0.274	-0.385	-0.473			
Urethane	-0.004	-0.318	-0.250			-0.003	-0.003	-0.003
Flux		-0.376	-0.365	-0.529	-0.513			
Benzi*Parylene		0.381			0.440		-0.001	-0.002
Imm Ag*Parylene								
Imm Au/Pd*Parylene								
Benzi*Silicone		0.374			0.390			
Imm Ag*Silicone							-0.001	
Imm Au/Pd*Silicone								
Benzi*Urethane		0.321						
Imm Ag* Urethane				-0.42	-0.380			
Imm Au/Pd* Urethane				-0.49	-0.460	0.001	0.001	0.001
Benzi*Flux		0.382		0.274	0.530			
Imm Ag*Flux								
Imm Au/Pd*Flux								
Parylene*Flux		0.443	0.410	0.510	0.552			-0.002
Silicone*Flux		0.378	0.290	0.380	0.440			
Urethane*Flux		0.380	0.280					
Benzi*Parylene*Flux		-0.370			-0.500			0.003
Imm Ag*Parylene*Flux								
Imm Au/Pd*Parylene*Flux	0.004							
Benzi*Silicone*Flux		-0.380			-0.420			
Imm Ag*Silicone*Flux								
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux		-0.390						
Imm Ag*Urethane*Flux			0.540	0.630	0.510			
Imm Au/Pd*Urethane*Flux				0.490	0.500			
Model R ²	28.1%	45.0%	22.8%	34.6%	42.4%	38.6%	33.3%	40.0%
Standard Deviation	0.003	0.128	0.258	0.259	0.205	0.005	0.001	0.001

Table G.4 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HVLC SMT	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	0.695	1.679	2.084	2.121	2.479	0.706	0.696	0.695
Benzimidazole		-0.281						0.006
Immersion Ag		-0.175	-0.219	-0.271	-0.780	-0.750	-0.740	
Immersion Au/Pd		-0.156			-0.890			
Parylene		-0.743	-1.294	-1.311	-1.760			
Silicone		-0.716	-1.270	-1.340	-1.710			
Urethane	0.004	-0.752	-0.530	-0.557	-0.610			0.005
Flux		-0.156						
Benzi*Parylene								-0.006
Imm Ag*Parylene					0.560	0.740	0.740	
Imm Au/Pd*Parylene					0.950			
Benzi*Silicone								-0.005
Imm Ag*Silicone			1.070	0.750	1.040	0.740	0.740	
Imm Au/Pd*Silicone					0.880			
Benzi*Urethane		0.310						-0.008
Imm Ag* Urethane						0.740	0.750	
Imm Au/Pd* Urethane			-0.760	-0.770				
Benzi*Flux		0.230						-0.006
Imm Ag*Flux					0.420	0.740	0.740	
Imm Au/Pd*Flux								
Parylene*Flux								
Silicone*Flux								
Urethane*Flux		0.260						
Benzi*Parylene*Flux								0.006
Imm Ag*Parylene*Flux						-0.690	-0.740	
Imm Au/Pd*Parylene*Flux	0.015							
Benzi*Silicone*Flux								0.005
Imm Ag*Silicone*Flux			-0.960	-0.560	-0.740	-0.740	-0.740	
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux								0.008
Imm Ag*Urethane*Flux						-0.740	-0.740	
Imm Au/Pd*Urethane*Flux								
Model R ²	15.0%	57.0%	63.5%	66.0%	67.1%	18.6%	19.5%	42.5%
Standard Deviation	0.007	0.289	0.424	0.409	0.463	0.282	0.270	0.003

Table G.5 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HSD PTH	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	13.21	0.19	0.45	0.18	0.66	0.28	-0.12	-0.38
Benzimidazole Immersion Ag Immersion Au/Pd								
Parylene Silicone Urethane					-0.63 -0.54 -0.69			
Flux	3.88	-0.44				-0.63	1.83	1.99
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene								
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone			-0.68			-1.61	-1.13	-1.14 -1.38
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane			-0.76					
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux			-0.81			-0.79		
Parylene*Flux Silicone*Flux Urethane*Flux		-0.45	-0.50				-0.94	
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux			1.19					
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux	1.18							
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux		-1.58 -1.37 -1.04		-1.79 -1.80 -1.45	-1.85 -1.92 -1.54			
Model R ² Standard Deviation	87.8% 0.63	15.4% 0.82	13.1% 0.90	8.2% 0.94	16.6% 0.93	10.6% 1.47	32.1% 1.51	36.0% 1.40

