(2022.07.28 revised)

Comparison Evaluation of MPP(Metalized Polypropylene) Capacitors

フィルムキャパシタ比較試験結果報告Vol.2

KETI

J_Chip Consulting

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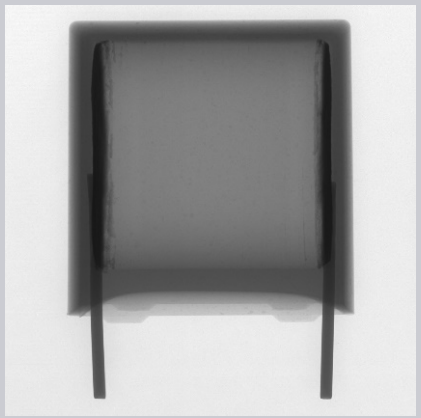
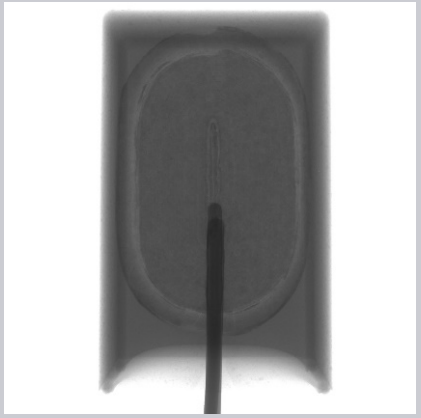
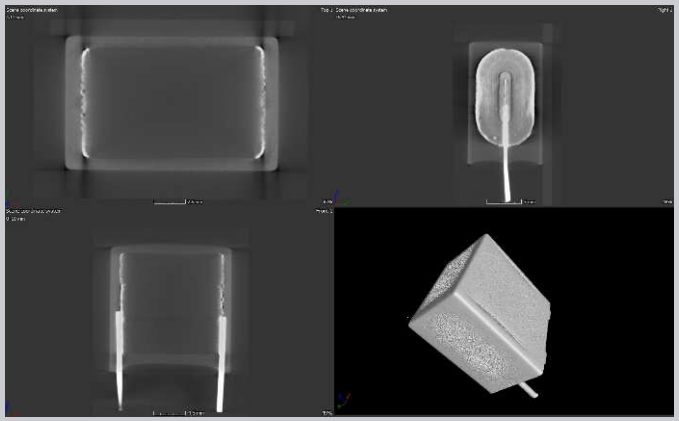
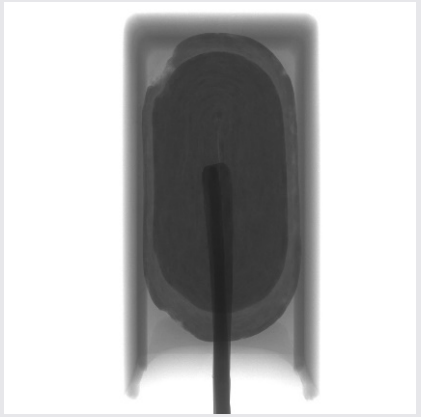
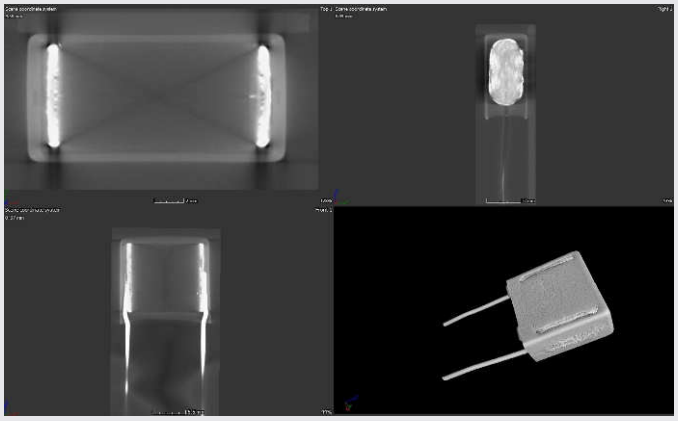
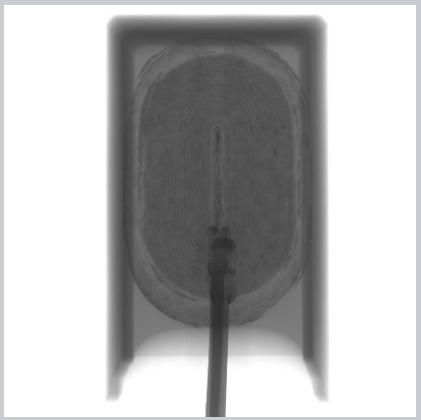
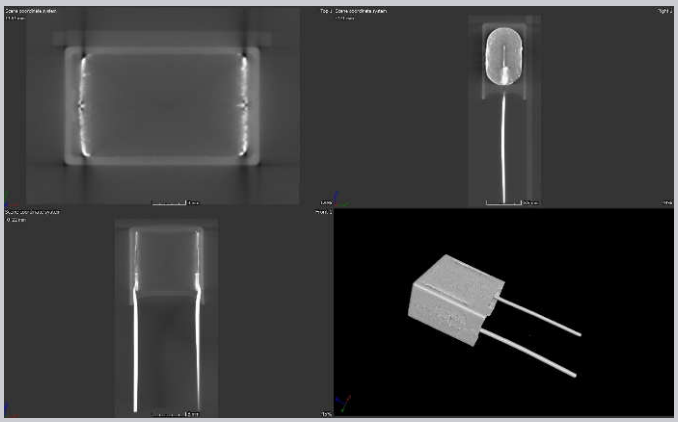
III. X-ray analyses

A/B/C社

Specimen	X-ray analyses		
A			
B			
C			

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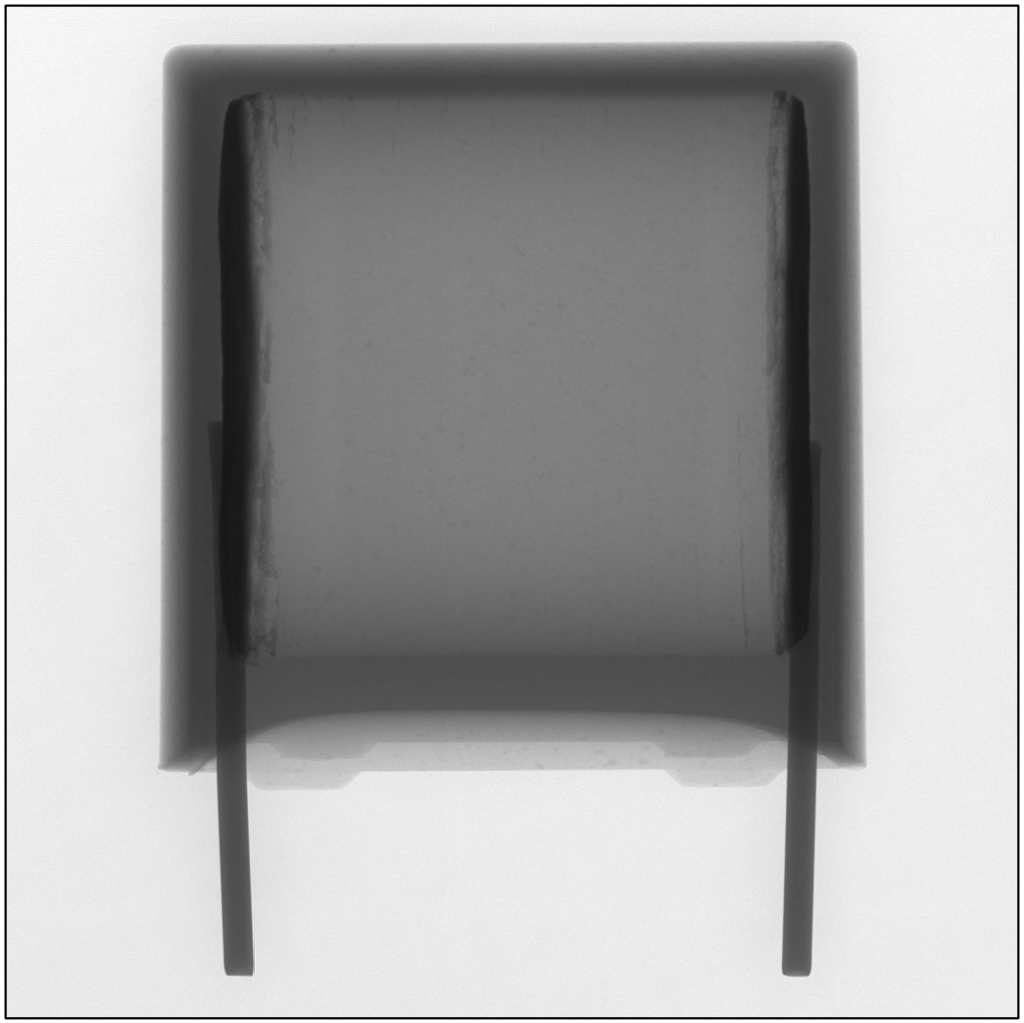

