(2025.06.28. revised)

Comparison Evaluation of SMD type NTC Thermistor

NTCサーミスタ比較試験結果報告Vol.2

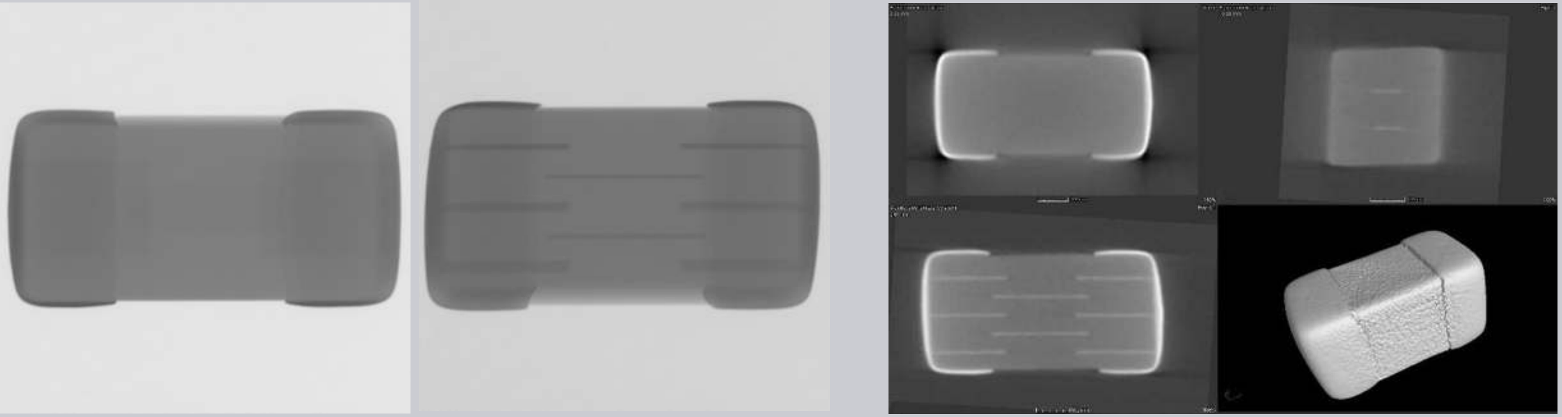
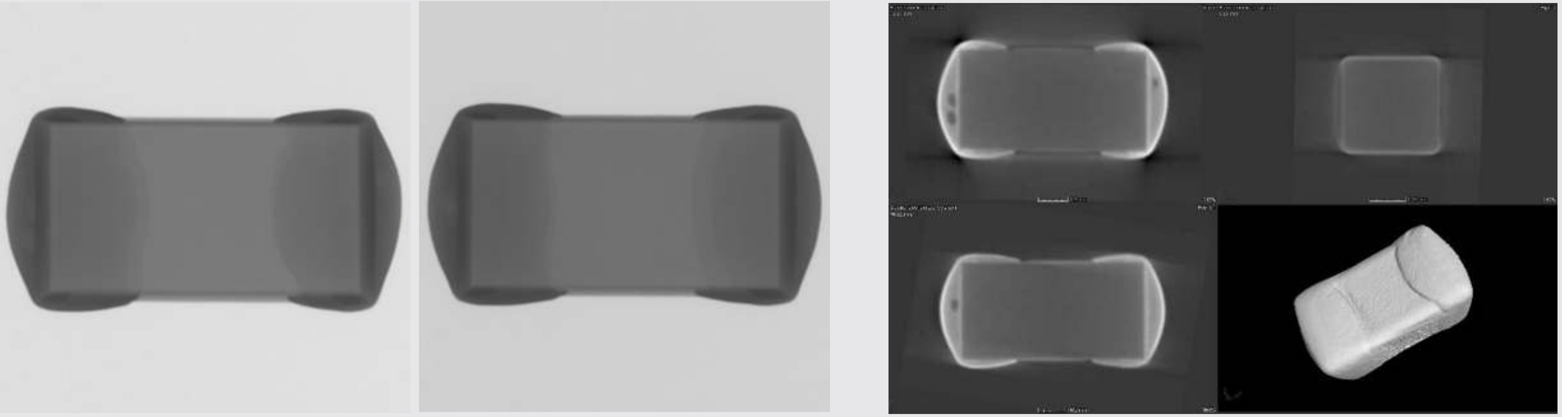
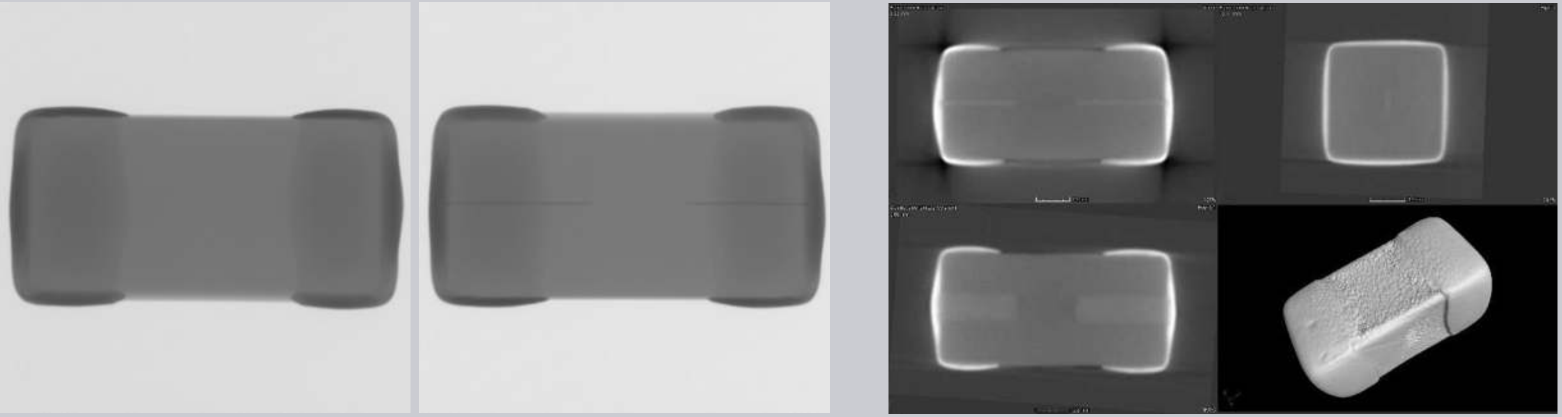
KETI