Table G.6 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HSD SMT	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	5.209	0.670	0.677	0.460	0.471	-0.857	-1.705	-2.329
Benzimidazole Immersion Ag Immersion Au/Pd								1.60
Parylene Silicone Urethane	4.14	-0.86					4.38	4.30
Flux							1.74	1.37
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene		-1.64						2.74
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone			-2.29			-3.43	-2.10	-4.70
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane				-1.26	-2.03	-1.56	-2.18	-2.50
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux						2.89		-1.59
Parylene*Flux Silicone*Flux Urethane*Flux		-1.61			1.45			
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux		2.60				2.62 -4.60	-3.50	-3.90
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux	1.06		3.20			2.70 4.50		4.30
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux					-2.30		-3.2	
Model R ²	89.3%	10.3%	5.1%	2.3%	6.6%	27.9%	39.1%	44.7%
Standard Deviation	0.626	1.76	1.93	2.06	2.02	2.14	2.60	2.49

Table G.7 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF PTH 50 MHz	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	-0.291	0.015	0.024	0.016	-0.017	-0.005	-0.016	-0.029
Benzimidazole	0.015				0.020			
Immersion Ag	0.010				0.024			
Immersion Au/Pd								
Parylene	-0.017				0.019			0.023
Silicone	-0.017				0.018			
Urethane					0.031	-0.025	-0.022	0.023
Flux								0.009
Benzi*Parylene							-0.020	-0.031
Imm Ag*Parylene	0.017							-0.024
Imm Au/Pd*Parylene	0.028							-0.029
Benzi*Silicone								
Imm Ag*Silicone								
Imm Au/Pd*Silicone	0.021				0.033			
Benzi*Urethane			-0.053	-0.076			0.023	0.024
Imm Ag* Urethane				-0.054	-0.033			
Imm Au/Pd* Urethane	0.035						0.031	0.032
Benzi*Flux								
Imm Ag*Flux								
Imm Au/Pd*Flux					0.036			
Parylene*Flux								
Silicone*Flux								
Urethane*Flux								-0.021
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux								
Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux		-0.057	-0.057					
Imm Ag*Silicone*Flux				-0.094				
Imm Au/Pd*Silicone*Flux					-0.058			
Benzi*Urethane*Flux			0.076	0.088				
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux								
Model R ²	32.4%	4.8%	5.8%	12.0%	19.2%	11.6%	10.1%	35.1%
Standard Deviation	0.019	0.045	0.058	0.066	0.033	0.030	0.027	0.021

Table G.8 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF PTH f(-3dB)	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	253.9	0.19	0.79	0.06	-0.40	-3.97	-3.30	-2.03
Benzimidazole								
Immersion Ag	-4.5	-2.7	-4.4					
Immersion Au/Pd	-2.3			-1.6			1.2	
Parylene	-2.7							
Silicone	-3.2							
Urethane								
Flux								
Benzi*Parylene								
Imm Ag*Parylene	4.9	4.7	4.9					
Imm Au/Pd*Parylene								
Benzi*Silicone								
Imm Ag*Silicone								
Imm Au/Pd*Silicone						-3.4		
Benzi*Urethane								
Imm Ag* Urethane	4.3		5.1					
Imm Au/Pd* Urethane								
Benzi*Flux								
Imm Ag*Flux								
Imm Au/Pd*Flux								
Parylene*Flux		-3.6						-10.6
Silicone*Flux								
Urethane*Flux								
Benzi*Parylene*Flux		5.9						9.9
Imm Ag*Parylene*Flux								11.7
Imm Au/Pd*Parylene*Flux								12.4
Benzi*Silicone*Flux								
Imm Ag*Silicone*Flux								
Imm Au/Pd*Silicone*Flux		-5.6	-5.1		-4.6			
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux								
Model R ²	16.3%	10.3%	10.9%	1.7%	2.3%	1.8%	0.7%	9.9%
Standard Deviation	5.11	5.06	4.97	5.22	5.28	6.04	5.90	5.83