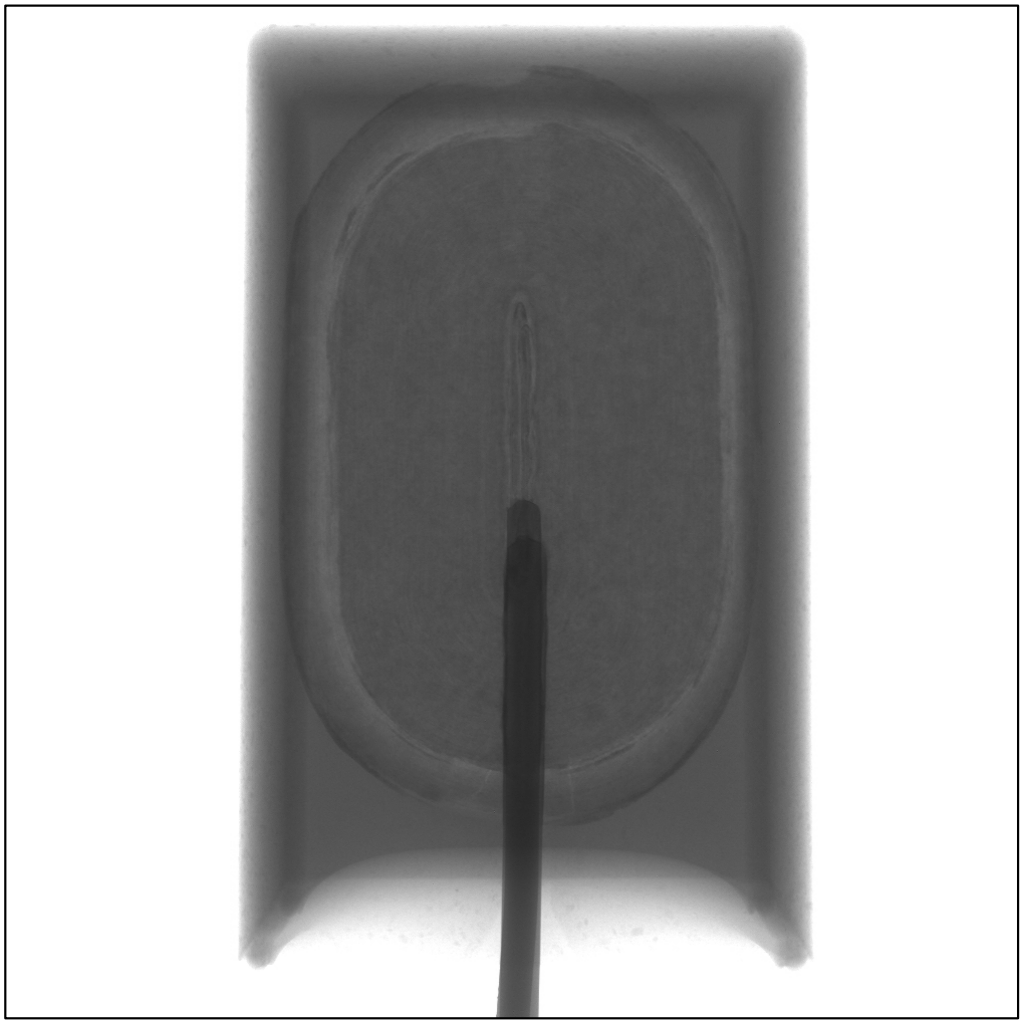

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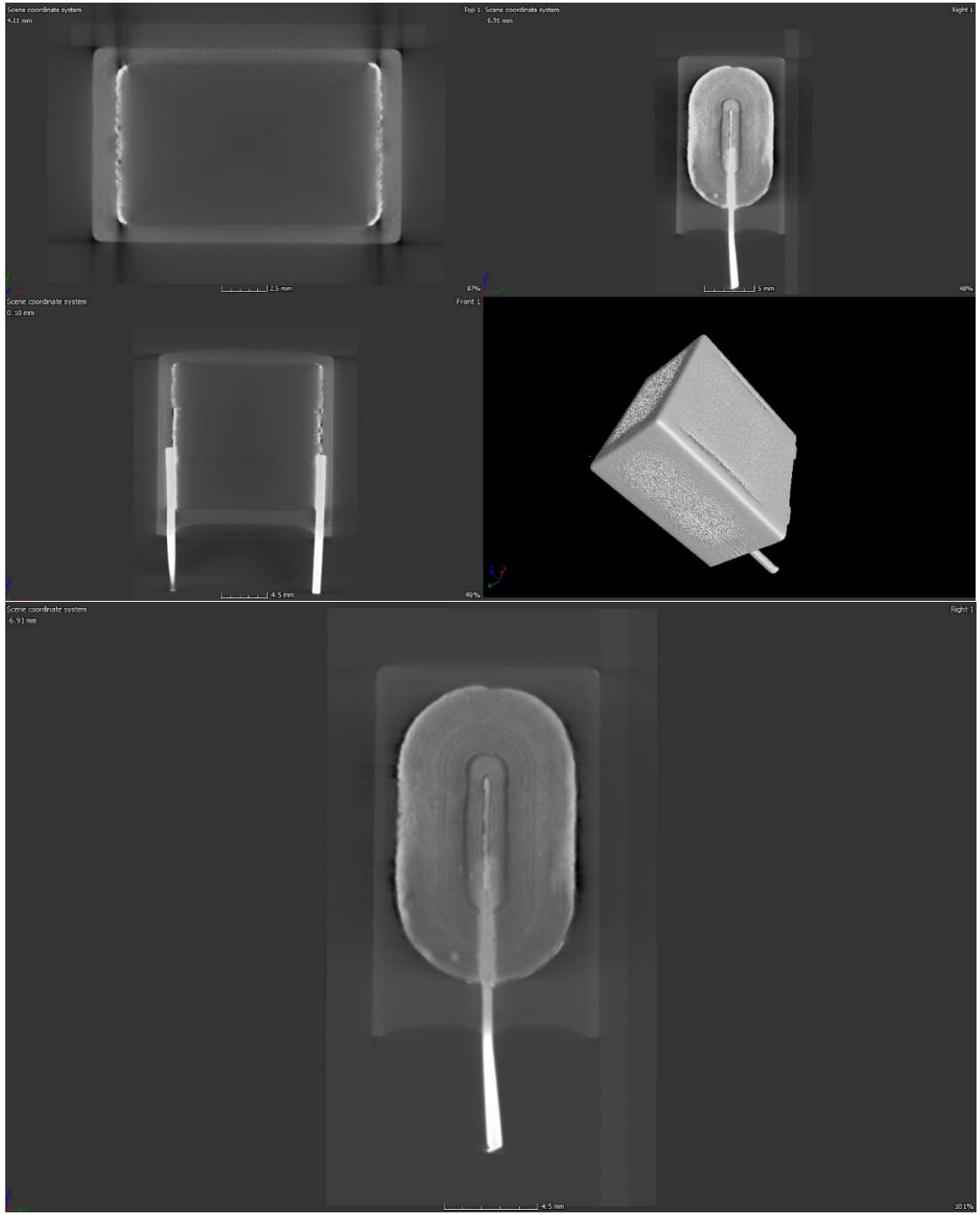

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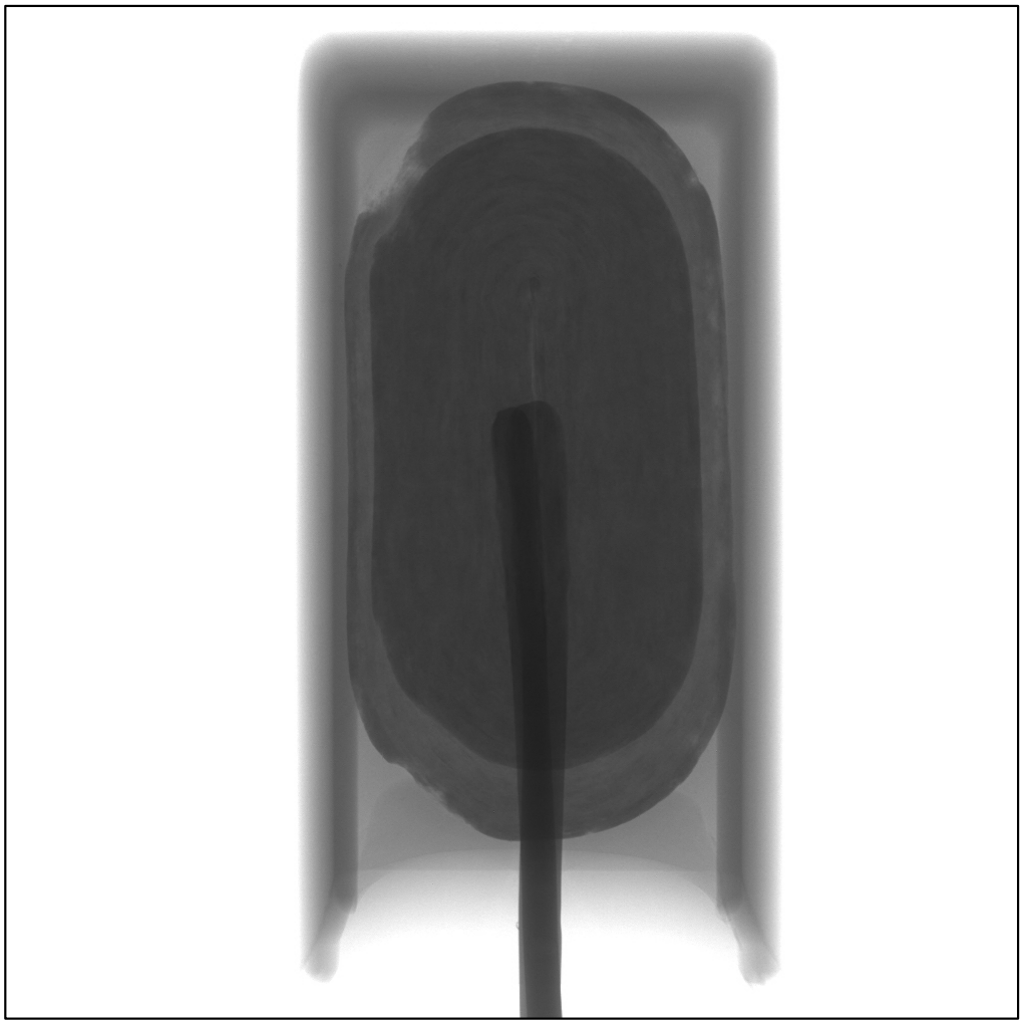

