JOHANSON DIELECTRICS INC.
15191 Bledsoe Street, Sylmar, Ca. 91342 Phone (818) 364-9800 Fax (818) 364-6100

Tin Whisker Test Summary

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In order to evaluate the tin whisker growth on pure tin and tin lead plated capacitors Johanson Dielectrics performed tin whisker testing on various sizes of capacitors using iNEMI and JESDA121 test methods.
The following samples were tested:

0805 X7R Pure Matte Tin Finish with nickel barrier
1210 X7R Pure Matte Tin Finish with nickel barrier
1210 X7R Tin Lead Finish with 5% minimum lead content (same lot as pure tin part)
1812 X7R Pure Matte Tin Finish with nickel barrier

Two different tests were performed:
1) Temperature Cycle Test:
Temperature Cycle per JESD22-A104 Test Condition A Soak Mode 3 1000 cycles
SEM inspections per JESD22-A121.
The parts are temperature cycled from -55C to 85C, with a minimum of 10 minutes soak time at the minimum and maximum temperatures.

2) Temperature Humidity Test:
4000 hours at 60 C and 93% relative humidity per iNEMI recommendations.

Inspection of whiskers:
The capacitors were inspected by SEM before and after each test at 250 and 2500 magnification.
The parts were evaluated to the requirements of Class 2 devices as stipulated by iNEMI 'Tin Whisker Acceptance Test Requirements', July 28, 2004, paragraph 18.2.3. The maximum acceptable whisker length is 40 um.
The whisker length reported is the total axial whisker length as per JEDEC standard JESD22A121 definition 3.1. Although only whiskers of 10um or greater in length are classified as 'true' whiskers as per JEDEC standard JESD22A121 definition 3.2, whiskers of all lengths are reported below.

Part Description	Number of parts tested	Maximum Whisker Length (um)		Meets iNEMI Class 2
		Temp Cycling (1000 cycles)	Temp Humidity (4000 hrs)	
0805 Pure Tin	15	4	No Whiskers Present	Yes
1210 Pure Tin	9	14	1	Yes
1812 Pure Tin	9	17	No Whiskers Present	Yes
1210 Tin Lead	9	No Whiskers Present	No Whiskers Present	Yes

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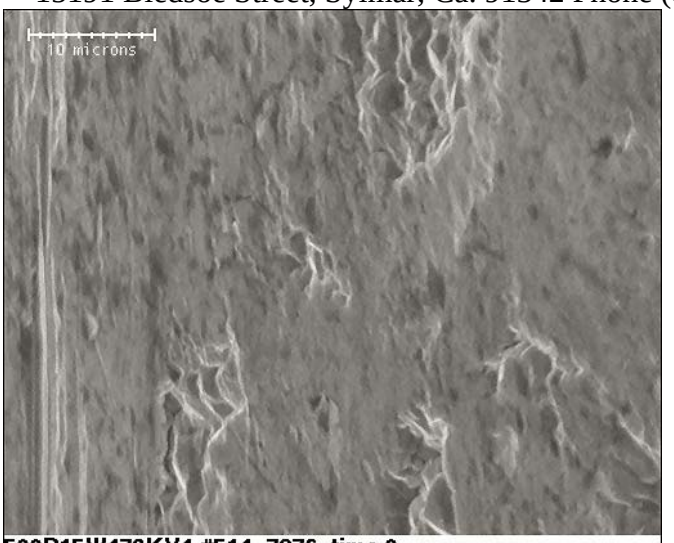
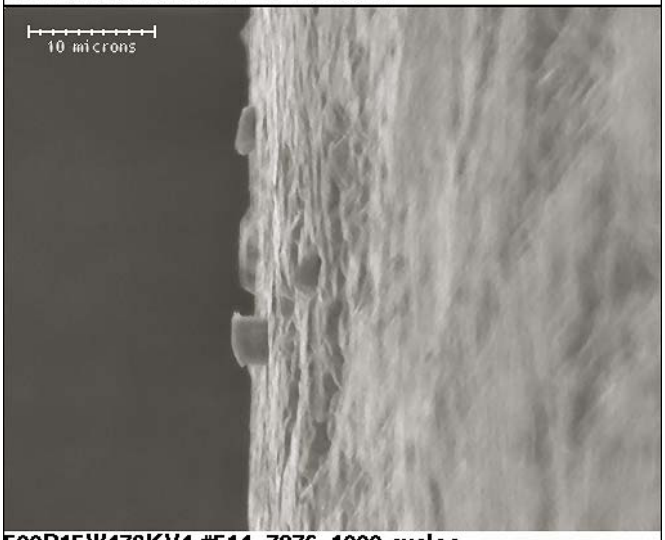