Table G.9 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF PTH f(-40dB)	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	444.0	-1.85	-0.84	0.43	1.43	-2.56	-3.59	-3.38
Benzimidazole								
Immersion Ag	-5.5	-2.59		-3.10	-5.10			
Immersion Au/Pd	-3.6			-2.40	-3.70		3.20	3.50
Parylene								
Silicone								
Urethane					-4.00			
Flux	-2.6	-2.71	-2.90	-2.86	-6.60			
Benzi*Parylene								
Imm Ag*Parylene	5.6				4.10			
Imm Au/Pd*Parylene								
Benzi*Silicone								
Imm Ag*Silicone								
Imm Au/Pd*Silicone								
Benzi*Urethane								
Imm Ag* Urethane	4.5				6.40			
Imm Au/Pd* Urethane					6.30			
Benzi*Flux					2.90			
Imm Ag*Flux								
Imm Au/Pd*Flux					4.70	-1.40	-3.80	-4.30
Parylene*Flux	-5.1							
Silicone*Flux					5.00			
Urethane*Flux					6.20			
Benzi*Parylene*Flux	6.2							
Imm Ag*Parylene*Flux								
Imm Au/Pd*Parylene*Flux	6.5							
Benzi*Silicone*Flux		6.00	6.70	5.60				
Imm Ag*Silicone*Flux								
Imm Au/Pd*Silicone*Flux			4.90	6.10				
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux					-8.40			
Model R ²	22.0%	12.2%	10.4%	16.3%	27.6%	0.6%	3.6%	4.0%
Standard Deviation	5.2	5.38	5.22	5.17	4.78	6.09	5.77	5.98

Table G.10 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF SMT 50 MHz	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	-0.291	-0.016	-0.010	-0.020	-0.011	-0.010	-0.017	-0.018
Benzimidazole	0.018	0.023	0.014	0.019				
Immersion Ag	0.021	0.030	0.021	0.035	0.025			
Immersion Au/Pd	0.019	0.023		0.015	0.023			
Parylene		0.012	0.013	0.028	0.017			
Silicone	-0.007	0.014	0.018	0.017	0.020			
Urethane	0.013	0.039	0.024	0.039	0.037		-0.022	
Flux								
Benzi*Parylene								
Imm Ag*Parylene				-0.026				
Imm Au/Pd*Parylene			0.024					
Benzi*Silicone								
Imm Ag*Silicone								
Imm Au/Pd*Silicone								
Benzi*Urethane	-0.019	-0.022				-0.027	0.019	0.018
Imm Ag* Urethane	-0.030	-0.039		-0.038	-0.030	-0.023		
Imm Au/Pd* Urethane							0.021	0.019
Benzi*Flux								
Imm Ag*Flux								
Imm Au/Pd*Flux			0.0293	0.021				
Parylene*Flux					0.023			
Silicone*Flux								
Urethane*Flux								
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux					-0.039			
Imm Au/Pd*Parylene*Flux	0.015	0.039						
Benzi*Silicone*Flux								
Imm Ag*Silicone*Flux								
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux			-0.043					
Imm Au/Pd*Urethane*Flux								
Model R ²	31.5%	35.5%	26.5%	36.8%	27.4%	11.3%	12.6%	12.9%
Standard Deviation	0.016	0.022	0.0264	0.023	0.028	0.024	0.020	0.016