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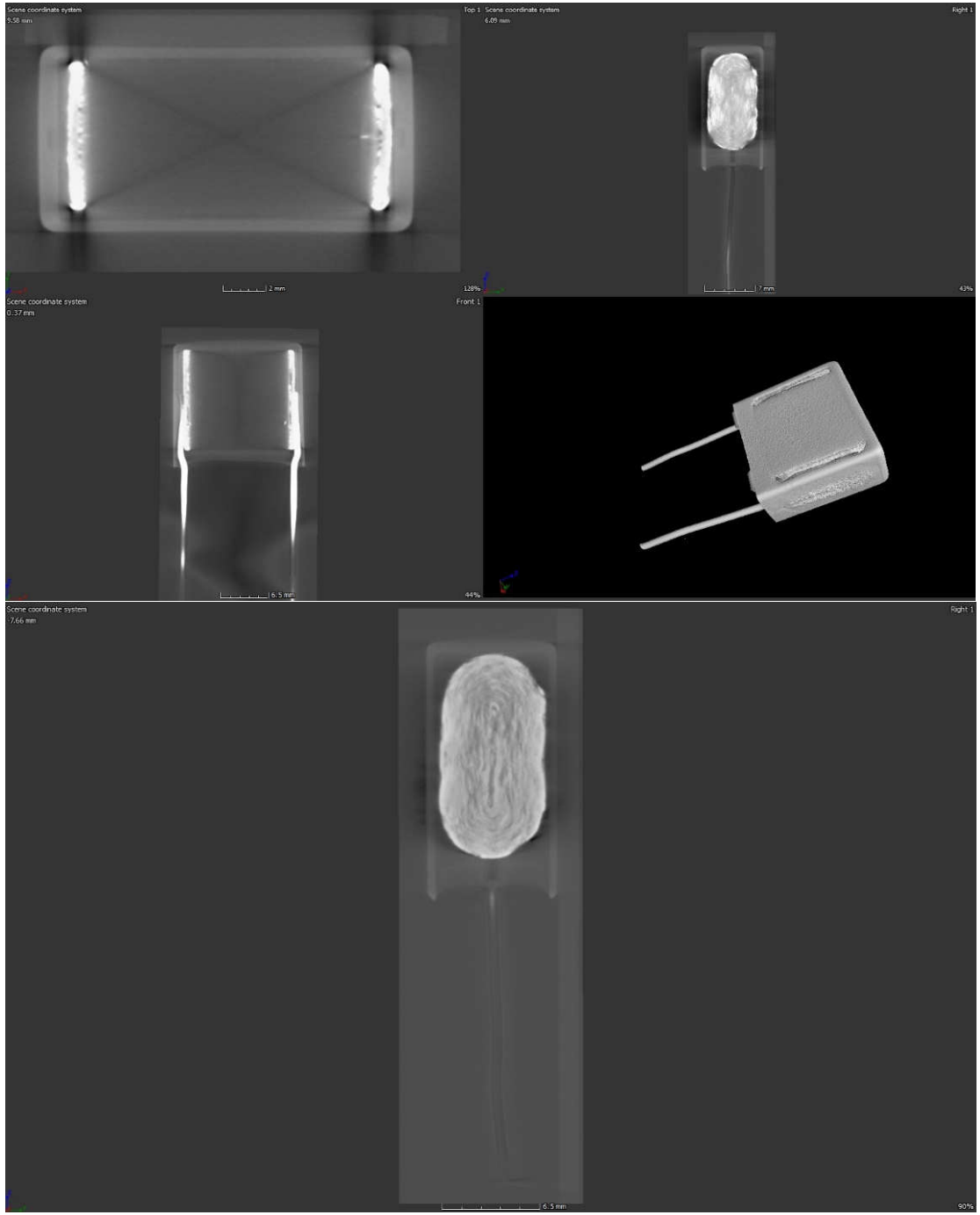
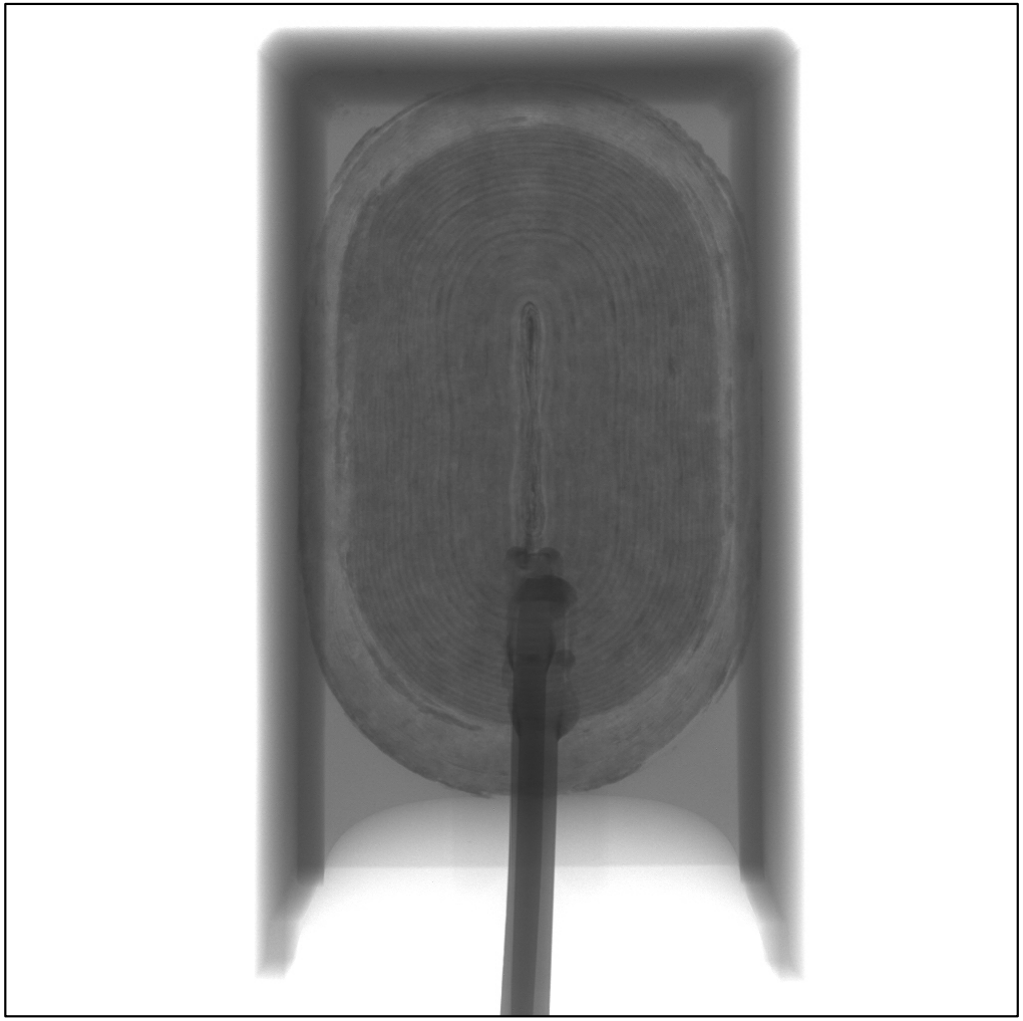
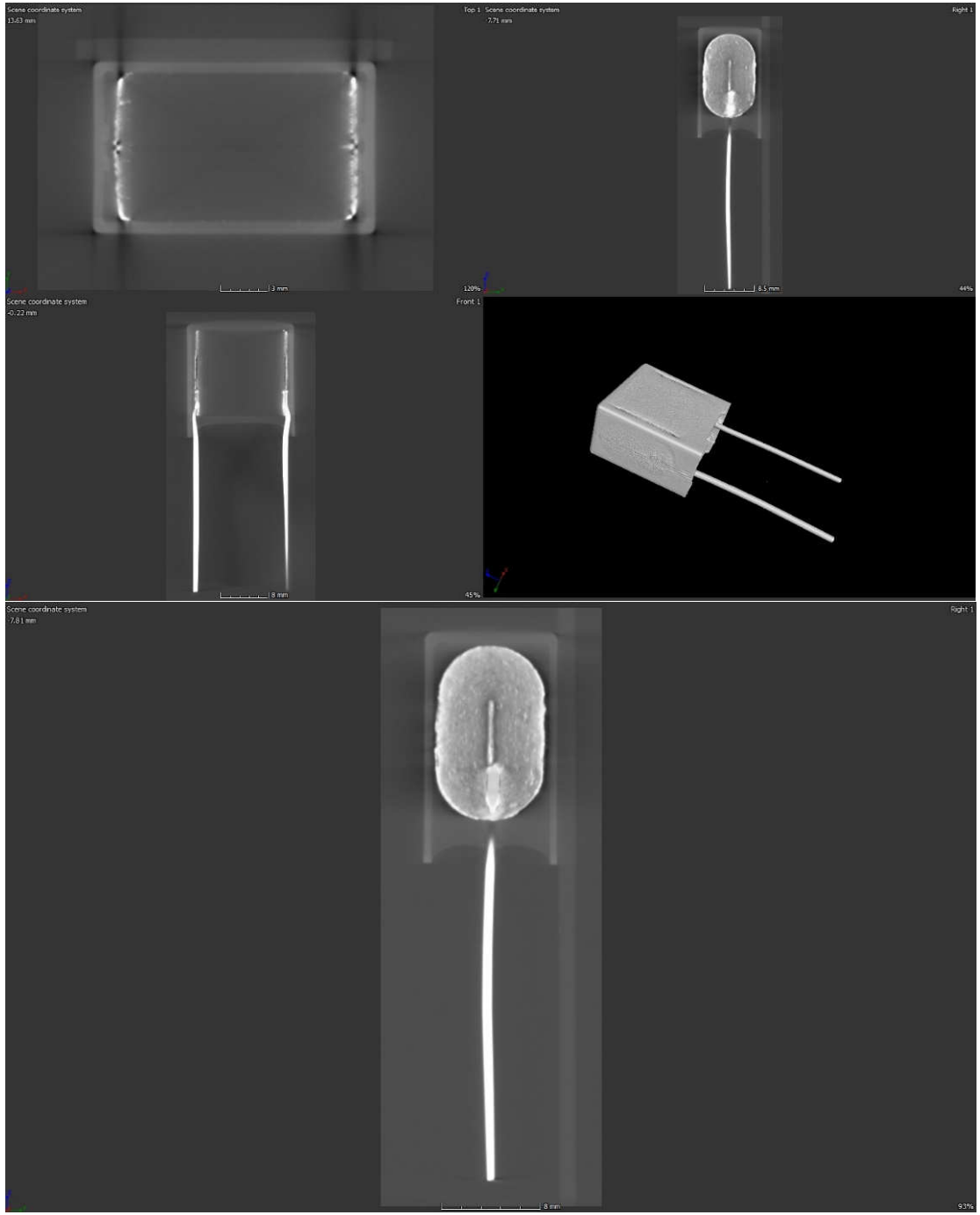