J_Chip Consulting

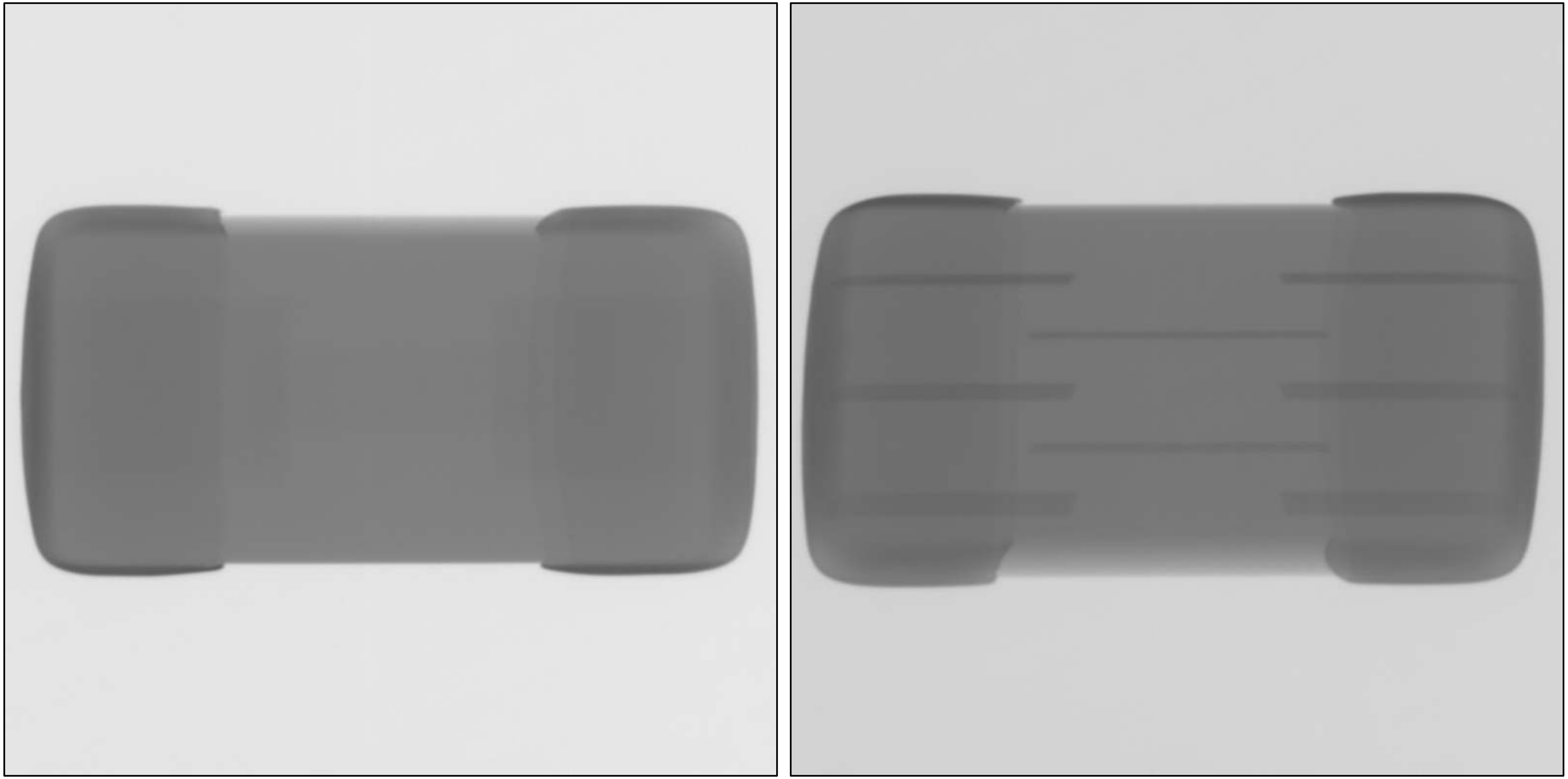
Table of Contents

III. X-ray analyses

A/B/C社

Specimen	X-ray analyses
A	
B	
C	

A社



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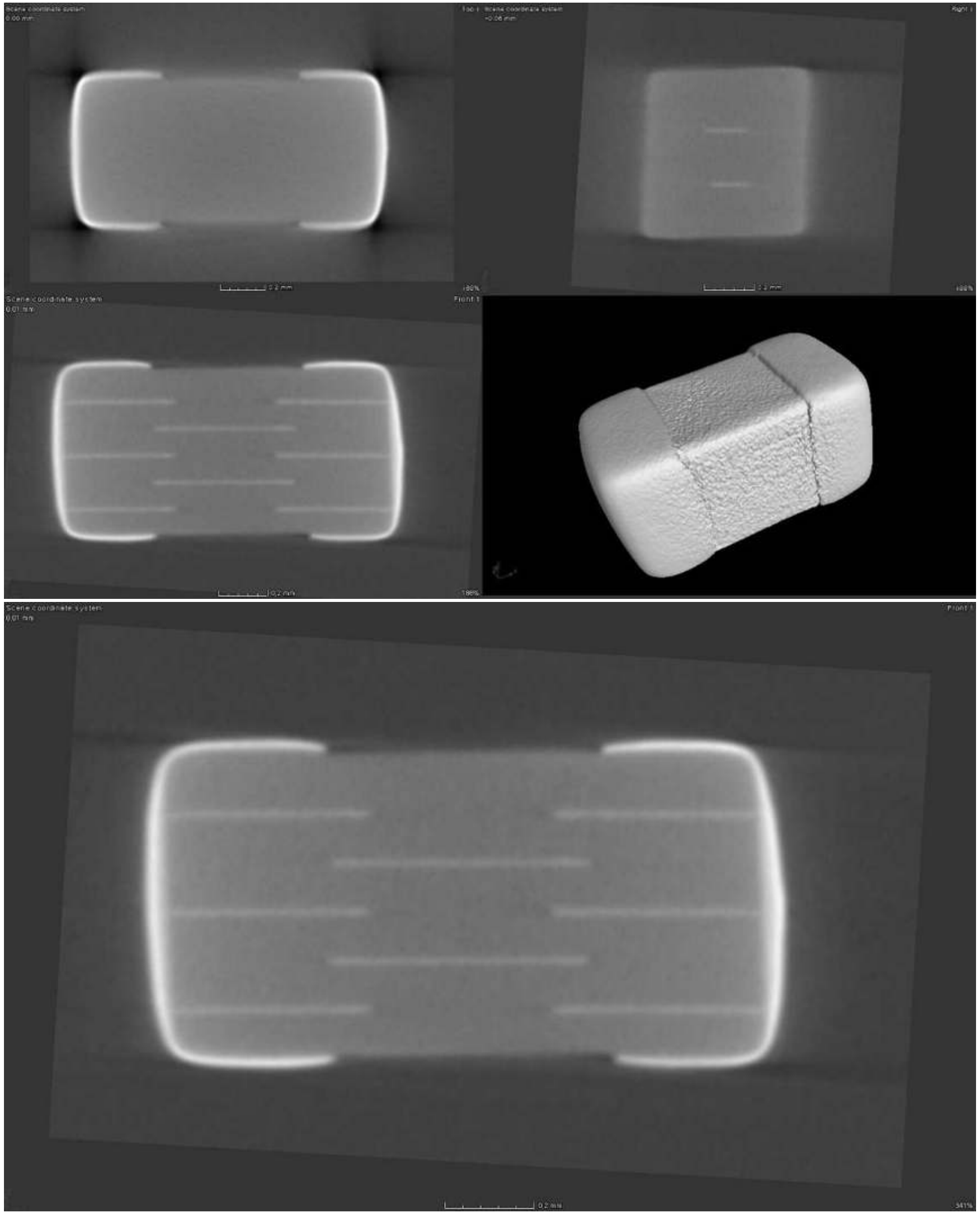
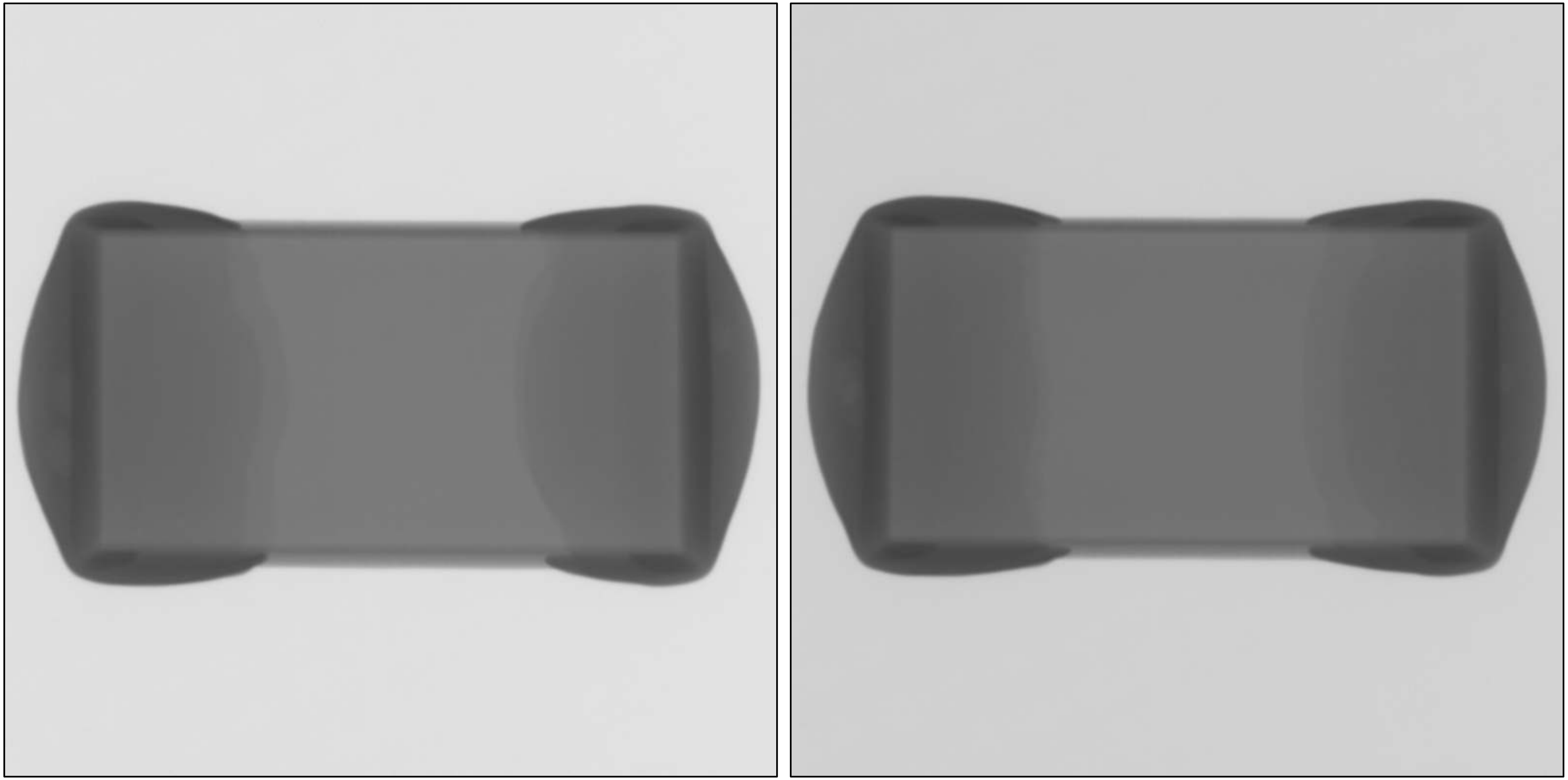
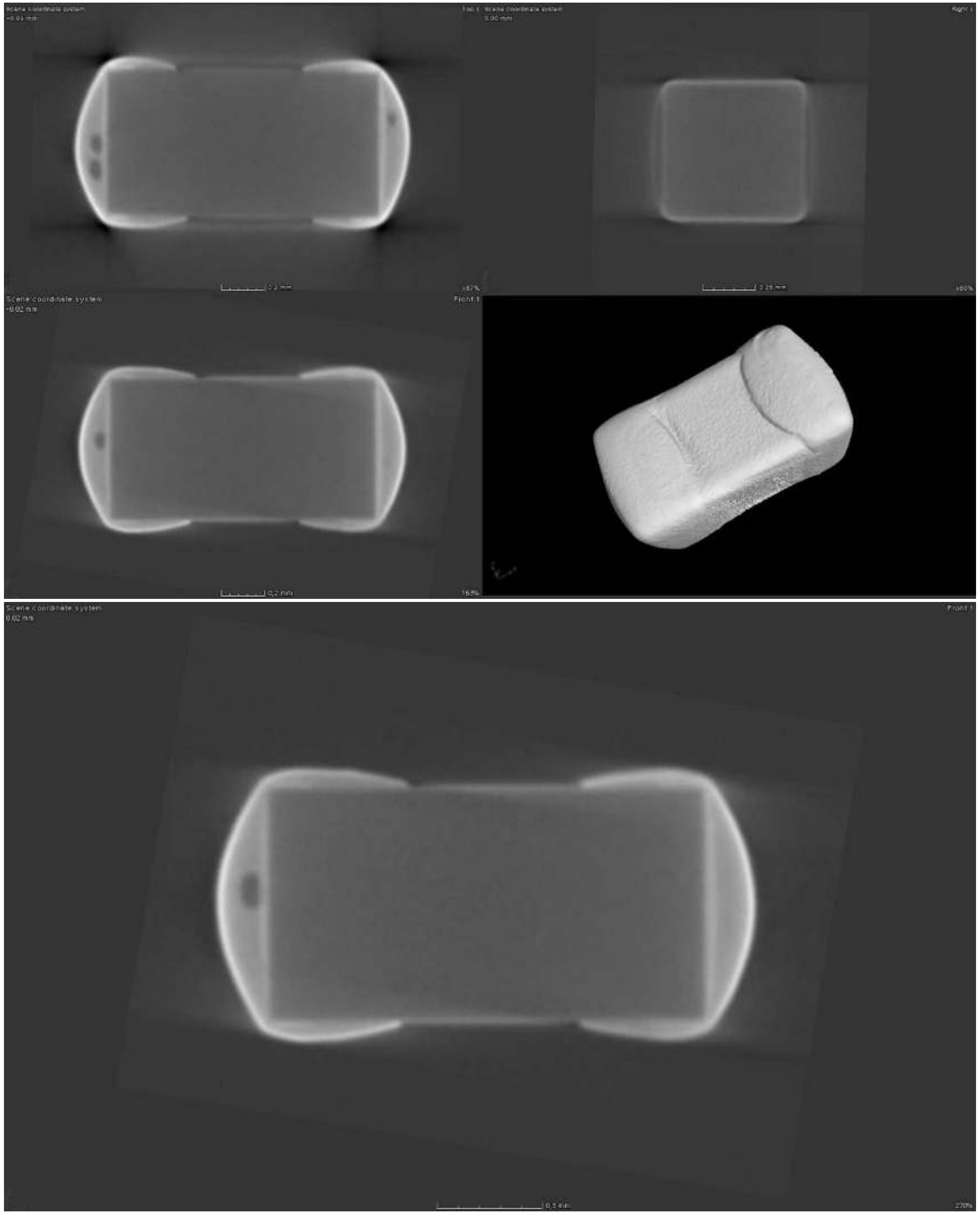


Scene coordinate system
0.00 mm
Top
Scene coordinate system
Right
0.2 mm
Scene coordinate system
0.01 mm
Front
0.2 mm
Scene coordinate system
0.01 mm
Front
0.2 mm