Table G.11 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF SMT f(-3dB)	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	273.1	-1.42	-1.22	-1.26	-1.57	0.72	0.36	0.46
Benzimidazole Immersion Ag Immersion Au/Pd	-0.43							
Parylene Silicone Urethane	-1.28	0.50	0.61	0.70	0.95			0.65 1.13
Flux								
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene	-0.94							
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone	-0.80							
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane	-0.70 -1.55			-1.59 -2.09				
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux							0.86	
Parylene*Flux Silicone*Flux Urethane*Flux	-0.48							1.02
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux								
Model R ²	35.6%	8.2%	12.2%	13.2%	16.9%	3.4%	9.5%	10.7%
Standard Deviation	0.93	0.98	1.13	1.44	1.13	1.32	1.70	1.57

Table G.12 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF SMT f(-40dB)	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	663.1	-2.20	-2.32	-3.39	-2.76	-20.29	-17.37	-19.88
Benzimidazole	-9.9	-9.8	-9.2	-8.6	-7.4			
Immersion Ag	-12.6	-11.8	-10.8	-10.9	-10.3			
Immersion Au/Pd	-13.8	-13.5	-13.2	-12.0	-12.4			
Parylene								
Silicone								
Urethane	-4.7	-4.9	-5.3	-4.4				
Flux								
Benzi*Parylene								
Imm Ag*Parylene								
Imm Au/Pd*Parylene								
Benzi*Silicone								
Imm Ag*Silicone								
Imm Au/Pd*Silicone								
Benzi*Urethane		7.3	7.8					
Imm Ag* Urethane	15.8	13.1	12.3	10.1	8.4	6.5		7.2
Imm Au/Pd* Urethane						-13.9	-14.2	-12.7
Benzi*Flux								
Imm Ag*Flux								
Imm Au/Pd*Flux								
Parylene*Flux								
Silicone*Flux								
Urethane*Flux				6.0				
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux								
Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux								
Imm Ag*Silicone*Flux								
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux	12.0							
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux				-10.1	-7.1			
Model R ²	45.0%	39.7%	36.7%	38.5%	37.5%	18.6%	13.7%	17.3%
Standard Deviation	6.67	6.77	7.03	7.14	6.87	8.06	8.73	8.06

Table G.13 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF TLC 50 MHz Forward	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	-37.61	-0.45	-0.43	-0.17	-0.34	-3.10	0.03	-0.22
Benzimidazole	1.25							
Immersion Ag	1.56							
Immersion Au/Pd		0.20				-3.94		
Parylene	-1.44	0.29	0.38			4.18		
Silicone	-6.65			-0.24		7.18		
Urethane	-2.51			-0.42		1.47	3.62	0.72
Flux								
Benzi*Parylene						-4.50		
Imm Ag*Parylene						-5.40		
Imm Au/Pd*Parylene								
Benzi*Silicone	2.81					-3.00		
Imm Ag*Silicone	3.08					-5.60		
Imm Au/Pd*Silicone	3.56							
Benzi*Urethane							-3.52	
Imm Ag* Urethane	-1.55		0.50	1.30			-2.57	
Imm Au/Pd* Urethane	1.93					5.10	-3.76	
Benzi*Flux		-0.82						
Imm Ag*Flux						2.69	-2.99	-1.70
Imm Au/Pd*Flux	0.75					5.60		
Parylene*Flux								
Silicone*Flux								
Urethane*Flux		-0.66					-3.67	
Benzi*Parylene*Flux		0.65						
Imm Ag*Parylene*Flux							3.14	1.98
Imm Au/Pd*Parylene*Flux						-6.20		
Benzi*Silicone*Flux		0.99						
Imm Ag*Silicone*Flux							2.95	1.86
Imm Au/Pd*Silicone*Flux						-4.00		
Benzi*Urethane*Flux		1.18					3.20	
Imm Ag*Urethane*Flux			-1.16	-2.21	-0.76		3.30	
Imm Au/Pd*Urethane*Flux						-6.20	3.80	
Model R ²	76.8%	31.6%	19.7%	25.7%	1.6%	44.0%	28.9%	8.8%
Standard Deviation	1.10	0.46	0.458	0.560	1.04	2.81	1.54	1.57