Scene coordinate system
Top 1
Right 1
Front 1
2 mm
7 mm
6.5 mm
120%
43%
44%
90%

C社

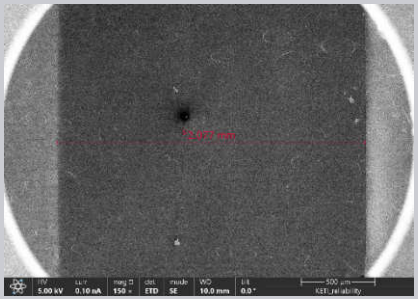
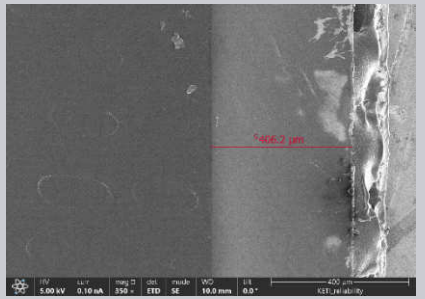
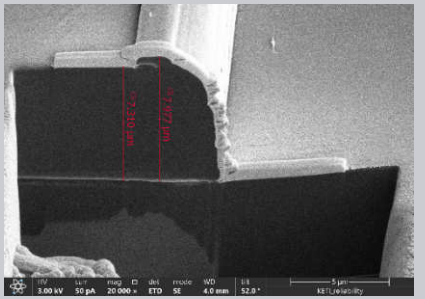
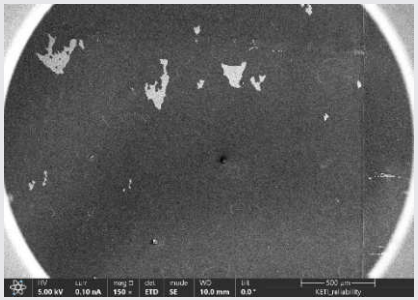
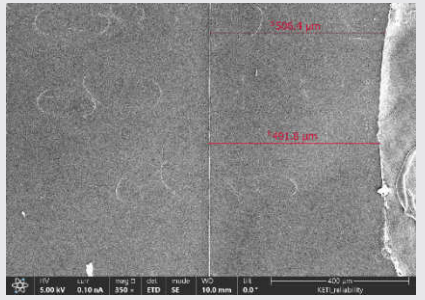
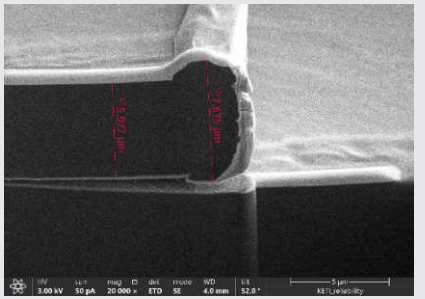
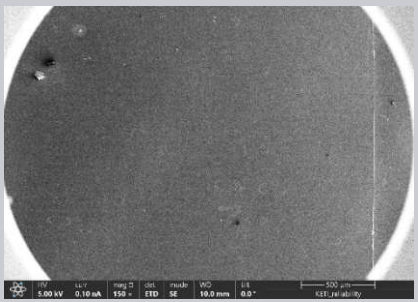
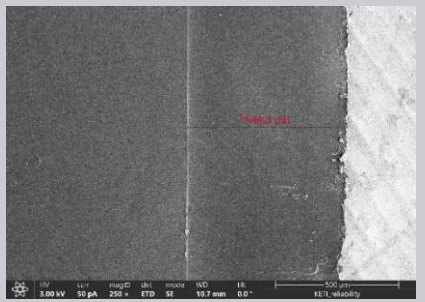
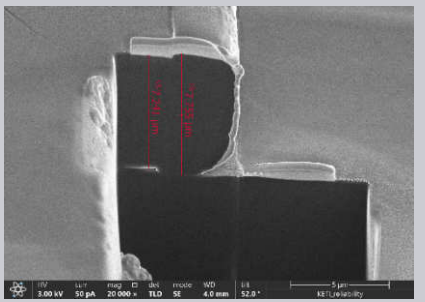


C社



IV. SEM analyses

A/B/C社

Sample	SEM analyses
A	   
B	   
C	   

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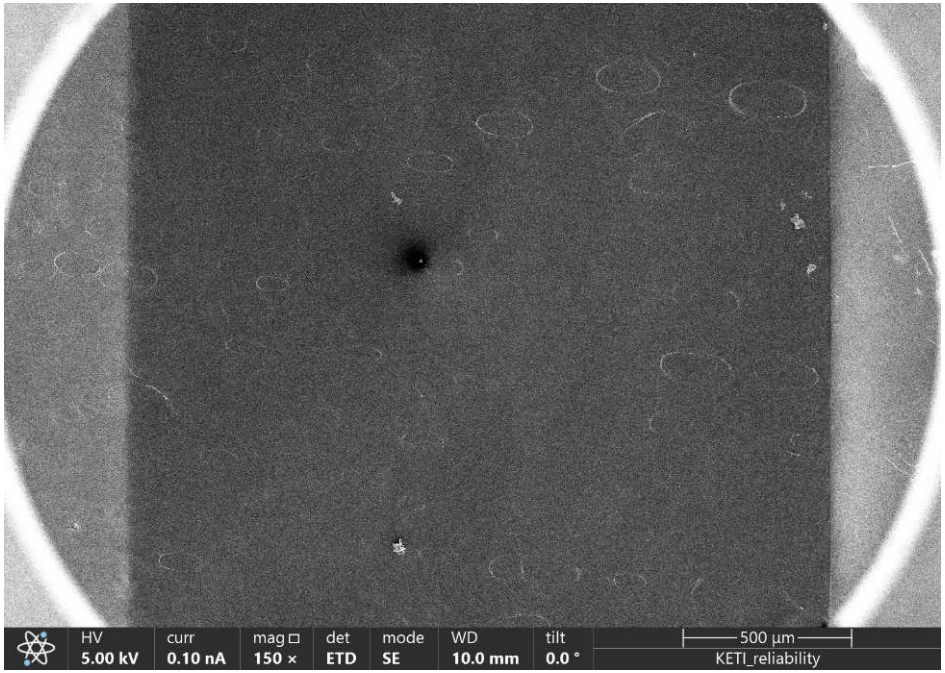
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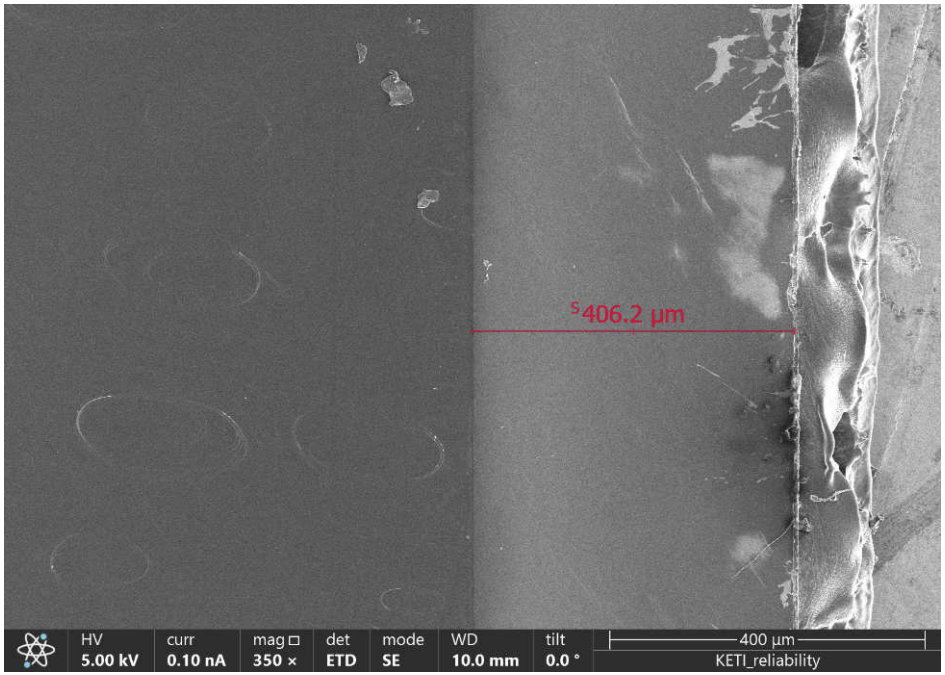
mag 150 ×
det ETD
mode SE
WD 10.0 mm
tilt 0.0 °
500 µm
KETI_reliability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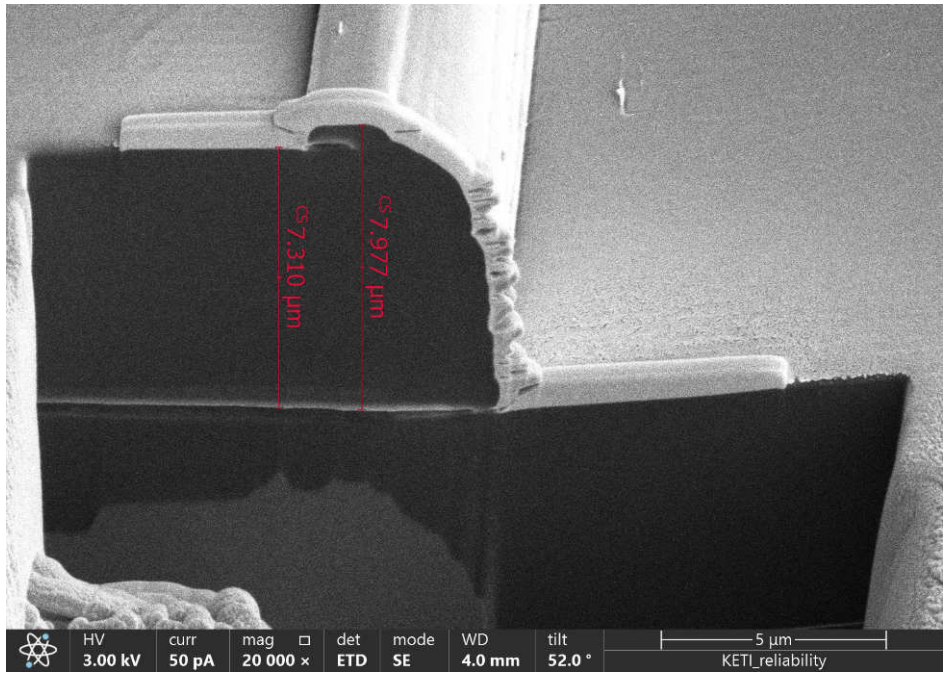
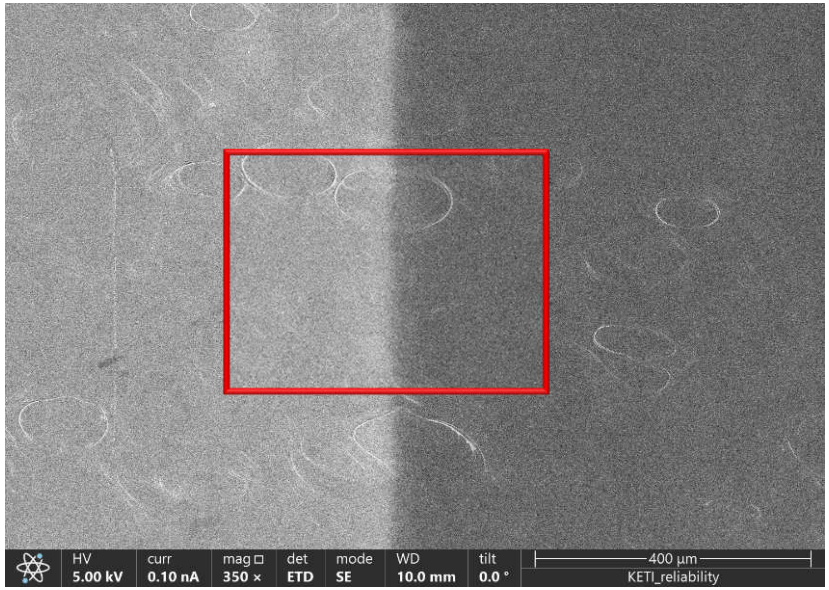
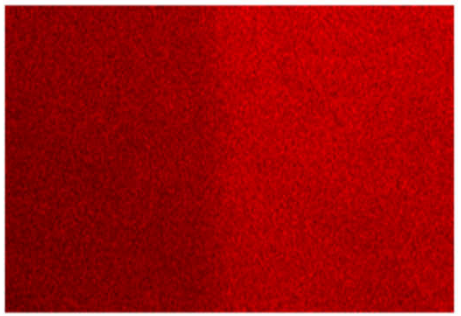
HV 5.00 kV
curr 0.10 nA
mag 350 ×
det ETD
mode SE
WD 10.0 mm
tilt 0.0 °
400 µm
KETI_reliability