B社



B社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Top
Scene coordinate system
0.00 mm
Right
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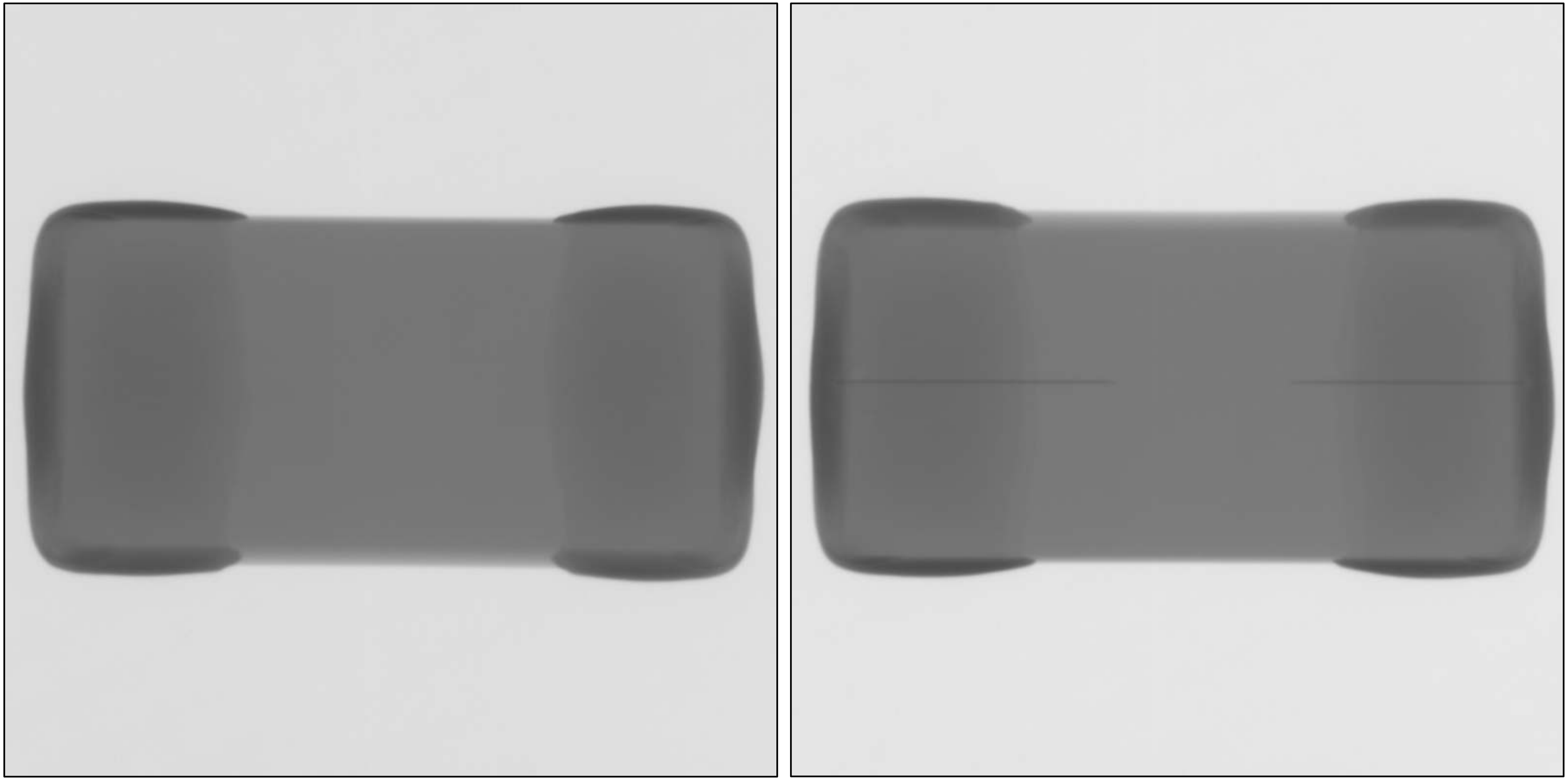
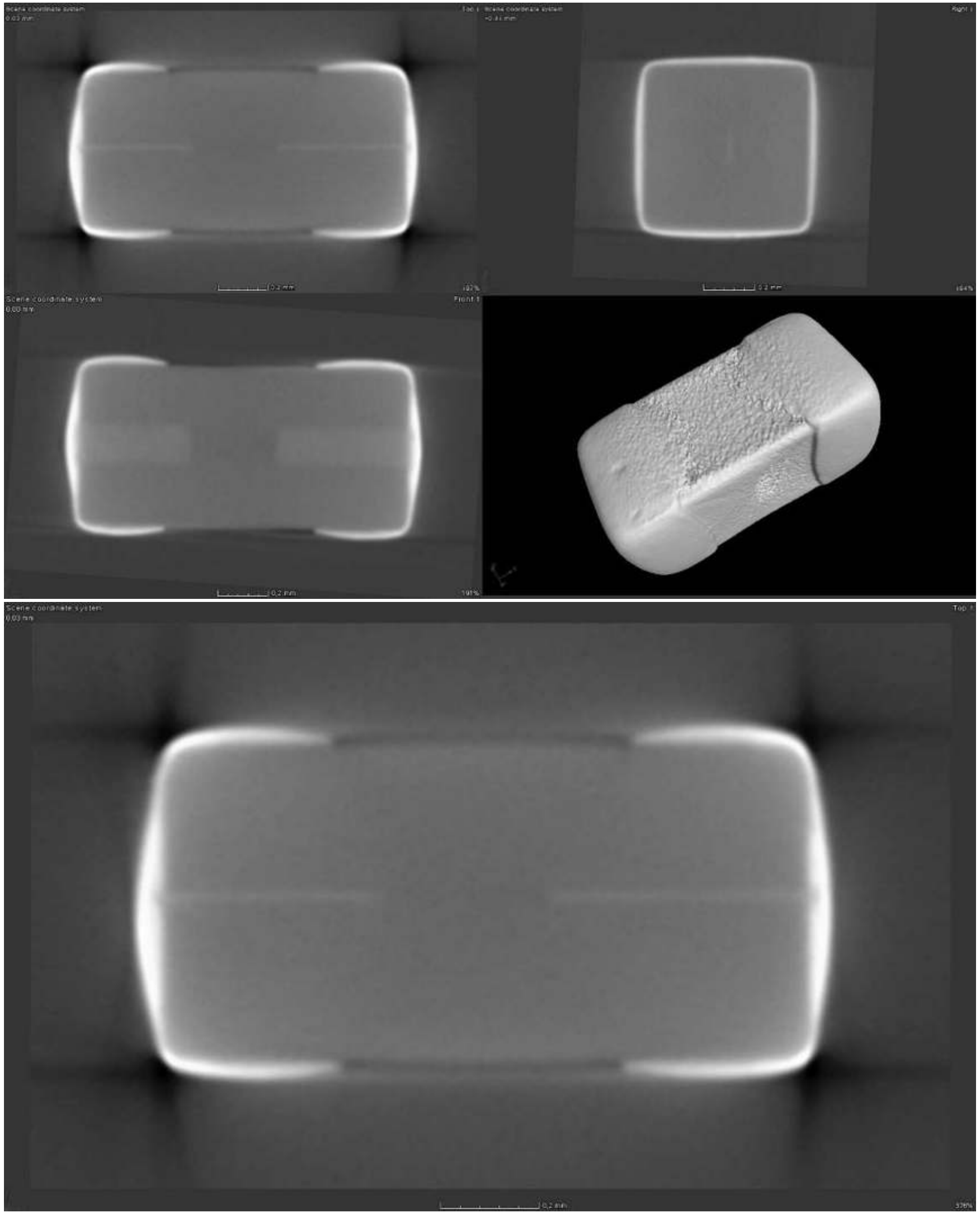
0.25 mm
Scene coordinate system
-0.02 mm
Front
0.2 mm
Scene coordinate system
0.02 mm
Front
0.5 mm

C社

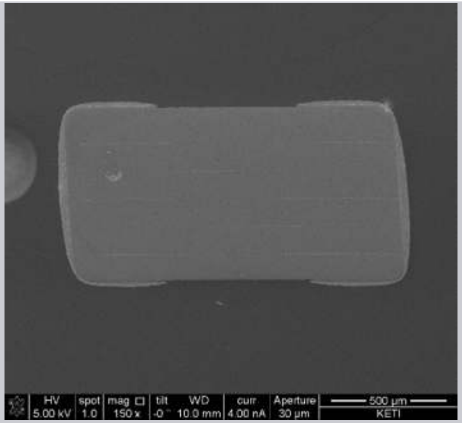
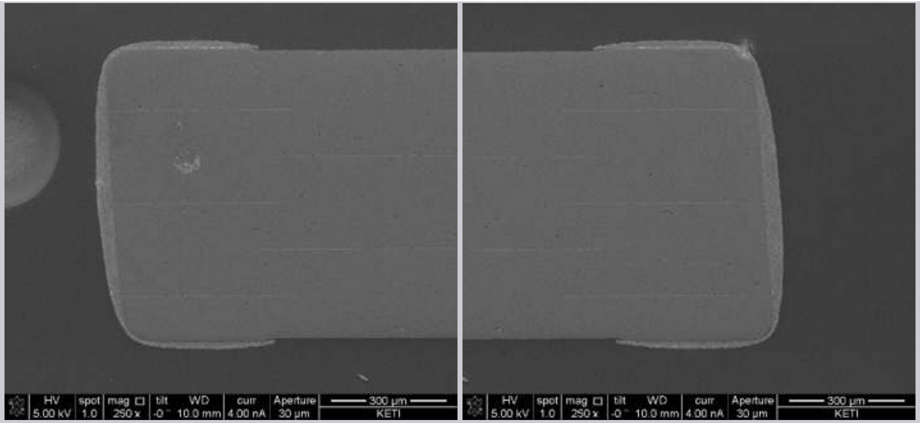
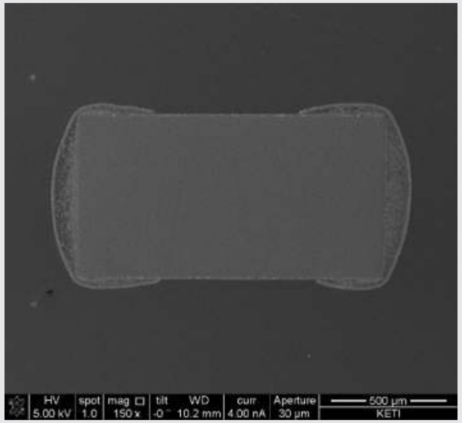
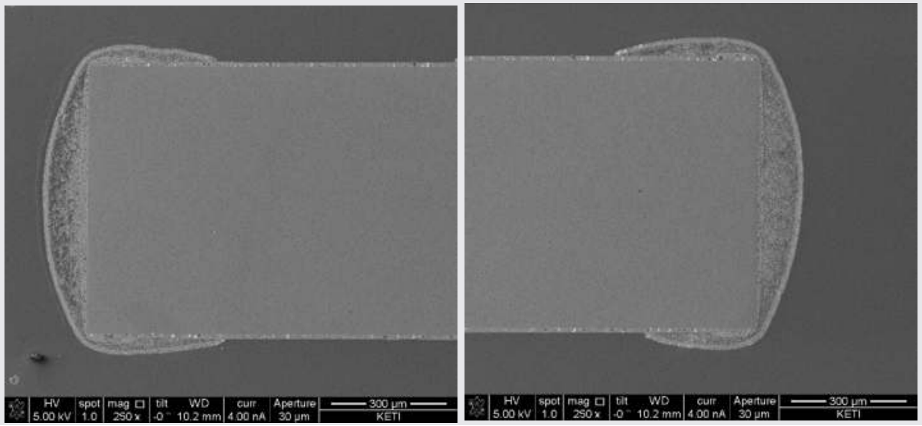
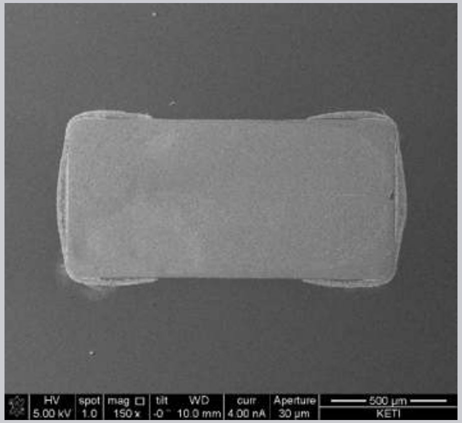
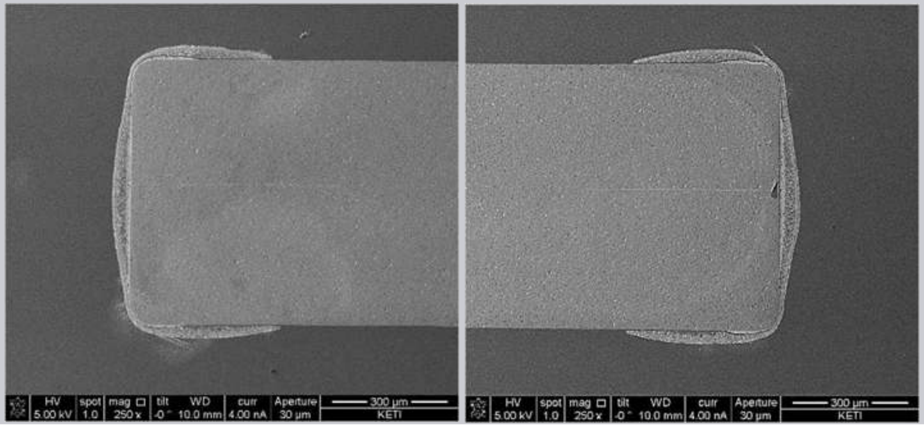