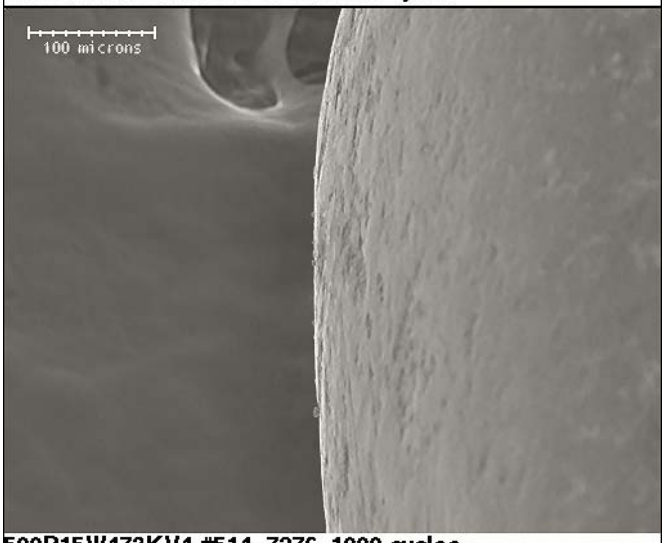
500R15W473KV4 #514-7276, time 0

0805 size pure tin 2500x magnification
time 0



500R15W473KV4 #514-7276, 1000 cycles

0805 size pure tin 2500x magnification
1000 Temperature Cycles



500R15W473KV4 #514-7276, 1000 cycles

0805 size pure tin 250x magnification
1000 Temperature Cycles

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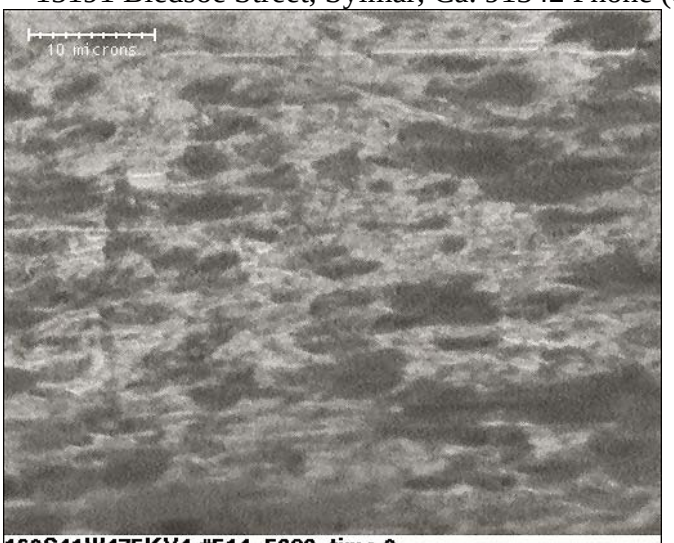
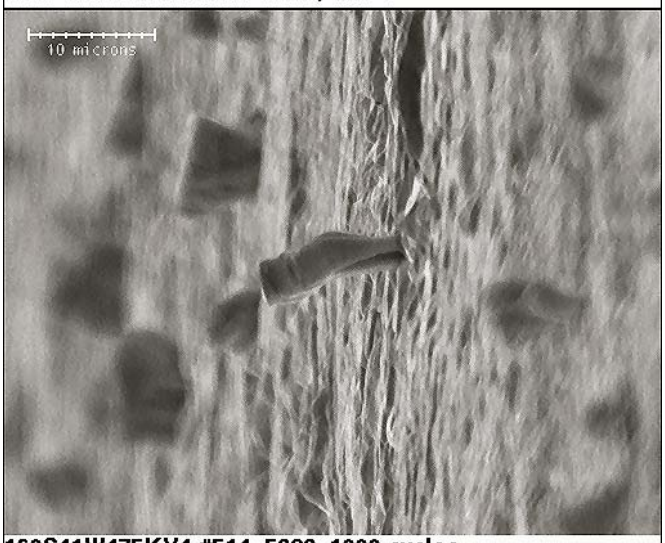