7.977 µm
7.310 µm
HV 3.00 kV
curr 50 pA
mag 20 000 ×
det ETD
mode SE
WD 4.0 mm
tilt 52.0 °
5 µm
KETI_reliability

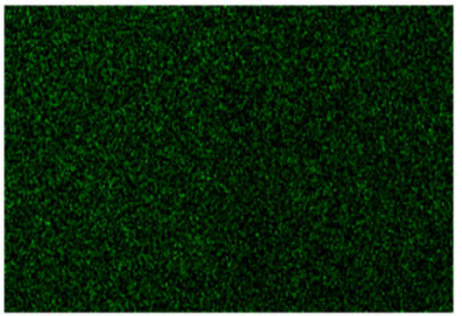
A社



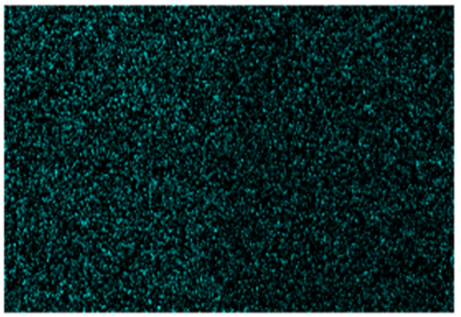
C K series



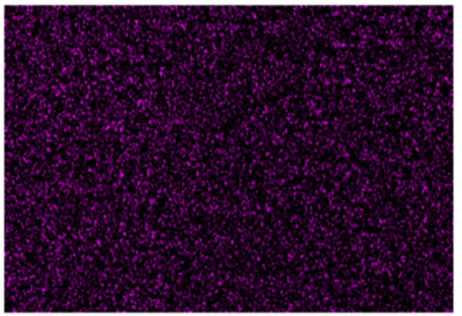
Zn K series

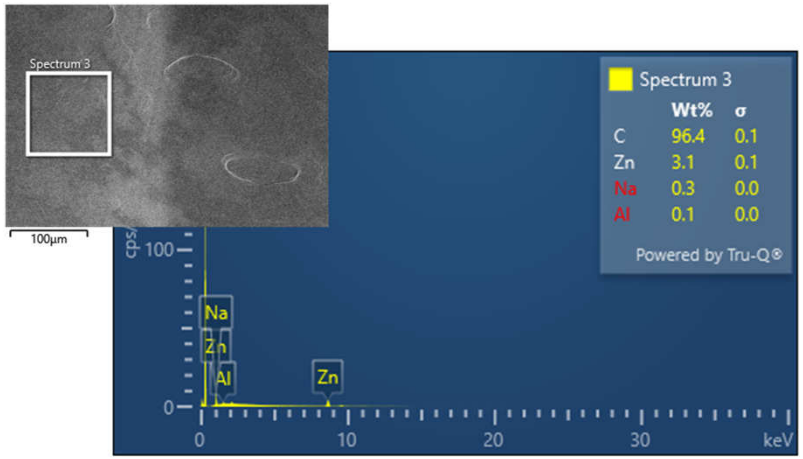


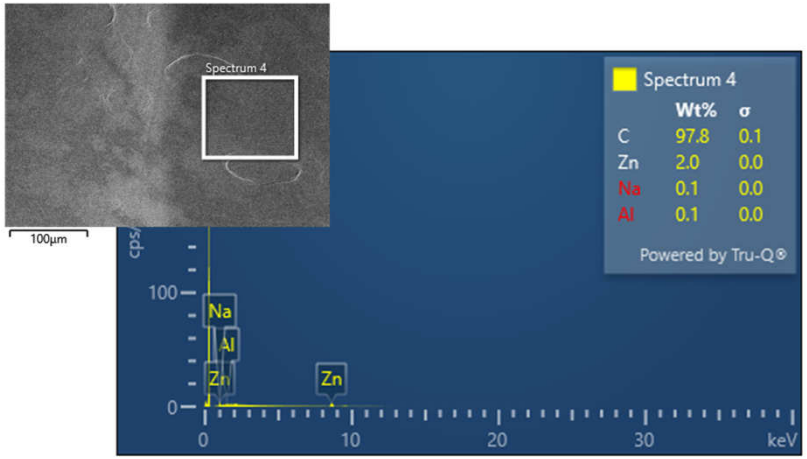
Na K series



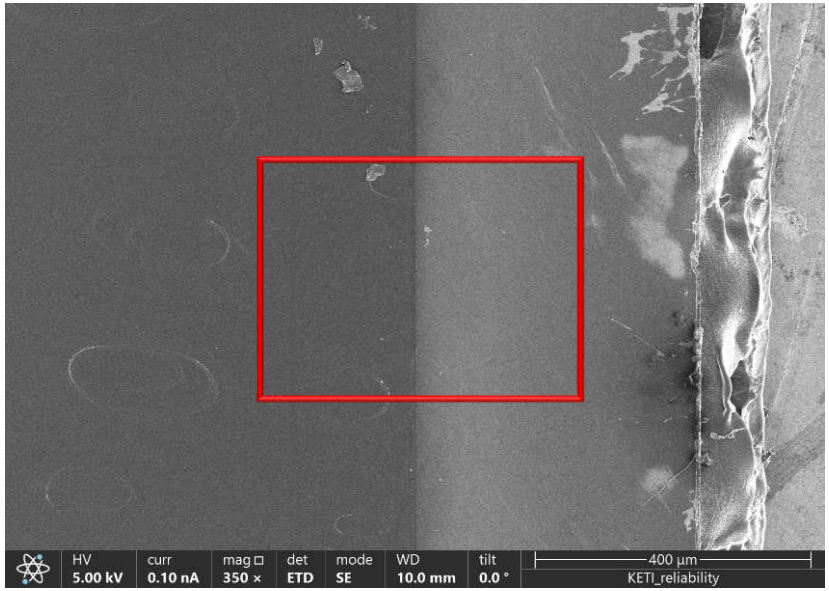
Al K series

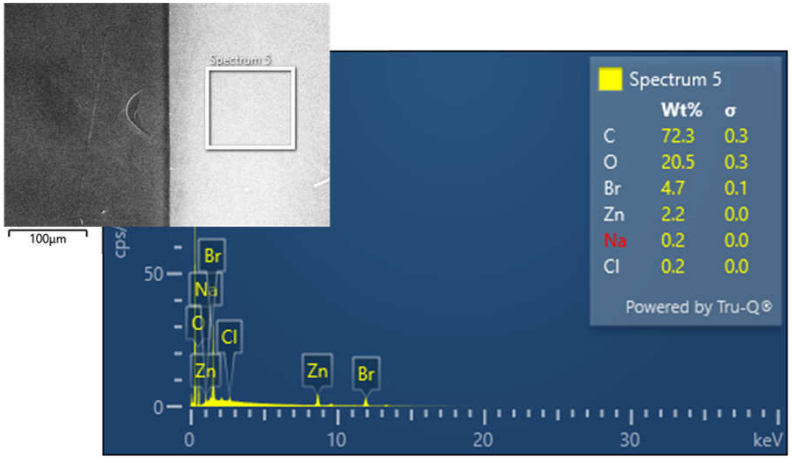


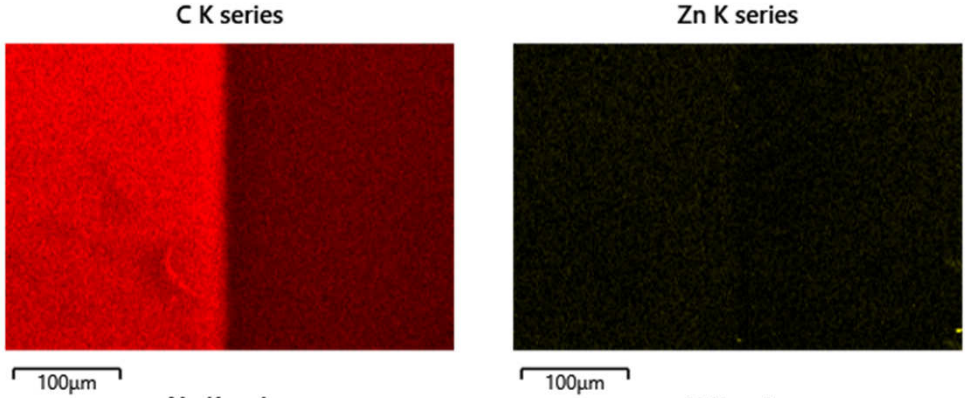




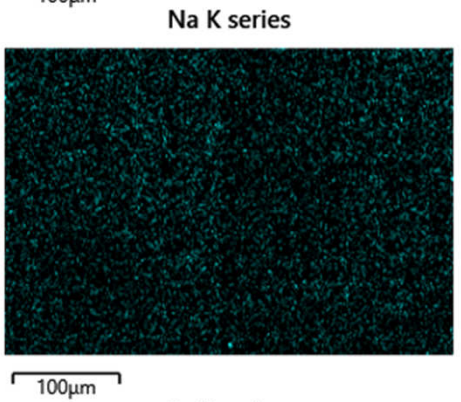
A社

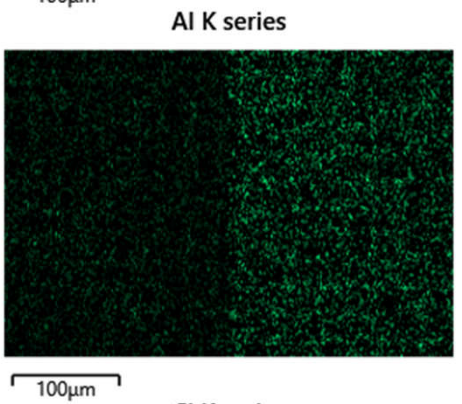

HV
5.00 kV
curr
0.10 nA
mag
350 ×
det
ETD
mode
SE
WD
10.0 mm
tilt
0.0 °
400 µm
KETI_reliability

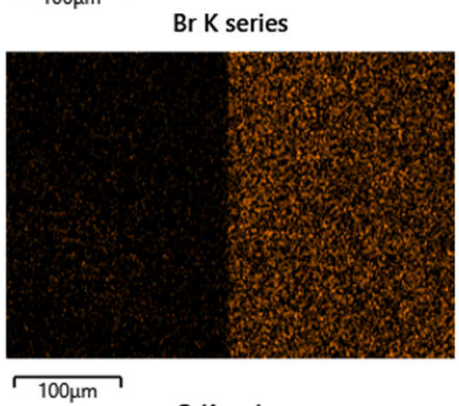

100µm
Spectrum 5
Wt% σ
C 72.3 0.3
O 20.5 0.3
Br 4.7 0.1
Zn 2.2 0.0
Na 0.2 0.0
Cl 0.2 0.0
Powered by Tru-Q®
cps
50
0
Br
Na
C
Cl
Zn
Zn
Br
0
10
20
30
keV