C社

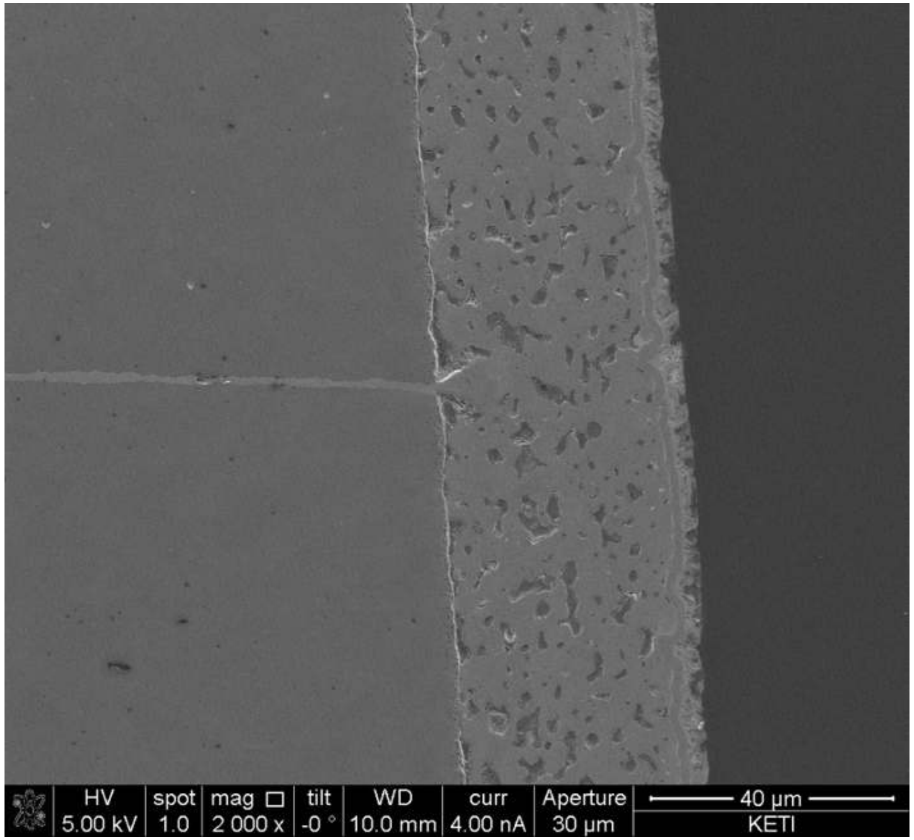

Scene coordinate system
0.03 mm
Top
Right
Front
0.2 mm
Scene coordinate system
0.03 mm
Top
0.2 mm

IV. (Cross section) SEM analyses

A/B/C社

Specimen	SEM analyses
A	 
B	 
C	 

A社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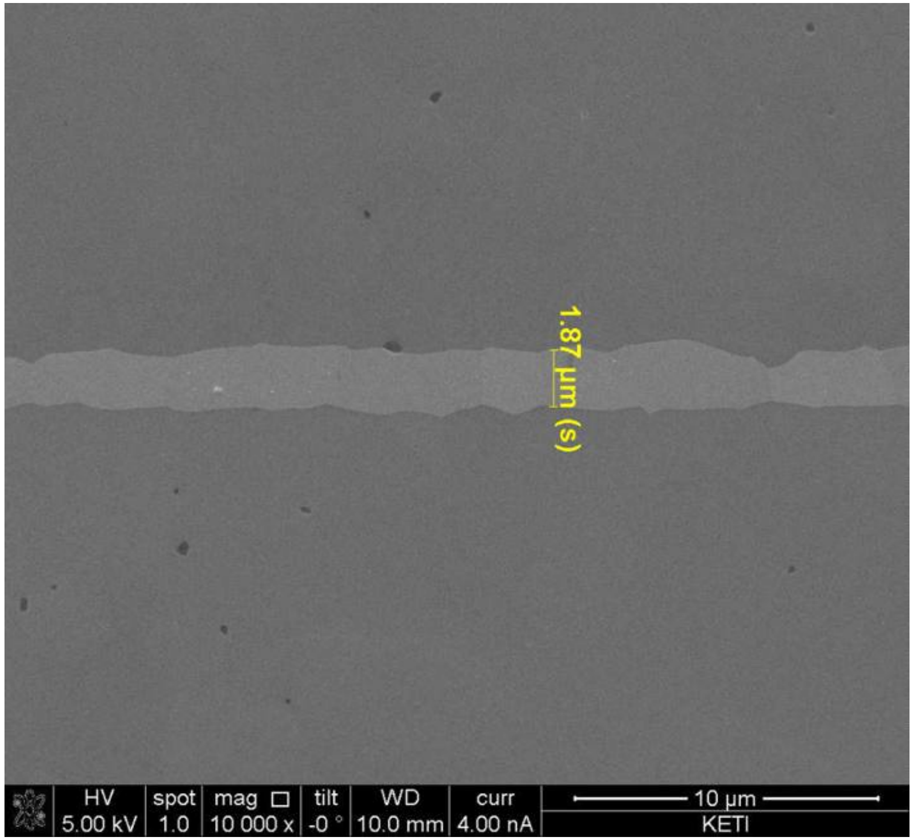
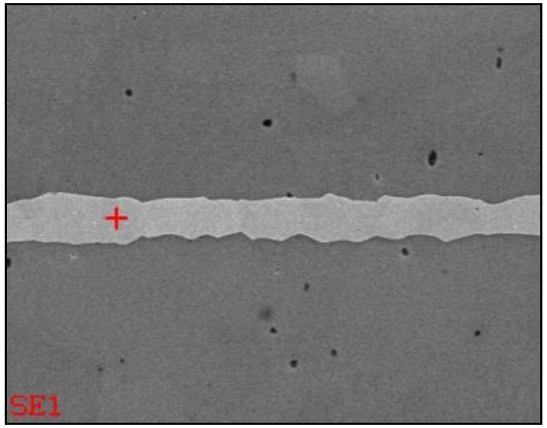
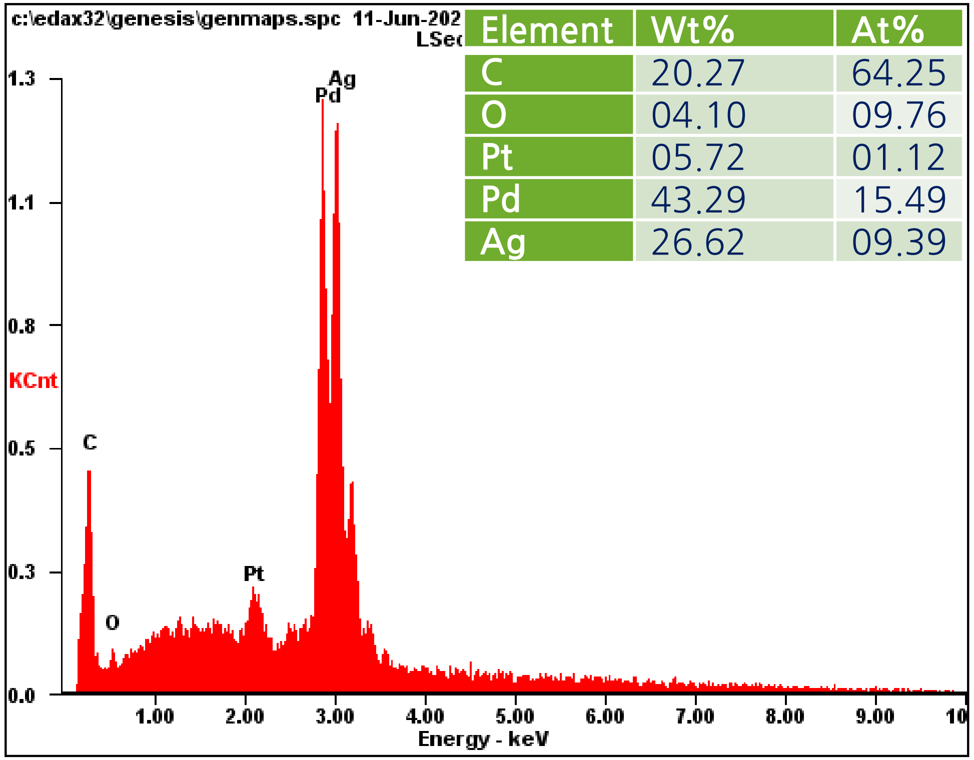
mag ☐ 2 000 x
tilt -0 °
WD 10.0 mm
curr 4.00 nA
Aperture 30 µm
40 µm
KETI

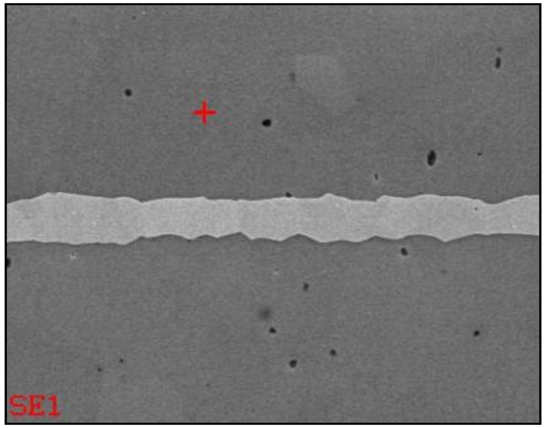

1.87 µm (s)
HV 5.00 kV
spot 1.0
mag ☐ 10 000 x
tilt -0 °
WD 10.0 mm
curr 4.00 nA
10 µm
KETI

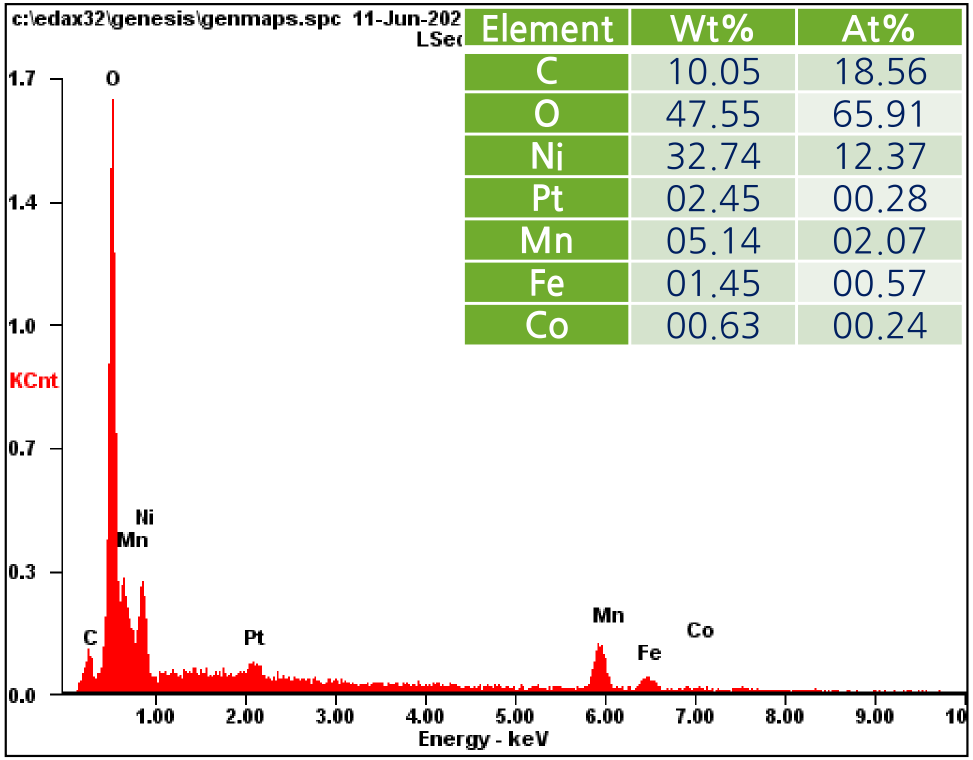
A社





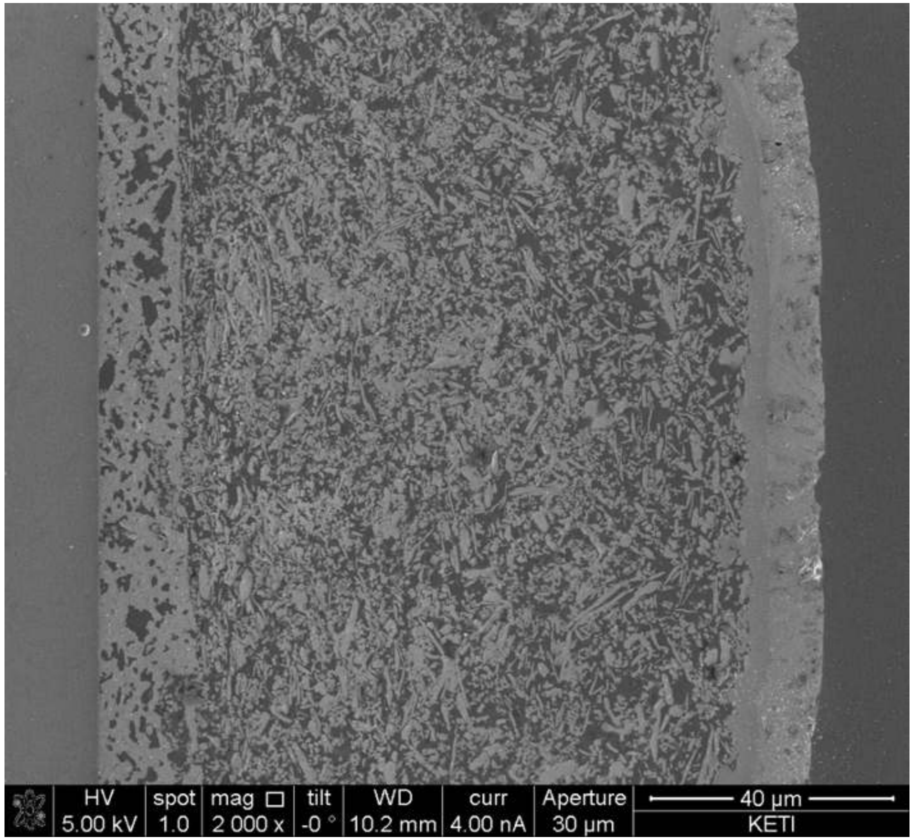
Element	Wt%	At%
C	20.27	64.25
O	04.10	09.76
Pt	05.72	01.12
Pd	43.29	15.49
Ag	26.62	09.39

