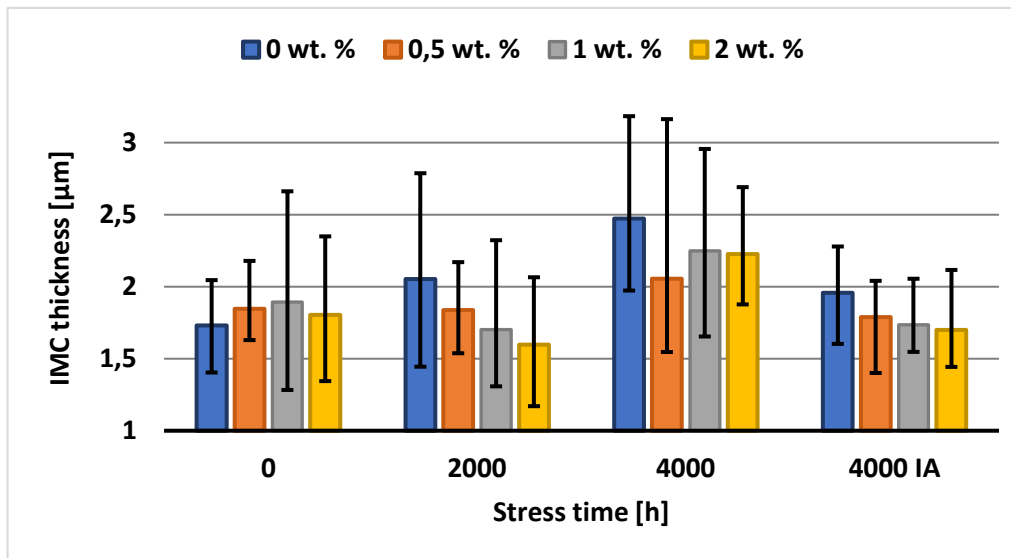


Table 1
Test and sample designations.

Treatment	Duration [hours]	Test Name	Fe-NPs [wt.%]	Sample names
Reflow soldering	–	aR	0.0 0.5 1.0 2.0	aR-0Fe, aR-0.5Fe, aR-1Fe, aR-2Fe
Current stressing to study Electromigration (EM) effects	1000	1h EM		1hEM-0Fe, 1hEM-0.5Fe, 1hEM-1Fe, 1hEM-2Fe
	2000	2h EM		2hEM-0Fe, 2hEM-0.5Fe, 2hEM-1Fe, 2hEM-2Fe
	4000	4h EM		4hEM-0Fe, 4hEM-0.5Fe, 4hEM-1Fe, 4hEM-2Fe
Isothermal Aging (75 °C)	1000	1h IA		1hIA-0Fe, 1hIA-0.5Fe, 1hIA-1Fe, 1hIA-2Fe
	2000	2h IA		2hIA-0Fe, 2hIA-0.5Fe, 2hIA-1Fe, 2hIA-2Fe
	4000	4h IA		4hIA-0Fe, 4hIA-0.5Fe, 4hIA-1Fe, 2hIA-4Fe

Average IMC thickness of SAC solderjoints of the 0402 resistors at the left(L) and right (R) pad side as reflowed and after EM test

		Mean thickness (μm)	Dev (μm)	Min (μm)	Max (μm)	Min. val (μm)	Max. val (μm)
As-reflowed	0%RT	1,73	0,22	1,40	2,05	0,33	0,31
	0.5%RT	1,85	0,16	1,63	2,18	0,22	0,33
	1%RT	1,89	0,42	1,28	2,66	0,61	0,77
	2%RT	1,80	0,34	1,34	2,35	0,46	0,55
2000 H	0%2H	2,05	0,50	1,44	2,79	0,61	0,73
	0.5%2H	1,84	0,23	1,54	2,17	0,30	0,33
	1%2H	1,70	0,42	1,31	2,32	0,39	0,62
	2%2H	1,60	0,28	1,17	2,07	0,43	0,47
4000 H	0%4H	2,47	0,44	1,97	3,18	0,50	0,71
	0.5%4H	2,06	0,48	1,55	3,16	0,51	1,11
	1%4H	2,25	0,49	1,65	2,96	0,60	0,71
	2%4H	2,23	0,31	1,88	2,69	0,35	0,47
4000 H IA	0%4H	1,96	0,23	1,60	2,28	0,35	0,32
	0.5%4H	1,79	0,21	1,40	2,04	0,39	0,25
	1%4H	1,74	0,20	1,55	2,06	0,19	0,32
	2%4H	1,70	0,21	1,44	2,12	0,26	0,42



Comparison of relative IMC layer growth in comparison with theoretical models (Vianco et al, and Krammer st al.)

Relative IMC Growth Cathode			
	0	2000	4000
0	0	0,15311085	0,24507419
0,5	0	-0,03759432	0,1002818
1	0	-0,10127536	0,3428451
2	0	-0,11376182	0,18853158
Vianco	0	0,22973036	0,34341226
Krammer	0	0,22510983	0,28414533
Relative IMC Growth anode			
	0	2000	4000
0	0	0,26299649	0,65890848
0,5	0	0,04016295	0,13051587
1	0	-0,09910302	-0,01858114
2	0	-0,14322011	0,27951229
Vianco	0	0,22973036	0,34341226
Krammer	0	0,22510983	0,28414533

Sources

O. Krammer, T. Hurtony and Á. Hadarits, SIITME 2017, doi: 10.1109/SIITME.2017.8259860.

Vianco, P.T., Rejent, J.A. & Hlava, J. *Electron. Mater.* **33**, 991–1004 (2004). <https://doi.org/10.1007/s11664-004-0026-9>