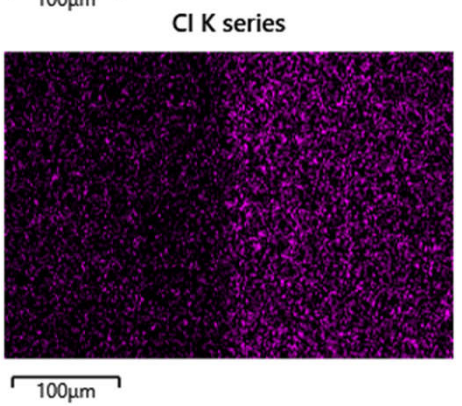

C K series
100µm

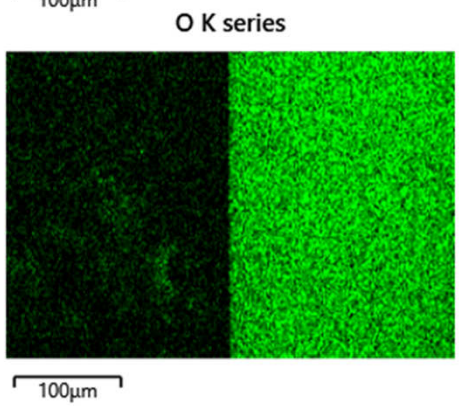
Zn K series
100µm


Na K series
100µm

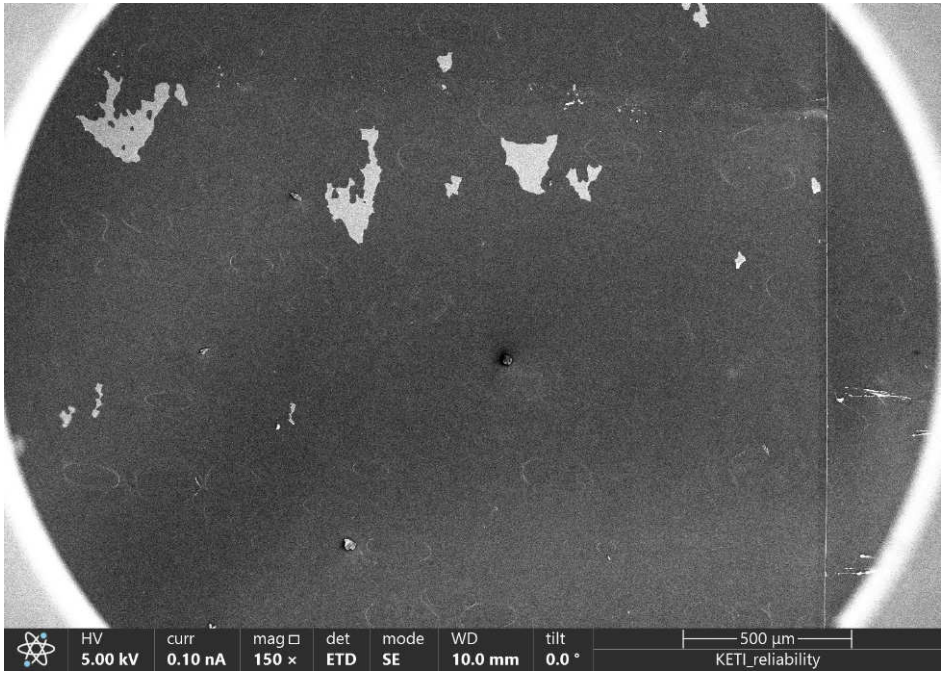

Al K series
100µm

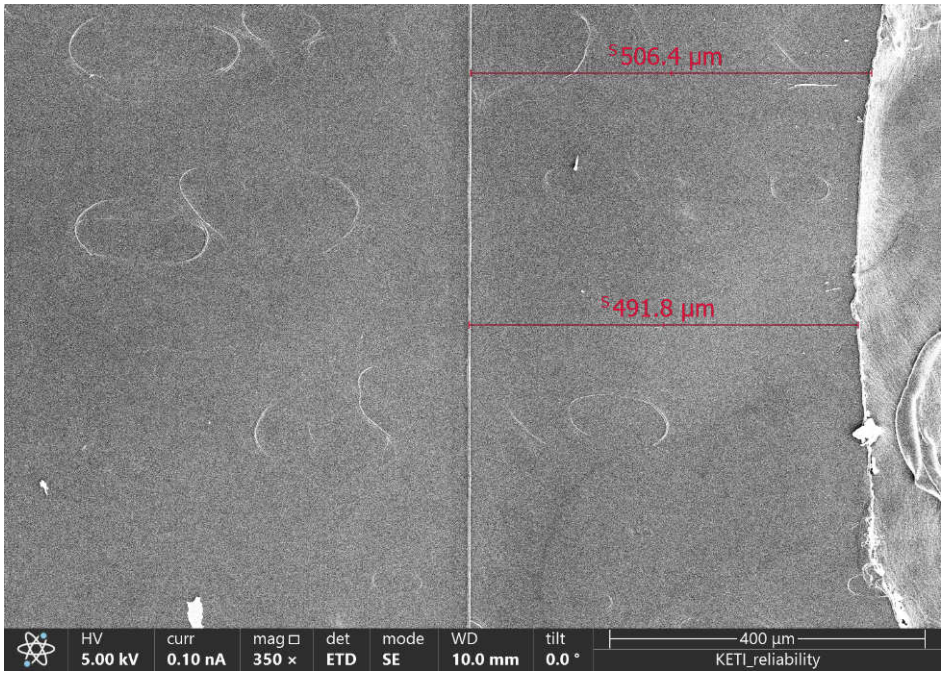

Br K series
100µm

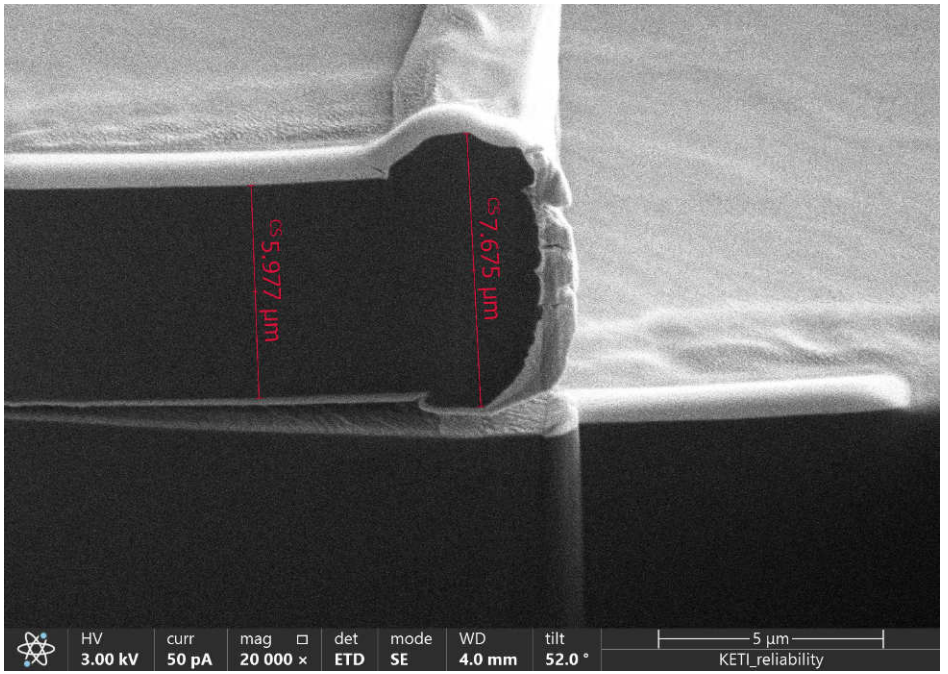

Cl K series
100µm


O K series
100µm

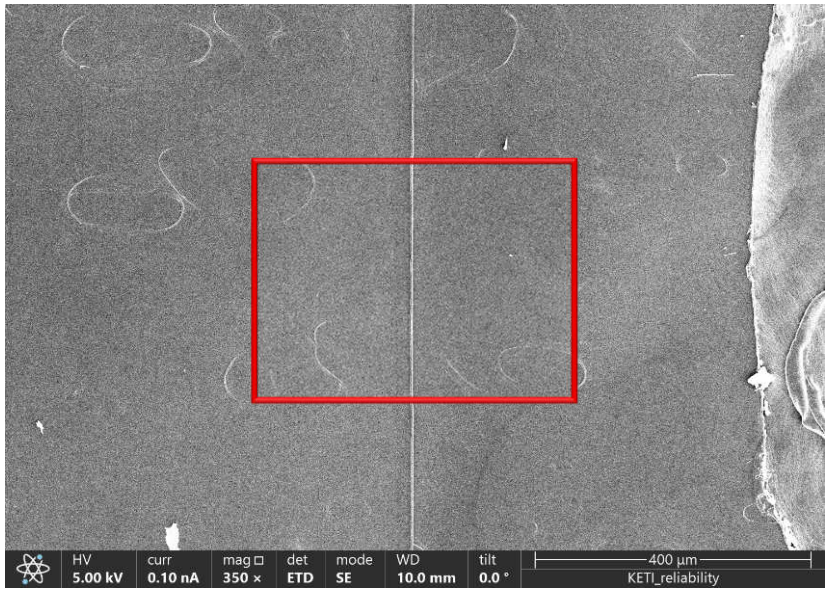
B社

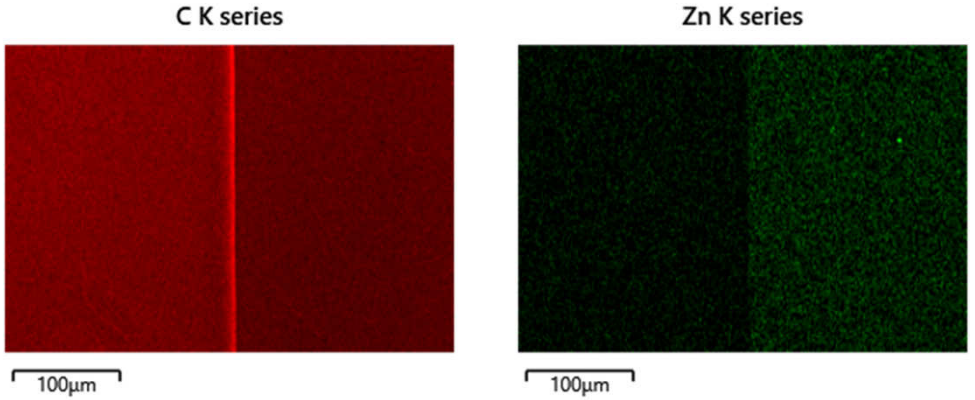

HV 5.00 kV
curr 0.10 nA
mag 150 ×
det ETD
mode SE
WD 10.0 mm
tilt 0.0 °
500 µm
KETI_reliability