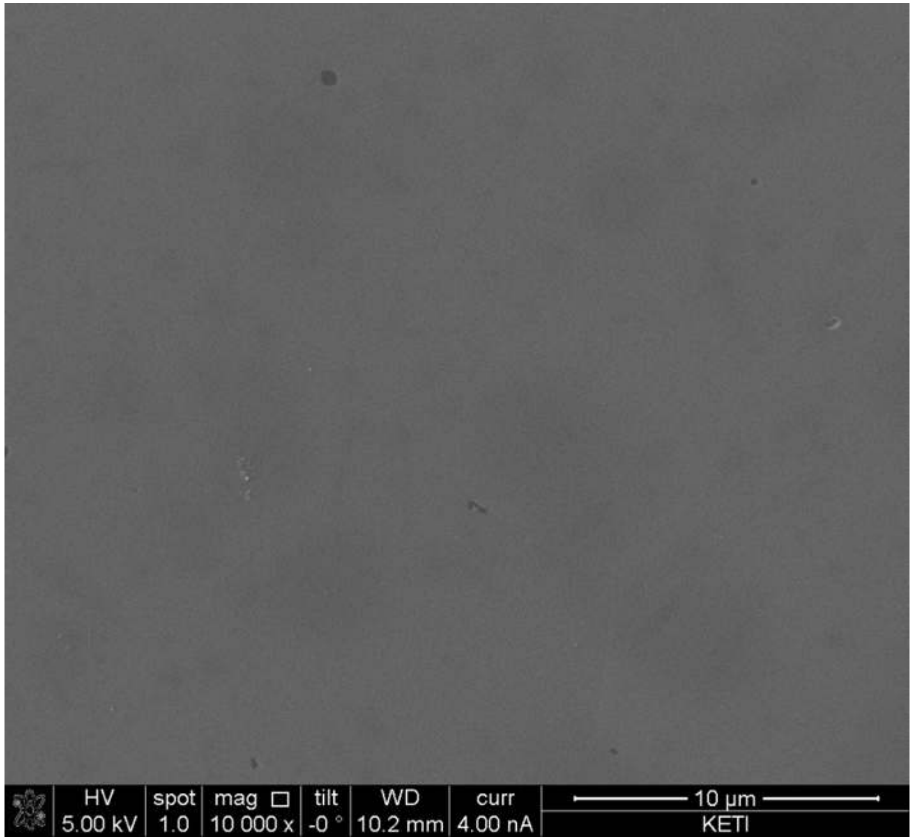




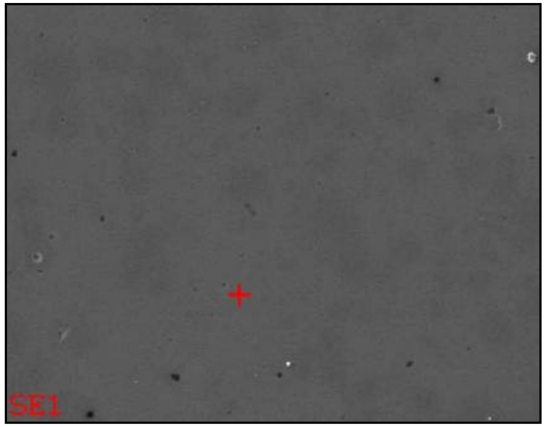
Element	Wt%	At%
C	10.05	18.56
O	47.55	65.91
Ni	32.74	12.37
Pt	02.45	00.28
Mn	05.14	02.07
Fe	01.45	00.57
Co	00.63	00.24

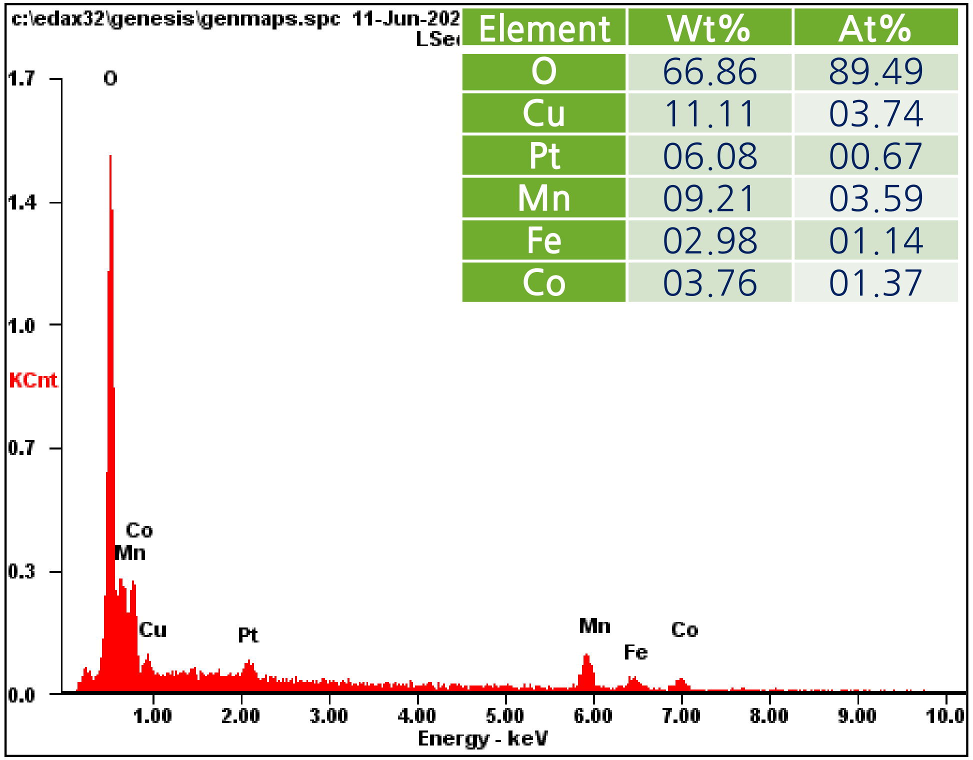
B社


HV 5.00 kV
spot 1.0
mag ☐ 2 000 x
tilt -0 °
WD 10.2 mm
curr 4.00 nA
Aperture 30 μm
40 μm
KETI

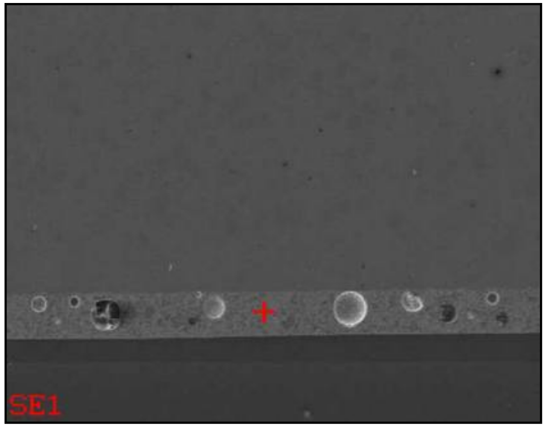

HV 5.00 kV
spot 1.0
mag ☐ 10 000 x
tilt -0 °
WD 10.2 mm
curr 4.00 nA
10 μm
KETI

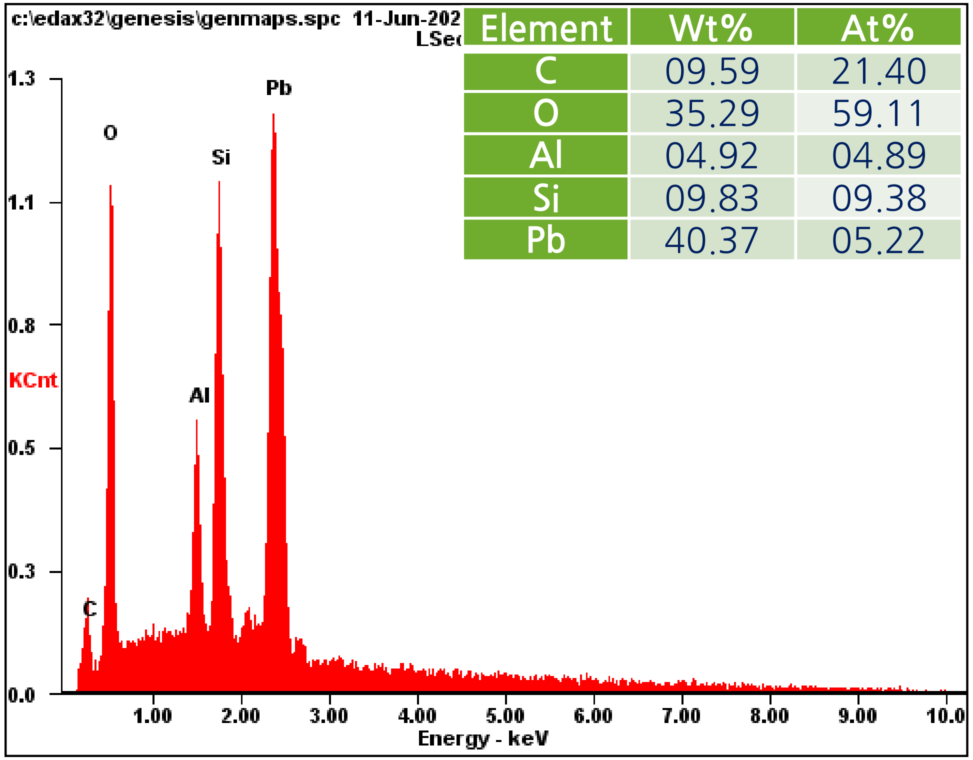
B社





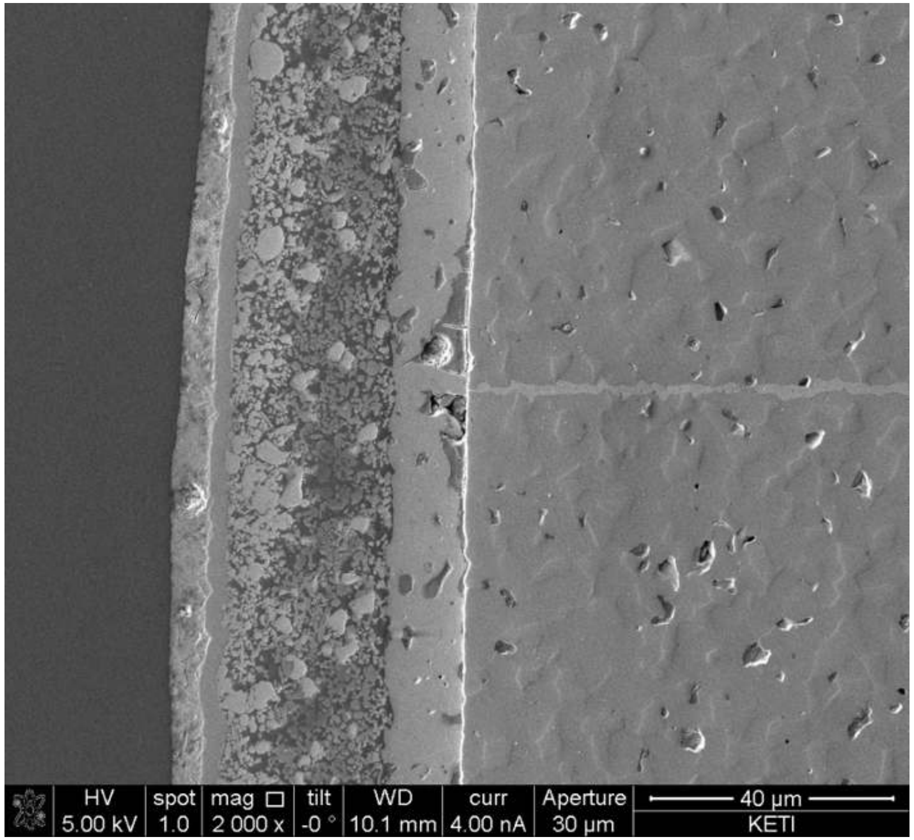
Element	Wt%	At%
O	66.86	89.49
Cu	11.11	03.74
Pt	06.08	00.67
Mn	09.21	03.59
Fe	02.98	01.14
Co	03.76	01.37