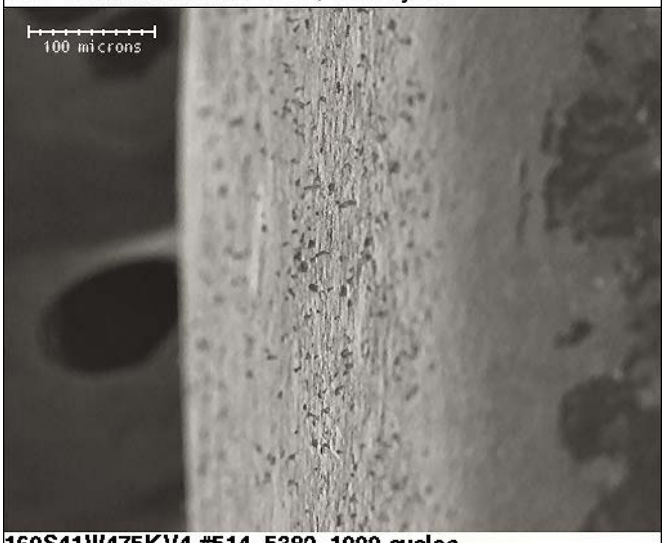
160S41W475KV4 #514-5389, time 0

1210 size pure tin 2500x magnification
time 0



160S41W475KV4 #514-5389, 1000 cycles

1210 size pure tin 2500x magnification
1000 Temperature Cycles



160S41W475KV4 #514-5389, 1000 cycles

1210 size pure tin 250x magnification
1000 Temperature Cycles

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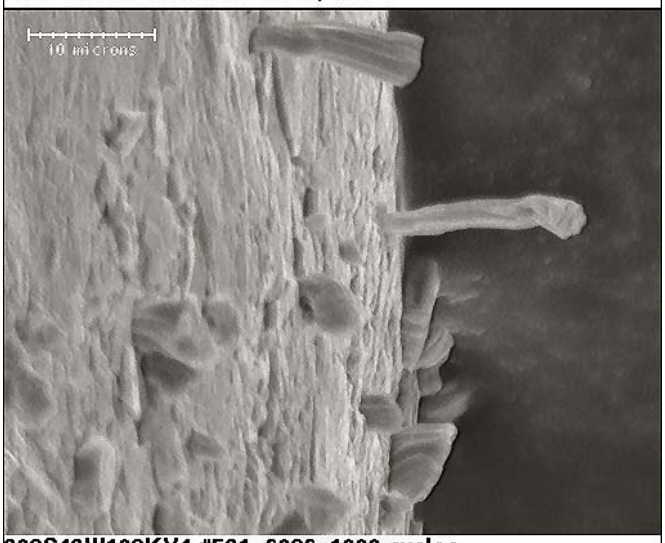
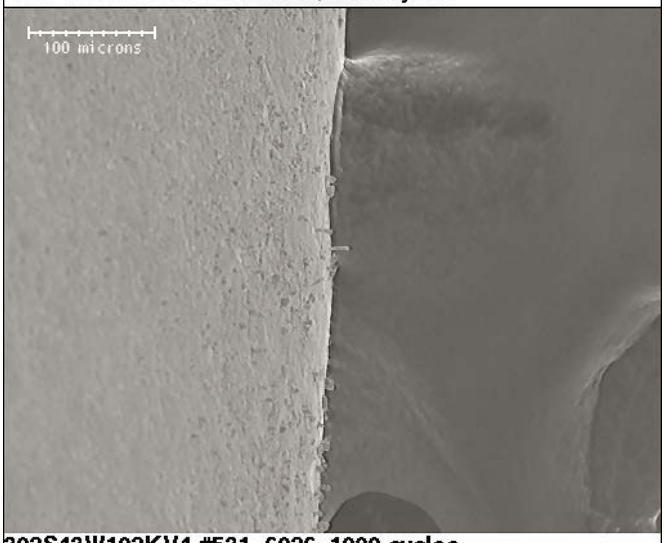
302S43W102KV4 #531-6026, time 0