Table G.14 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF TLC 500 MHz Forward	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	-17.65	-0.13	-0.20	-0.16	-0.78	-2.00	-0.61	-0.85
Benzimidazole	-0.48					0.52		
Immersion Ag	-0.52				0.70	0.81		
Immersion Au/Pd	-0.54							-0.48
Parylene	-1.07				0.79	0.64		0.40
Silicone	-2.50				0.66	2.51		
Urethane	-1.81				0.44	1.43		
Flux						0.52		
Benzi*Parylene								
Imm Ag*Parylene					-0.70			
Imm Au/Pd*Parylene						1.69		
Benzi*Silicone								
Imm Ag*Silicone					-0.68			
Imm Au/Pd*Silicone								0.71
Benzi*Urethane		-0.62		-0.55				
Imm Ag* Urethane			0.54	0.80				
Imm Au/Pd* Urethane								0.68
Benzi*Flux								
Imm Ag*Flux							-0.33	
Imm Au/Pd*Flux								
Parylene*Flux								
Silicone*Flux								
Urethane*Flux								
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux							0.63	
Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux								
Imm Ag*Silicone*Flux							-0.72	
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux								
Model R ²	77.1%	4.3%	3.0%	15.1%	17.5%	45.1%	8.7%	8.7%
Standard Deviation	0.53	0.69	0.75	0.57	0.71	1.16	0.54	0.70

Table G.15 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF TLC 1 GHz Forward	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	-11.78	-0.21	-0.50	-0.86	-1.26	-1.83	-0.46	-0.54
Benzimidazole	-0.40							
Immersion Ag	-0.38			0.72	0.84			
Immersion Au/Pd	-0.43					-0.59		
Parylene	-1.00		0.49	0.83	1.24	0.54		
Silicone	-2.43			0.72	1.12	2.49		
Urethane	-1.74			0.41	0.88	1.56		
Flux						0.51		
Benzi*Parylene								
Imm Ag*Parylene				-0.68	-0.84			
Imm Au/Pd*Parylene						1.68		
Benzi*Silicone								
Imm Ag*Silicone				-0.73	-0.84			
Imm Au/Pd*Silicone								
Benzi*Urethane		-1.25						
Imm Ag* Urethane			0.88					
Imm Au/Pd* Urethane	0.43							
Benzi*Flux								
Imm Ag*Flux								
Imm Au/Pd*Flux								
Parylene*Flux								
Silicone*Flux			0.49				2.19	
Urethane*Flux								
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux								
Imm Au/Pd*Parylene*Flux							-1.44	
Benzi*Silicone*Flux							-3.84	
Imm Ag*Silicone*Flux							-2.16	
Imm Au/Pd*Silicone*Flux							-2.22	
Benzi*Urethane*Flux	0.74					-1.14		
Imm Ag*Urethane*Flux				0.86				
Imm Au/Pd*Urethane*Flux								-2.88
Model R ²	78.7%	10.9%	13.3%	27.8%	29.1%	46.6%	18.0%	8.2%
Standard Deviation	0.48	0.83	0.74	0.67	0.78	1.08	1.19	1.69

Table G.16 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF TLC Rev Null Freq	Condensing Atmosphere						Thermal Cycling	
Experimental Variables	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	655.4	-20.9	-15.7	-26.2	-31.3	-16.0	10.4	9.0
Benzimidazole	-5.6	18.1		17.4	26.5	4.7	-1.4	-1.1
Immersion Ag	-3.6	19.2		10.2	9.9	3.5		
Immersion Au/Pd								
Parylene	-6.1	18.1	14.8	25.4	31.6	3.8		
Silicone	-17.8	20.2	13.7	25.0	29.9	12.6		
Urethane	-9.2	24.5	14.7	26.6	31.0		-3.7	3.1
Flux		16.3				3.1		
Benzi*Parylene		-15.7		-17.6	-27.2			
Imm Ag*Parylene		-16.8		-11.0	-11.6			
Imm Au/Pd*Parylene						6.1		
Benzi*Silicone	4.0	-18.1		-17.2	-26.2			
Imm Ag*Silicone	4.0	-19.8		-10.4	-10.0			
Imm Au/Pd*Silicone	4.2							
Benzi*Urethane	4.8	-24.7		-20.2	-35.8			
Imm Ag* Urethane		-28.4		-13.1	-13.6		2.4	
Imm Au/Pd* Urethane	-8.0		10.4					
Benzi*Flux		-22.6			-19.5			
Imm Ag*Flux		-25.6						
Imm Au/Pd*Flux	-2.1							
Parylene*Flux		-12.1						
Silicone*Flux		-16.4						
Urethane*Flux		-26.5					-2.0	
Benzi*Parylene*Flux		16.8			18.0			
Imm Ag*Parylene*Flux		20.9						
Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux		21.9			19.7			
Imm Ag*Silicone*Flux		26.5						
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux		32.0			27.6			
Imm Ag*Urethane*Flux		43.5			13.7			
Imm Au/Pd*Urethane*Flux	5.1	10.7	-12.0					-3.5
Model R ²	81.4%	44.2%	36.2%	51.0%	68.7%	40.2%	43.0%	32.0%
Standard Deviation	2.9	6.9	9.1	8.9	8.1	7.3	2.4	2.0