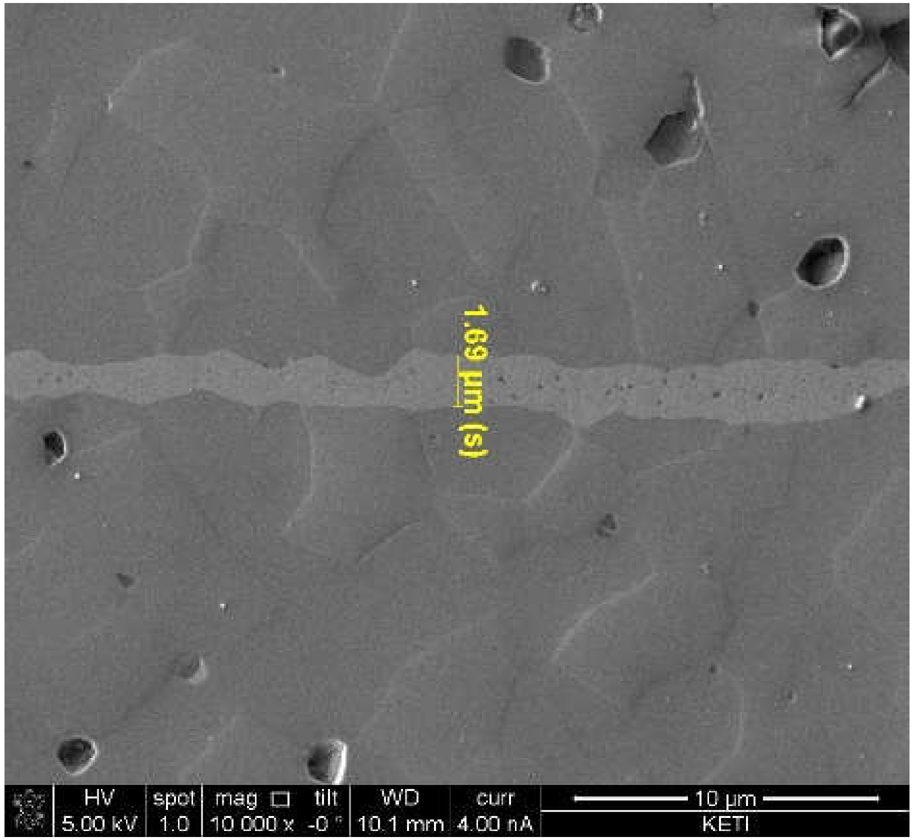




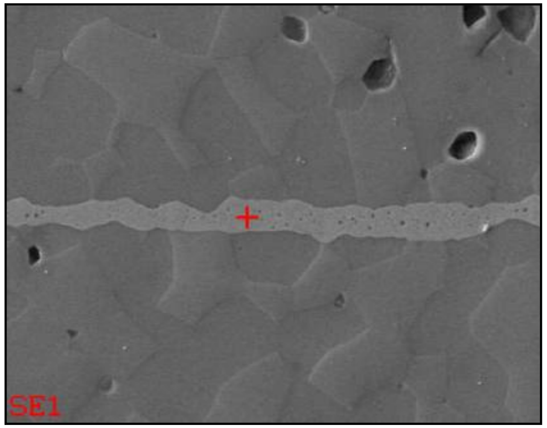
Element	Wt%	At%
C	09.59	21.40
O	35.29	59.11
Al	04.92	04.89
Si	09.83	09.38
Pb	40.37	05.22

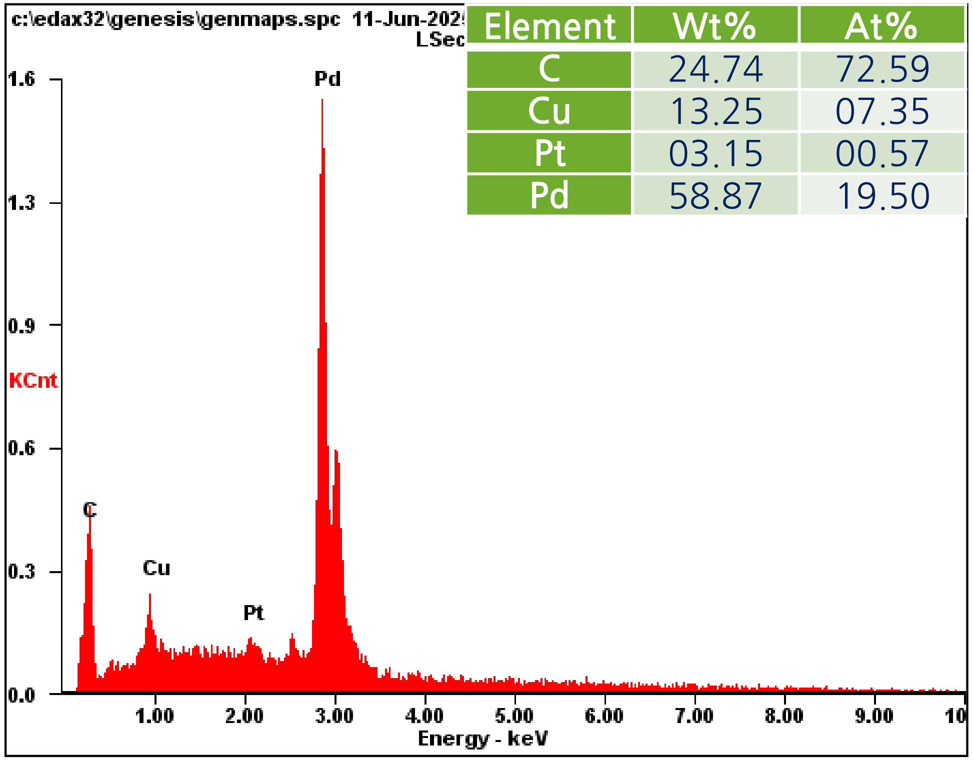
C社


HV
5.00 kV
spot
1.0
mag □
2 000 x
tilt
-0 °
WD
10.1 mm
curr
4.00 nA
Aperture
30 μm
40 μm
KETI

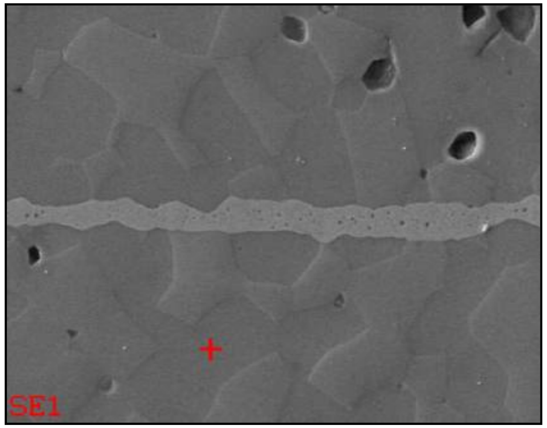

1.69 μm (s)
HV
5.00 kV
spot
1.0
mag □
10 000 x
tilt
-0 °
WD
10.1 mm
curr
4.00 nA
10 μm
KETI

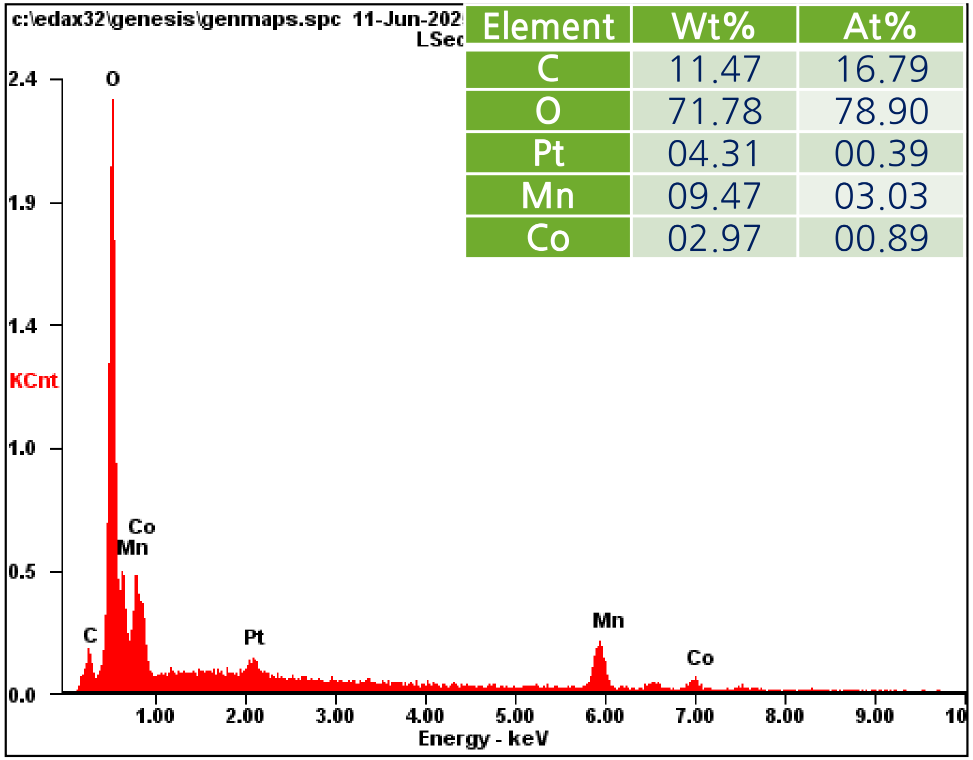
C社





Element	Wt%	At%
C	24.74	72.59
Cu	13.25	07.35
Pt	03.15	00.57
Pd	58.87	19.50





Element	Wt%	At%
C	11.47	16.79
O	71.78	78.90
Pt	04.31	00.39
Mn	09.47	03.03
Co	02.97	00.89