1812 size pure tin 2500x magnification
time 0



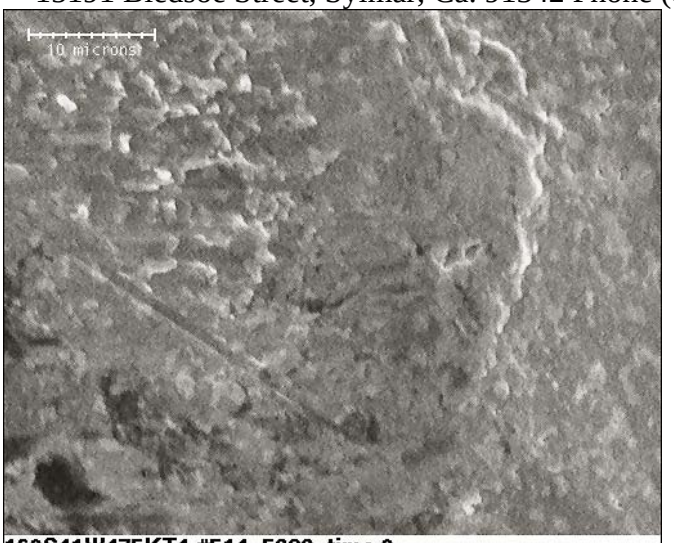
302S43W102KV4 #531-6026, 1000 cycles

1812 size pure tin 2500x magnification
1000 Temperature Cycles



302S43W102KV4 #531-6026, 1000 cycles

1812 size pure tin 250x magnification
1000 Temperature Cycles

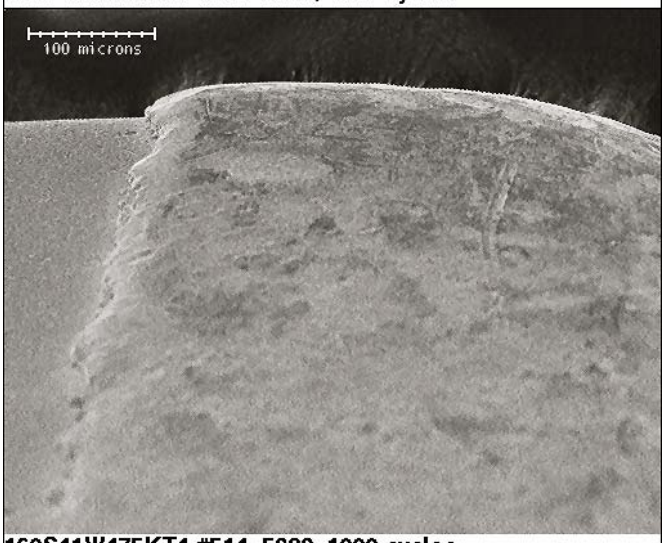


160S41W475KT4 #514-5389, time 0

1210 size tin/lead 2500x magnification
time 0

160S41W475KT4 #514-5389, 1000 cycles

1210 size tin/lead 2500x magnification
1000 Temperature Cycles



160S41W475KT4 #514-5389, 1000 cycles

1210 size tin/lead 250x magnification
1000 Temperature Cycles

Detailed test reports are available at http://www.johansondielectrics.com/technicalnotes/tin/