Table G.17 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: HF TLC Rev Null Resp	Condensing Atmosphere						Thermal Cycling	
Experimental Variables	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	-52.2	9.0	13.4	23.0	22.1	3.6	-0.5	-0.7
Benzimidazole Immersion Ag Immersion Au/Pd				-12.5 -12.2	-18.1			
Parylene Silicone Urethane		-8.5 -8.6 -7.2	-12.7 -12.2 -12.9	-22.9 -24.1 -20.2	-22.4 -21.6 -19.0		7.6	
Flux								
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene	-8.9			13.3 13.5	22.1	14.0		
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone				14.4 14.4	18.0			
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane				11.8	14.4		-5.3 -12.0	-3.7
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux					15.1			
Parylene*Flux Silicone*Flux Urethane*Flux	4.0 6.0						-5.1	
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux					-20.4			
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux					-14.2			-7.0
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux					-18.3		-6.8 10.8	
Model R ² Standard Deviation	16.0% 7.7	11.1% 10.2	22.9% 10.2	49.2% 8.8	57.0% 7.9	8.9% 10.9	18.9% 4.9	8.1% 5.0

Table G.18 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: 10-Mil Pads	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	11.44	5.73	5.86	5.81	5.70	11.69	13.23	12.80
Benzimidazole	0.85	1.93	1.36					
Immersion Ag	1.04					-1.43	-0.69	-0.95
Immersion Au/Pd							-0.82	
Parylene	0.77	4.76	4.36	4.49	4.42	0.82		
Silicone		3.35	3.36	4.21	4.31			
Urethane	1.20	5.56	5.08	3.88	3.70	0.84		
Flux		2.02		0.63	0.56			
Benzi*Parylene						-1.40	-1.10	
Imm Ag*Parylene		1.39						
Imm Au/Pd*Parylene	1.23	3.07	3.25	3.00	2.65	-2.10		-1.74
Benzi*Silicone	-1.08							
Imm Ag*Silicone	-1.53	1.81				1.96		1.16
Imm Au/Pd*Silicone		2.32	1.80					
Benzi*Urethane	-0.87	-2.08	-1.94					
Imm Ag* Urethane	-1.10		-1.76			1.37		1.26
Imm Au/Pd* Urethane								
Benzi*Flux								
Imm Ag*Flux			1.49					
Imm Au/Pd*Flux	1.60							
Parylene*Flux		-1.90						
Silicone*Flux								
Urethane*Flux		-1.89						
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux								
Imm Au/Pd*Parylene*Flux	-4.42	-3.87	-4.52	-5.04	-4.50	2.04		1.98
Benzi*Silicone*Flux		-2.02						
Imm Ag*Silicone*Flux		-2.17						
Imm Au/Pd*Silicone*Flux	-1.89	-2.46						
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux	-1.64							
Model R ²	50.9%	75.8%	70.4%	70.1%	70.4%	20.1%	6.0%	9.1%
Standard Deviation	0.80	1.20	1.37	1.31	1.27	1.39	1.62	1.44