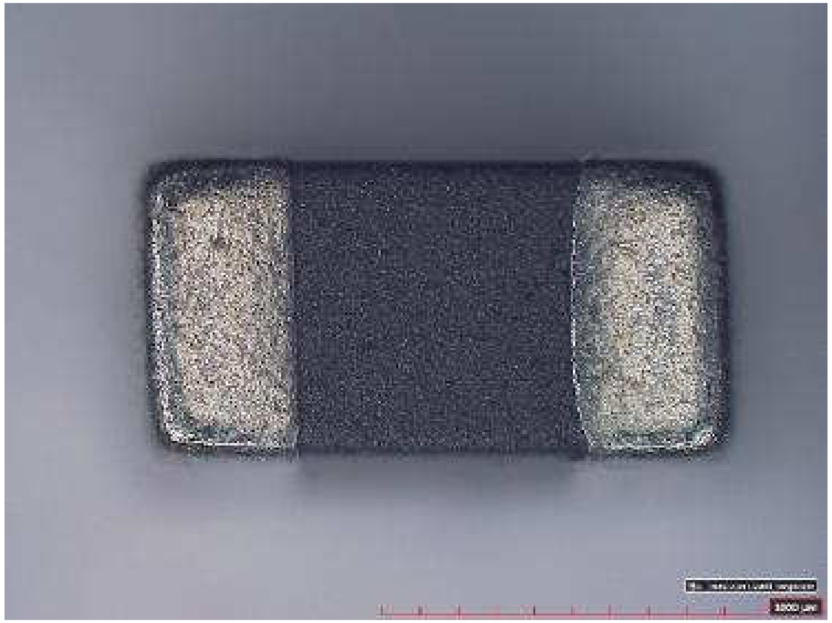
V. Solderability test

A/B/C社

Specimen	Solderability test (before and after)
A	 → 
B	 → 
C	 → 

A社

Solderability Test

	Before	After
#1		
#2		

A社

Solderability Test

	Before	After
#3		
#4		

A社

Solderability Test

	Before	After
#5		
#6		

A社

Solderability Test

	Before	After
#7		
#8		

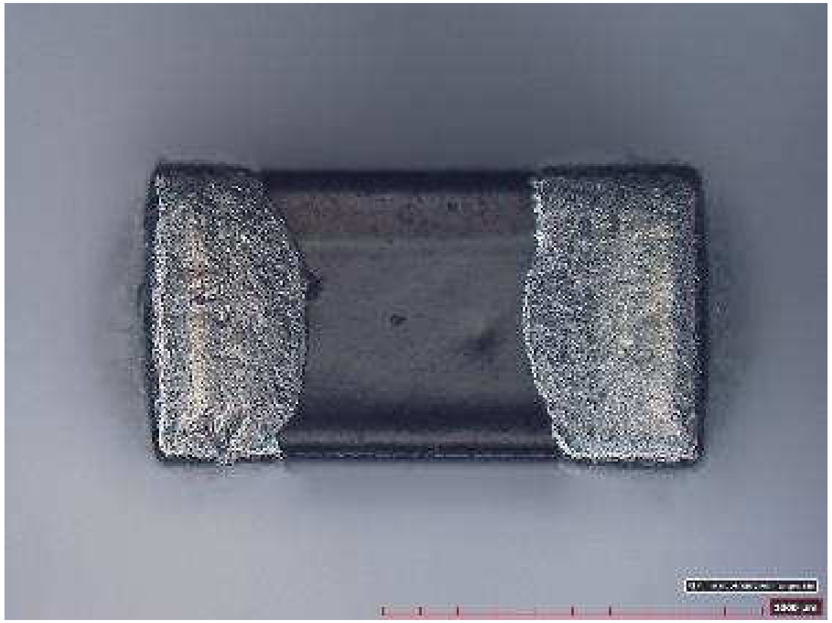
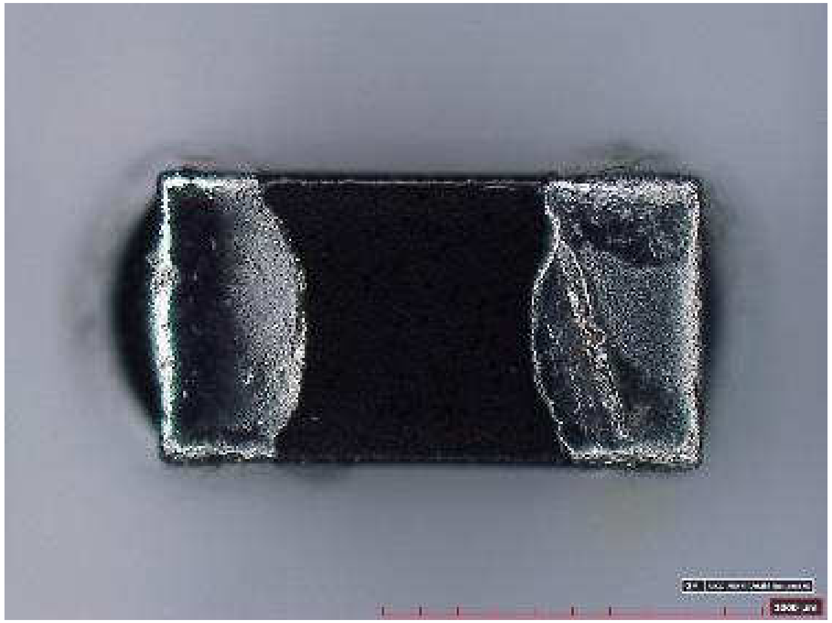
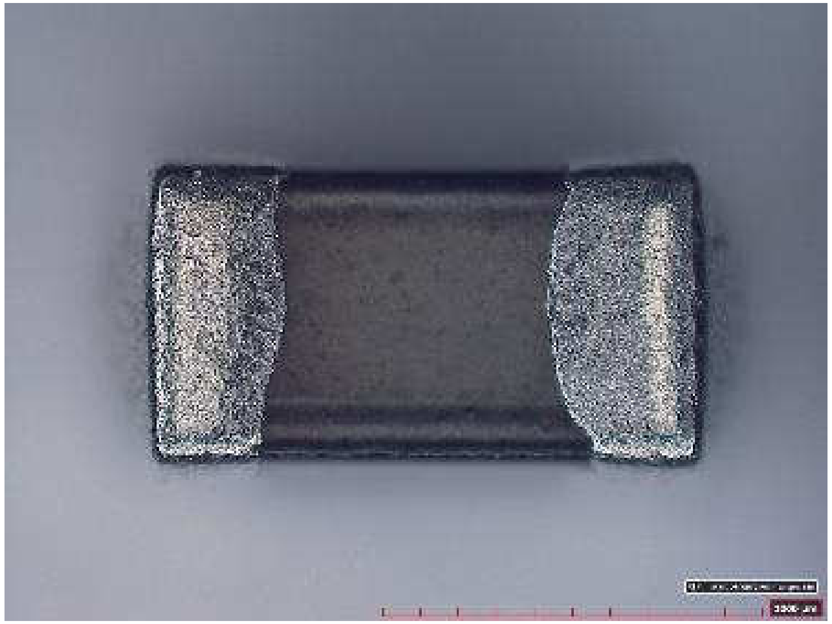
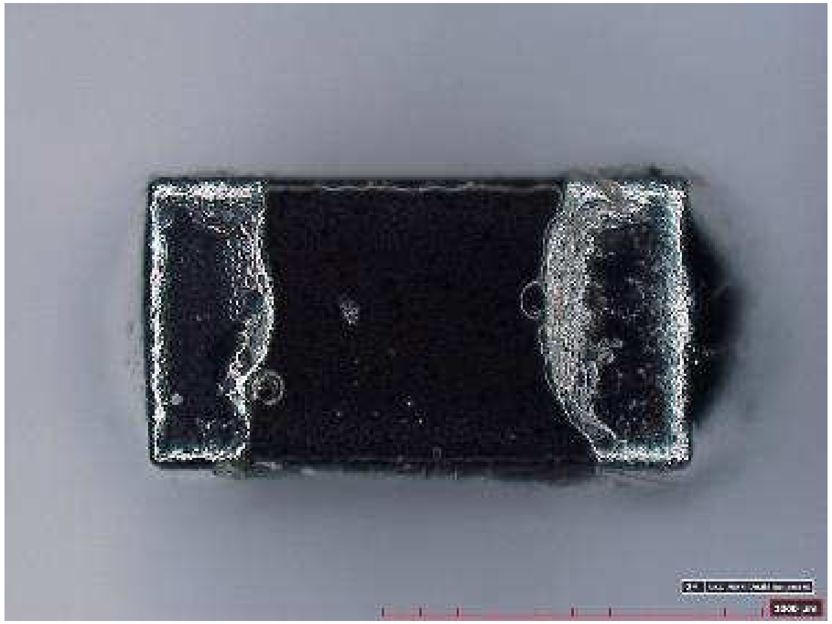
A社

Solderability Test

	Before	After
#9		
#10		

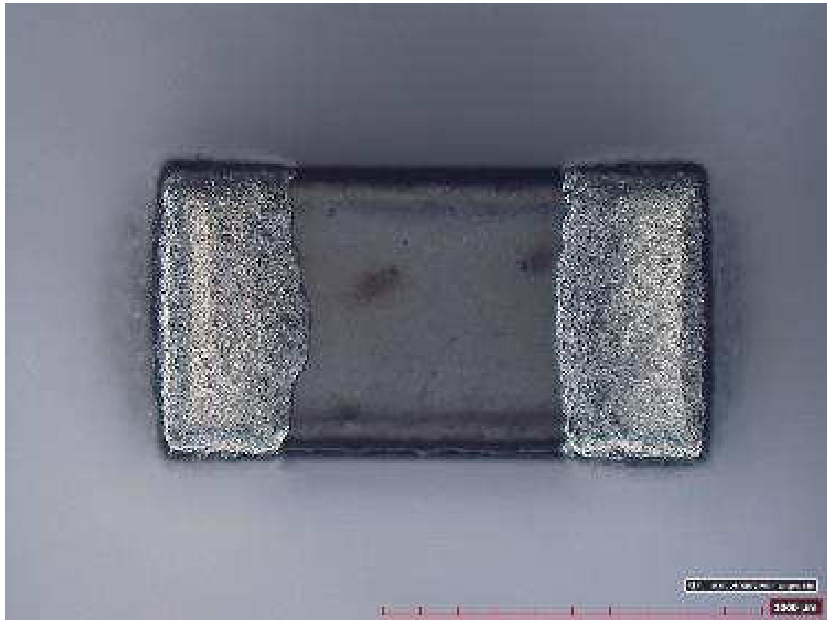
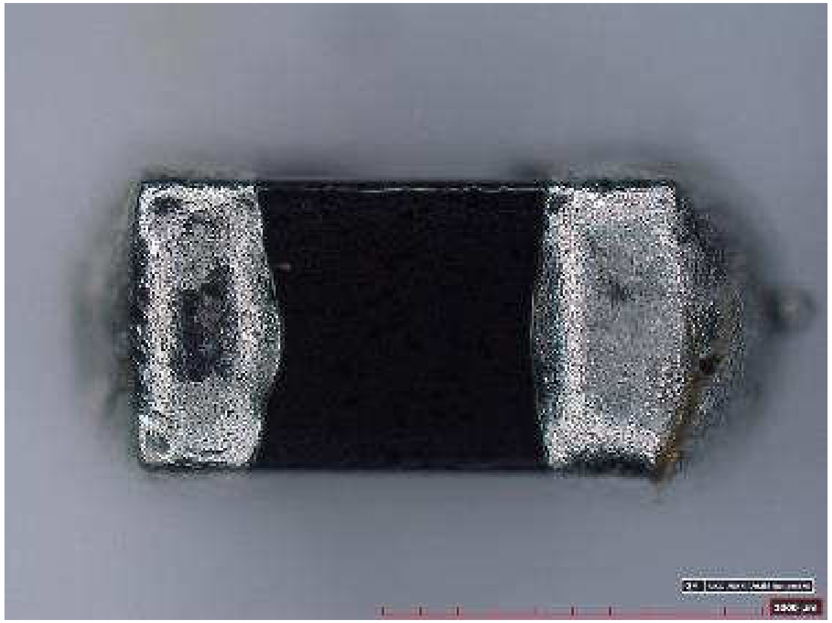
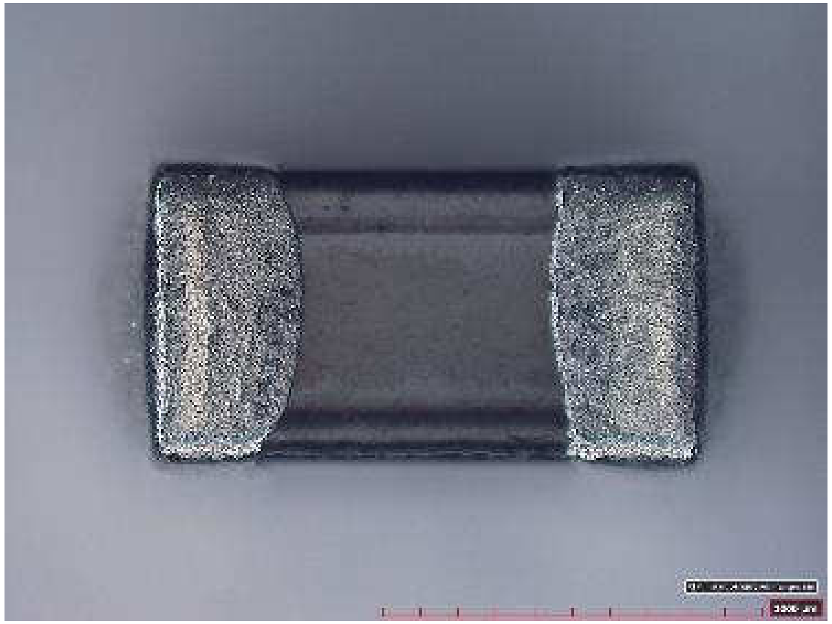
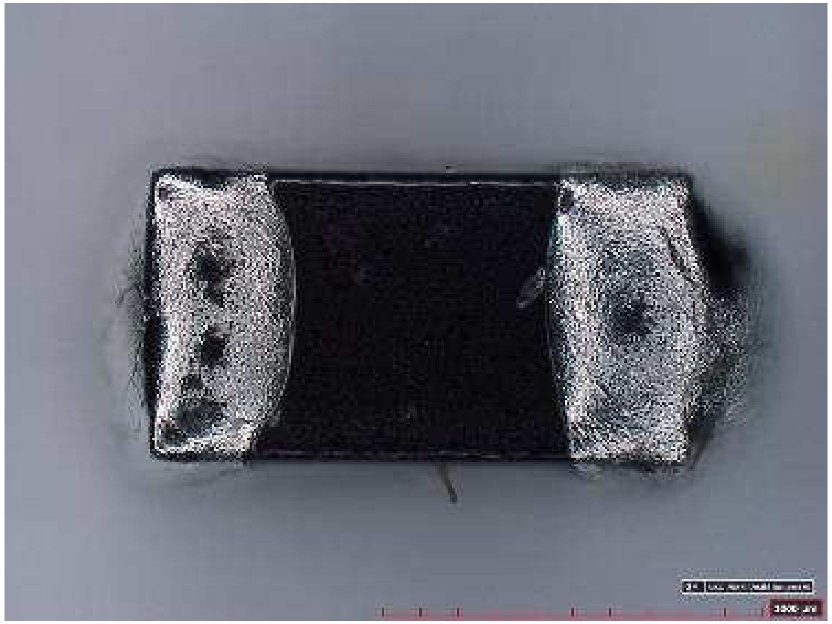
B社