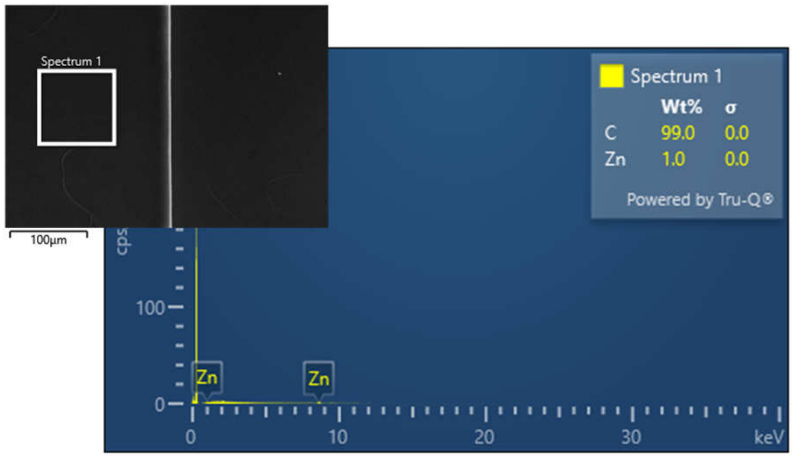

506.4 µm
491.8 µm
HV 5.00 kV
curr 0.10 nA
mag 350 ×
det ETD
mode SE
WD 10.0 mm
tilt 0.0 °
400 µm
KETI_reliability

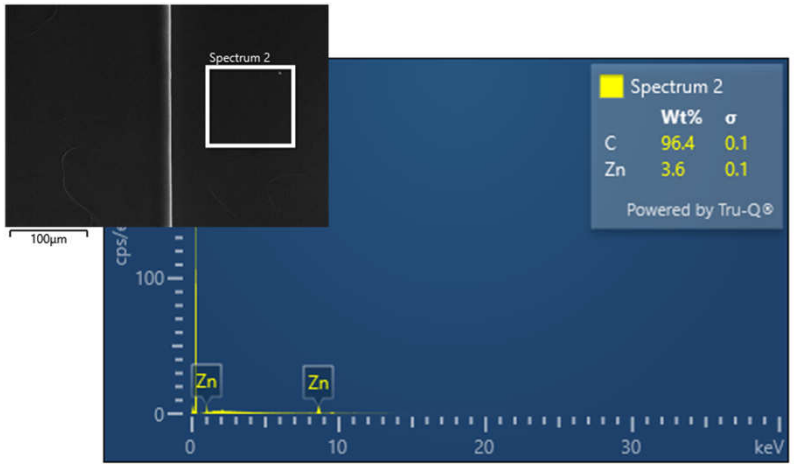

5.977 µm
7.675 µm
HV 3.00 kV
curr 50 pA
mag 20 000 ×
det ETD
mode SE
WD 4.0 mm
tilt 52.0 °
5 µm
KETI_reliability

B社

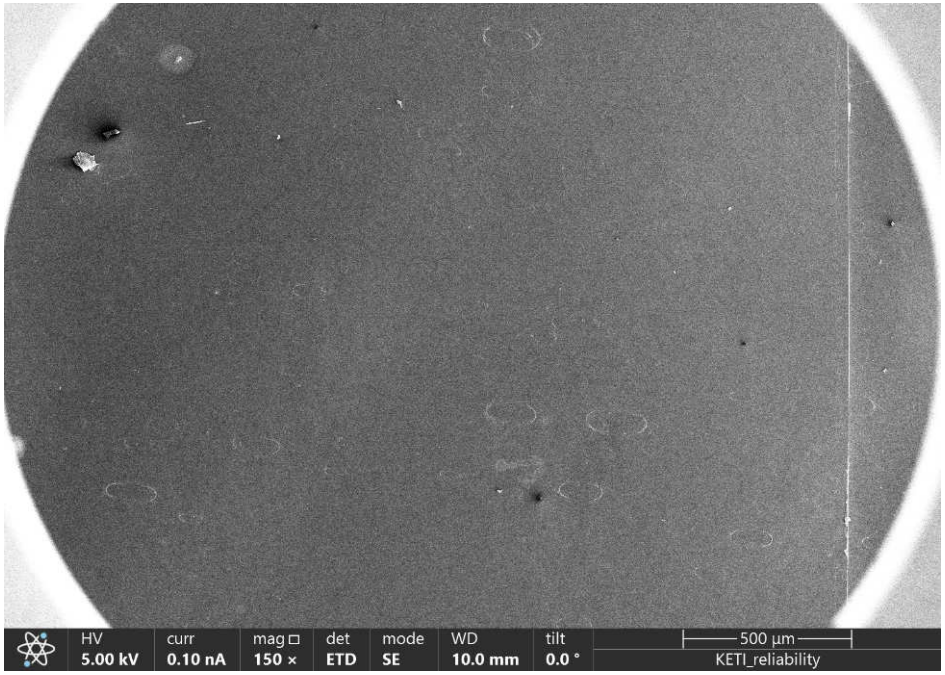

HV
5.00 kV
curr
0.10 nA
mag
350 ×
det
ETD
mode
SE
WD
10.0 mm
tilt
0.0 °
400 µm
KETI_reliability

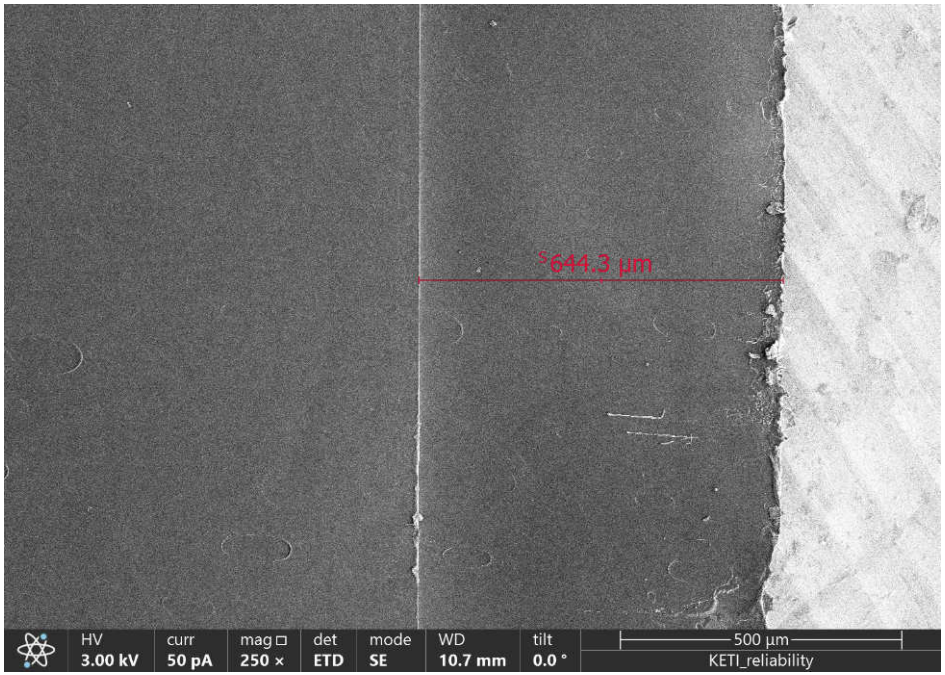

C K series
Zn K series
100µm
100µm

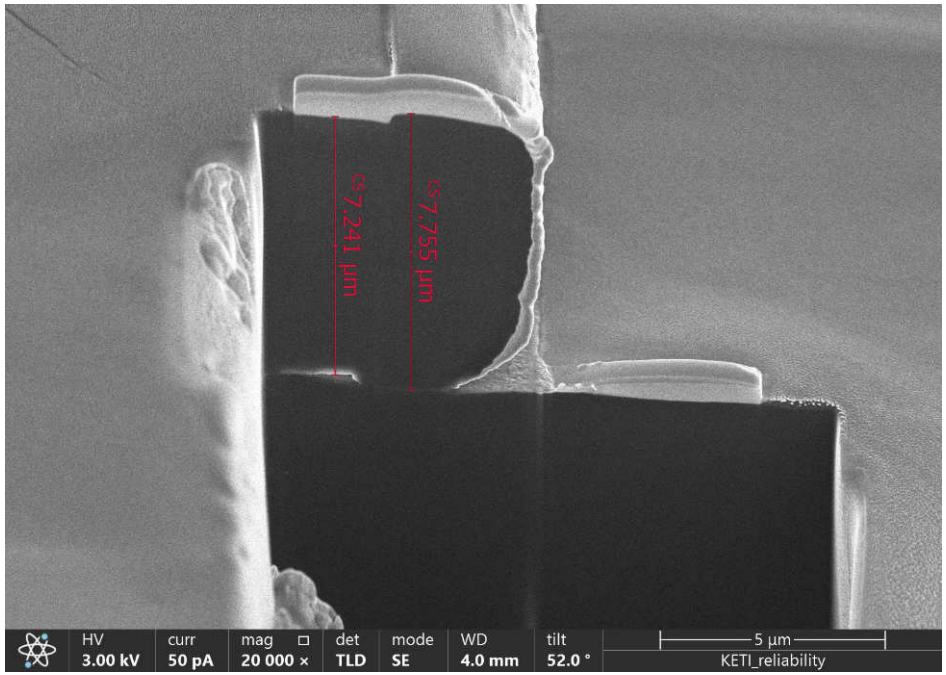

Spectrum 1
100µm
Spectrum 1
Wt% σ
C 99.0 0.0
Zn 1.0 0.0
Powered by Tru-Q®
cps
100
0
Zn
Zn
0
10
20
30
keV


Spectrum 2
100µm
Spectrum 2
Wt% σ
C 96.4 0.1
Zn 3.6 0.1
Powered by Tru-Q®
100
0
Zn
Zn
0
10
20
30
keV