Table G.19 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: PGA A	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	10.56	7.36	6.828	6.57	6.54	11.37	12.54	12.66
Benzimidazole	1.68							
Immersion Ag	0.76							
Immersion Au/Pd								
Parylene			1.16					
Silicone		3.21	3.48	3.90	3.84			
Urethane	0.85	3.70	3.66	3.76	3.56		-0.74	-0.68
Flux	2.11	2.08	1.74	1.23	1.14			
Benzi*Parylene		3.59	2.24	3.38	3.15			
Imm Ag*Parylene		1.81		1.92	1.92			
Imm Au/Pd*Parylene	1.63	3.05	2.72	3.52	3.22			
Benzi*Silicone	-1.38							
Imm Ag*Silicone						-0.75		
Imm Au/Pd*Silicone								
Benzi*Urethane	-1.43							
Imm Ag* Urethane								
Imm Au/Pd* Urethane								
Benzi*Flux	-2.41						-0.72	
Imm Ag*Flux	-0.84							
Imm Au/Pd*Flux						0.52		
Parylene*Flux	-0.95	1.80		2.83	2.78			
Silicone*Flux	-1.85	-2.08	-1.61	-1.32	-1.20			
Urethane*Flux	-1.79	-2.33	-1.95	-1.57	-1.57			
Benzi*Parylene*Flux	1.53	-4.2	-2.39	-4.85	-4.2			
Imm Ag*Parylene*Flux		-3.7		-3.68	-3.7			
Imm Au/Pd*Parylene*Flux	-3.13	-5.5	-4.13	-6.11	-5.7			
Benzi*Silicone*Flux	2.26						0.98	
Imm Ag*Silicone*Flux								
Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux	2.10						1.13	
Imm Ag*Urethane*Flux								
Imm Au/Pd*Urethane*Flux								
Model R ²	48.1%	52.9%	49.2%	60.4%	58.1%	6.2%	13.4%	13.1%
Standard Deviation	0.77	1.25	1.35	1.23	1.25	1.03	0.87	0.76

Table G.20 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: PGA B	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	10.54	7.63	7.34	6.88	6.80	11.23	12.39	12.51
Benzimidazole Immersion Ag Immersion Au/Pd	0.39							
Parylene Silicone Urethane	0.77	2.75 3.14	2.57 2.77	3.10 2.87	3.16 2.67		-0.83	-0.79
Flux	1.80	2.41	1.94	2.19	1.92			
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene	1.33 1.24	2.86 2.41	2.43 2.18	2.52 2.50	2.32 2.47			
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone								
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane								
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux	-1.22					0.65		
Parylene*Flux Silicone*Flux Urethane*Flux	-1.94 -1.74	-2.49 -2.65	-1.89 -1.91	-2.29 -2.37	1.53 -2.11 -2.07			
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux	-2.48 -3.90	-3.40 -2.70 -3.84	-2.69 -2.18 -3.06	-2.42 -1.98 -3.34	-3.5 -3.09 -4.4			
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux	1.48					-1.21		
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux	1.31							
Model R ² Standard Deviation	40.0% 0.94	49.9% 1.22	44.6% 1.25	45.8% 1.29	44.6% 1.32	3.6% 1.13	13.4% 0.92	13.7% 0.87