Solderability Test

	Before	After
#1		
#2		

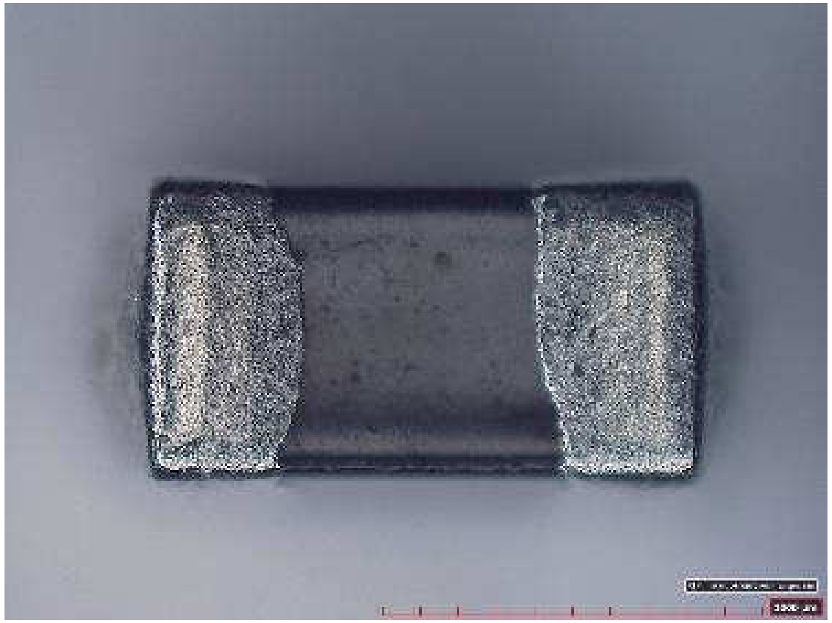
B社

Solderability Test

	Before	After
# 3		
# 4		

B社

Solderability Test

	Before	After
#5		
#6		

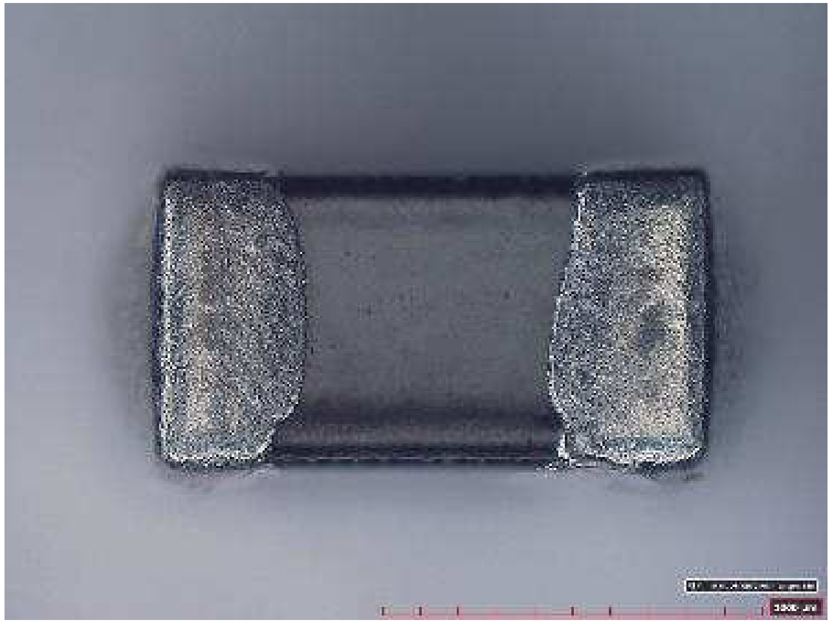
B社

Solderability Test

	Before	After
#7		
#8		

B社

Solderability Test

	Before	After
#9		
#10		

C社

Solderability Test

	Before	After
#1		
#2		

C社

Solderability Test

	Before	After
# 3		
# 4		

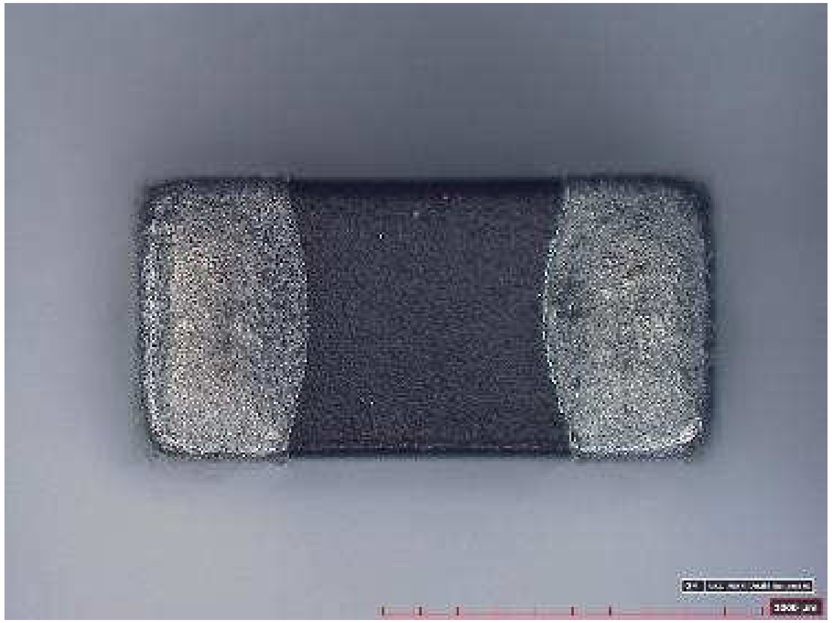
C社

Solderability Test

	Before	After
#5		
#6		

C社

Solderability Test

	Before	After
#7		
#8		

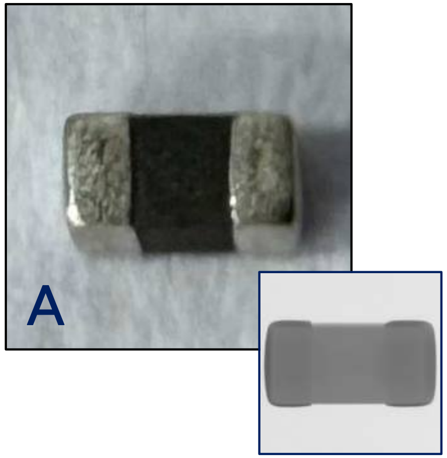
C社

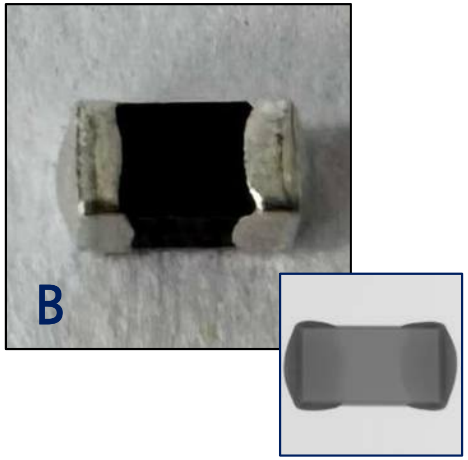
Solderability Test

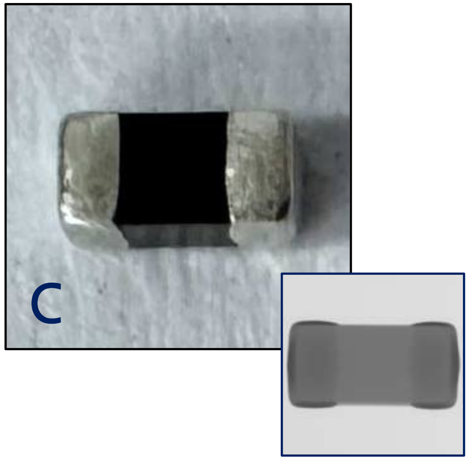
	Before	After
#9		
#10		

VI. Summary and conclusions

Specimens







Sample	Resistance (Ω @25℃)	Resistance Tolerance	B Constant (B25/85)	Operation Temp. (°C)
A	10k	±1%	3434k	-55 ~ +150
B	10k	±1%	3434k	-55 ~ +150
C	10k	±3%	3435k	-40 ~ +125

· A社 : Murata (日本) (NCU18XH103F6SRB) ※村田製製作所
· B社 : Vishay (USA) (NTCS0603E3103FLT)
· C社 : JOINSET (韓国) (ECTH160808 103H3435HST)

- 3社のSMD type NTC Thermistorにて、各種環境試験(高温, 低温, 熱衝撃, 耐湿性, 高温高湿負荷、はんだ付け性試験)、内部構造分析(非破壊分析)、 内部電極の成分分析(破壊分析)を行う。
- 全ての製品は外部からのストレスによる外形変化はない。
- 3社とも環境試験により主な特性が変わる。
- 抵抗値の変化量を基準にすると、韓国製品は他社製品に比べて外部ストレス（温度、湿度）に対して相対的に耐性が優れており、米国製品は相対的に脆弱である。
- B定数の変化量を基準とすると、韓国製品は他社製品に比べて外部ストレス（温度、湿度）に対して相対的に耐性が優れており、日本製品および米国製品は相対的に脆弱である。
- 内部構造の分析結果、日本製品および韓国製品では内部電極が観察されたが、米国製品では内部電極が観察されなかった。

KETI試験結果の考察

■NTCサーミスタ各種試験結果比較

2025年7月

KETIにて実施しましたNTCサーミスタ製品3社の各種試験結果を比較して纏めました。構造的な問題は有りませんでした。Vishay製品の抵抗値変化率が他社と比較して高い結果となっています。許容値は±1%ですが、環境変化にて適応可否についての規定が有りません。

試験項目		A: 村田製作所	B: Vishay	C: JOINSET
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		異常なし/異物なし	異常なし/単一層※	異常なし/異物なし
高温保存試験 (125℃/500時間)	抵抗変化最大値	0.50%	2.40%	0.37%
	抵抗変化平均値	0.45%	2.30%	0.30%
低温保存試験 (-45℃/500時間)	容量変化最大値	0.39%	-0.09%	-0.09%
	容量変化平均値	0.37%	-0.07%	-0.07%
高湿度保存試験 (85℃/85%RH/500時間)	容量変化最大値	0.86%	2.40%	0.35%
	容量変化平均値	0.83%	2.20%	0.28%
高湿度負荷試験 (85℃/85%RH/DC:5V印加/500時間/)	容量変化最大値	0.69%	0.77%	0.64%
	容量変化平均値	0.56%	0.72%	0.53%
サーマルショック試験 (-40℃～85℃変化/15分間隔200サイクル)	容量変化最大値	0.51%	1.25%	0.52%
	容量変化平均値	0.49%	1.22%	0.50%

※Vishay製品は複数層ではなく単一層構造である(電極は有る)。

KETI

J_Chip Consulting