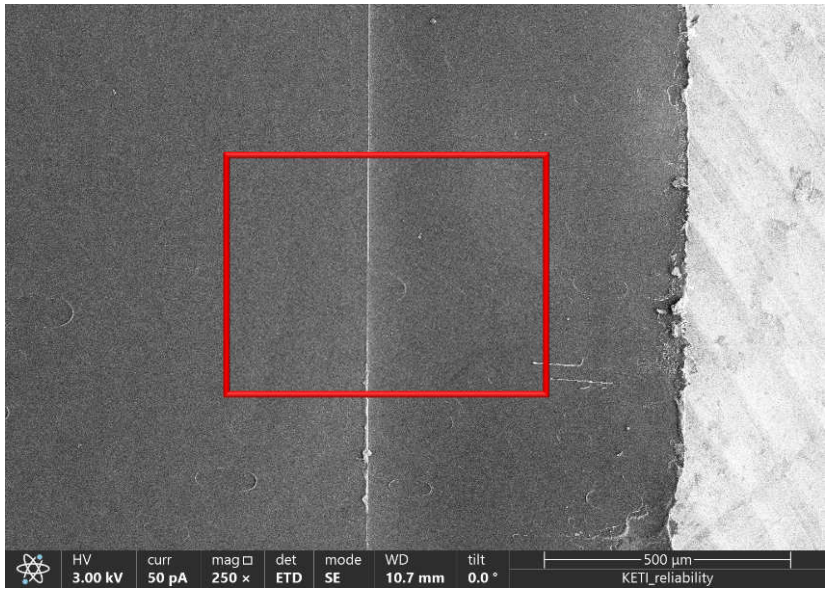
C社

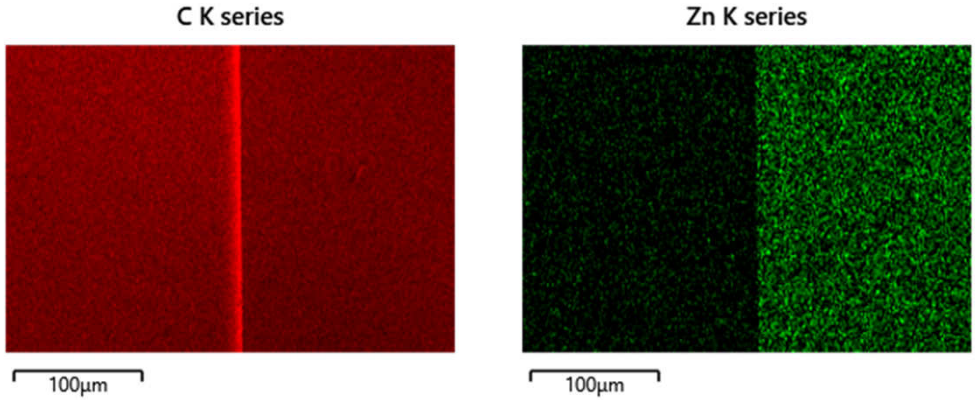

HV 5.00 kV
curr 0.10 nA
mag 150 ×
det ETD
mode SE
WD 10.0 mm
tilt 0.0 °
500 µm
KETI_reliability

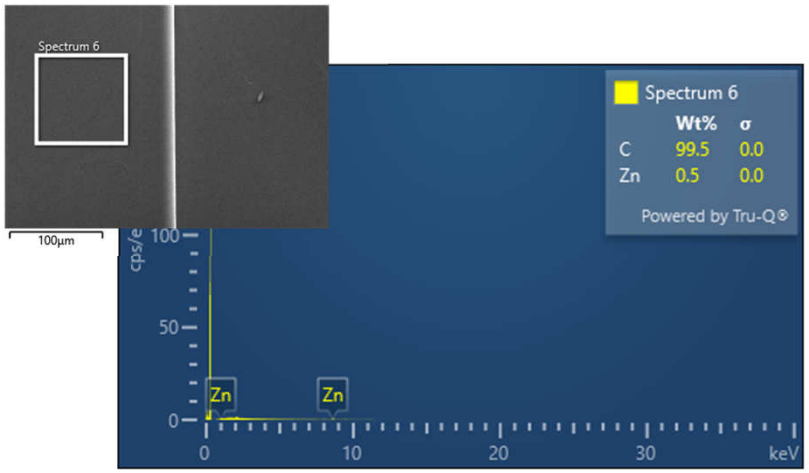

644.3 µm
HV 3.00 kV
curr 50 pA
mag 250 ×
det ETD
mode SE
WD 10.7 mm
tilt 0.0 °
500 µm
KETI_reliability

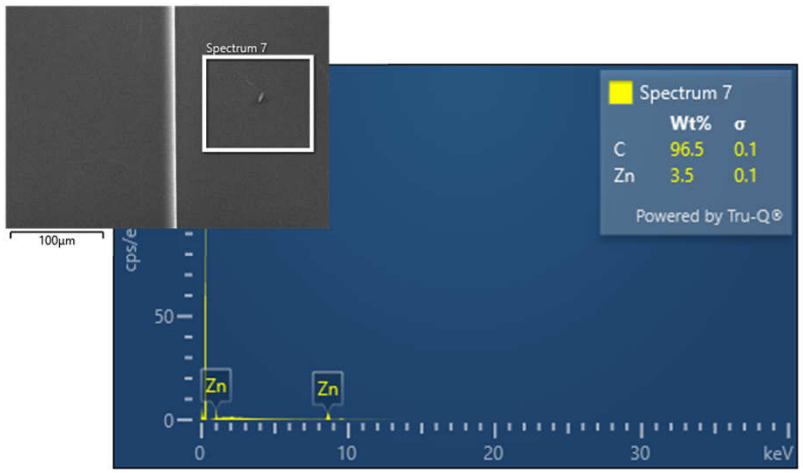

7.241 µm
7.755 µm
HV 3.00 kV
curr 50 pA
mag 20 000 ×
det TLD
mode SE
WD 4.0 mm
tilt 52.0 °
5 µm
KETI_reliability

C社


HV
3.00 kV
curr
50 pA
mag
250 x
det
ETD
mode
SE
WD
10.7 mm
tilt
0.0 °
500 µm
KETI_reliability


C K series
Zn K series
100µm
100µm


Spectrum 6
100µm
Spectrum 6
Wt% σ
C 99.5 0.0
Zn 0.5 0.0
Powered by Tru-Q®
cps/e
100
50
0
Zn
Zn
0
10
20
30
keV


Spectrum 7
100µm
Spectrum 7
Wt% σ
C 96.5 0.1
Zn 3.5 0.1
Powered by Tru-Q®
cps/e
50
0
Zn
Zn
0
10
20
30
keV

V. Summary and conclusions

【KETI試験結果考察】

- 三つの会社が製造したコンデンサーについて環境試験（高度、低温、高度湿度、熱衝撃、振動試験）、内部構造分析を行う。
- 三つのコンデンサーの内部構造には差がない。
- A社のコンデンサーが環境試験による特性変化が一番小さい。すなわち、外部環境のストレスに一番強いと言える。
- C社のコンデンサーは高度環境と熱衝撃環境に相対的に弱い。
- B社のコンデンサーは高度湿度環境に相対的に弱い。
- 高温試験によるCapacitanceの変化はA社の製品が一番小さい。(A<B<C)
- 低温試験によるCapacitanceの変化はA社の製品が一番大きい。(B=C<A)
- 高度湿度試験によるCapacitanceの変化はA社の製品が一番小さい。(A<C<B)
- 熱衝撃試験によるCapacitanceの変化はB社の製品が一番小さい。(B<A<C)
- 振動試験によるCapacitanceの変化はB社の製品が一番小さい。(B<A=C)

KETI試験結果の考察

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■フィルムキャパシタ各種試験結果比較

KETIにて実施しましたMPPフィルムキャパシタ製品3社の各種試験結果を比較して纏めました。特に大きな問題は散見されず性能/品質は安定していると推測できます。

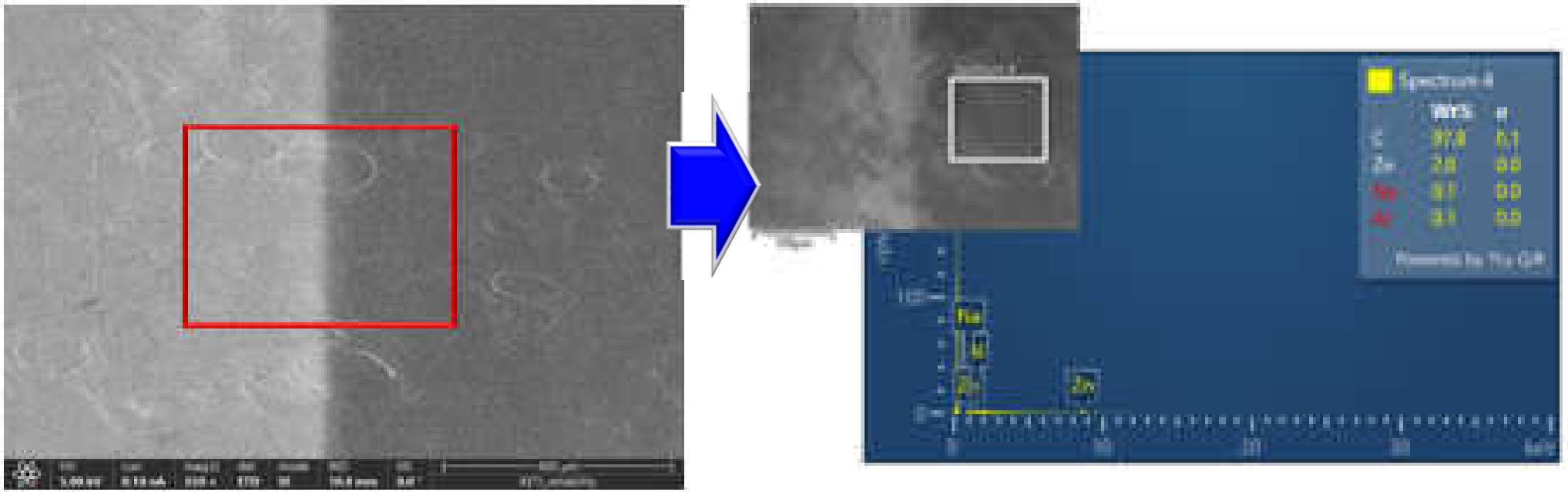
試験項目		A: PILKOR	B: TDK EPCOS	C: KEMET
X線解析		異常なし/異物なし	異常なし/異物なし	異常なし/異物なし
SEM観察/成分分析		やや異物が有る(Zn)	やや異物が有る(Zn)	異常なし/異物なし
高温保存試験 (105℃/16時間)	容量変化最大値	0.08%	0.16%	0.22%
	容量変化平均値	-0.02%	0.07%	0.18%
低温保存試験 (-40℃/2時間)	容量変化最大値	-0.05%	-0.04%	-0.03%
	容量変化平均値	-0.03%	-0.02%	-0.02%
高湿度保存試験 (40℃/93%RH/500時間)	容量変化最大値	0.04%	0.24%	0.09%
	容量変化平均値	0.02%	0.18%	0.06%
サーマルショック試験 (-40℃～105℃変化/30分間隔 5サイクル)	容量変化最大値	0.11%	0.10%	0.21%
	容量変化平均値	0.06%	0.04%	0.17%
振動試験 (XYZ方向/10Hz～55Hz)	容量変化最大値	0.02%	0.03%	0.02%
	容量変化平均値	0.01%	0.00%	0.01%

KETI試験結果の考察

J_Chip Consulting

①SEM観察/成分分析について:PILKOR製品

同社のSEM観察より、若干の異物混入が確認されました。それら成分を分析した結果.それら異物は”Zn（亜鉛）”が主成分と判明しました。これは酸化金属として亜鉛を使用しておりその残滓の一部が拡散したもので、性能的問題は無いと考えます。



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