Table G.21 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: Gull Wing	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	11.62	5.33	5.32	5.27	5.25	11.25	12.66	12.35
Benzimidazole							-0.77	-1.04
Immersion Ag		1.44	1.32	0.70	0.63			
Immersion Au/Pd								
Parylene		4.69	4.21	4.42	4.52			
Silicone		2.90	1.14	1.85	1.41			
Urethane		1.55	1.07				-0.87	
Flux			-0.84	-0.82	-0.99			
Benzi*Parylene	1.21	1.96	1.64	1.30	1.20			
Imm Ag*Parylene								
Imm Au/Pd*Parylene		1.84	1.80	1.50	1.33			
Benzi*Silicone			2.84	1.83	1.93			1.52
Imm Ag*Silicone								
Imm Au/Pd*Silicone			1.53					
Benzi*Urethane			-1.15			-2.85		
Imm Ag* Urethane		-1.70	-1.89					
Imm Au/Pd* Urethane				1.28	0.84	-1.66		
Benzi*Flux								
Imm Ag*Flux						-1.95	-2.70	
Imm Au/Pd*Flux		1.38				-2.02		-1.34
Parylene*Flux			1.21	1.29	1.33			
Silicone*Flux			2.32	2.50	2.88			
Urethane*Flux		-1.52						
Benzi*Parylene*Flux								
Imm Ag*Parylene*Flux								-2.63
Imm Au/Pd*Parylene*Flux	-1.25	-3.80	-2.57	-2.64	-2.47	2.70		2.50
Benzi*Silicone*Flux			-2.21	-3.02	-2.27			
Imm Ag*Silicone*Flux								-2.33
Imm Au/Pd*Silicone*Flux						3.50		2.50
Benzi*Urethane*Flux								
Imm Ag*Urethane*Flux				2.30			2.80	
Imm Au/Pd*Urethane*Flux								
Model R ²	9.4%	70.4%	77.1%	78.0%	81.6%	24.8%	14.9%	17.9%
Standard Deviation	1.17	1.50	1.34	1.28	1.18	2.08	1.98	1.83

Table G.22 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: Stranded Wire 1	Condensing Atmosphere						Thermal Cycling	
	Pre-Test	Cycle 1	Cycle 4	Cycle 7	Cycle 10	Post-CA	250 Cycles	500 Cycles
Constant	14.54	-0.0002	-0.0001	0.0002	0.0001	-0.0008	-0.0008	-0.0004
Benzimidazole Immersion Ag Immersion Au/Pd					-0.0010			
Parylene Silicone Urethane		0.0010			-0.0011			
Flux		0.0013	0.0029	0.0013	0.0026			-0.0010
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene					0.0015			
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone								
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane			-0.0036		-0.0039			
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux	-1.09							
Parylene*Flux Silicone*Flux Urethane*Flux		-0.0015						
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux					0.0011			
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux			0.0063		-0.0035 0.0026 -0.0019	-0.0020	-0.0024	
Model R ² Standard Deviation	2.2% 2.43	11.8% 0.0018	19.8% 0.0020	10.5% 0.0020	27.5% 0.0018	0.7% 0.0041	3.0% 0.0024	4.3% 0.0023

Table G.23 Significant Coefficients for the GLM Analyses by Test Time

Electrical Response: Stranded Wire 2	Condensing Atmosphere						Thermal Cycling	
	Pre-Test		Delta 4	Delta 7	Delta 10	Post-Delta	250 Cycles	500 Cycles
Constant	23.65	-0.0000	0.0005	0.0004	0.0004	0.0000	0.0002	0.0002
Benzimidazole Immersion Ag Immersion Au/Pd	1.10							
Parylene Silicone Urethane	-1.53					0.0073		
Flux	-1.27							
Benzi*Parylene Imm Ag*Parylene Imm Au/Pd*Parylene								
Benzi*Silicone Imm Ag*Silicone Imm Au/Pd*Silicone								
Benzi*Urethane Imm Ag* Urethane Imm Au/Pd* Urethane		0.0038	0.0025	0.0023	0.0025	-0.0062	0.0100	0.0046
Benzi*Flux Imm Ag*Flux Imm Au/Pd*Flux								
Parylene*Flux Silicone*Flux Urethane*Flux		0.0016						
Benzi*Parylene*Flux Imm Ag*Parylene*Flux Imm Au/Pd*Parylene*Flux								
Benzi*Silicone*Flux Imm Ag*Silicone*Flux Imm Au/Pd*Silicone*Flux								
Benzi*Urethane*Flux Imm Ag*Urethane*Flux Imm Au/Pd*Urethane*Flux		-0.0044					-0.0086 0.0056	0.0062
Model R ²	16.8%	12.9%	6.9%	5.5%	6.5%	17.2%	21.8%	13.6%
Standard Deviation	2.33	0.0021	0.0023	0.0023	0.0023	0.0063	0.0038	0.0039