

(2022.01.20 revised)

Comparison Evaluation of UVA LEDs

紫外線LED比較試驗結果報告Vol.1



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I. Introduction



Introduction

- **Specimen:** UVA LED
- **Test:**
 - Optical property measurements
 - X-ray analyses
 - SEM analyses
 - EBSD analyses
 - Environmental tests
- **Test term:** 2021. 08. 12. ~ 2022. 01. 04.
- **Test environment:** (25 ± 5) °C, Below 75% room humidity
- **Test apparatuses:**
 - 3D Digital optical microscope (KH-8700, Hirox, Japan)
 - X-ray (XTV160, Nikon, Japan)
 - Focused ion beam (Quanta 3D DualBeam, FEI, Netherland)
 - Temperature and humidity test chamber (HT125L, Hantech, Korea)
 - Thermal change chamber (Excal 5425T, Climats, France)
 - Temperature and humidity test chamber (Excal 1421-TA, Climats, France)
 - Thermal shock chamber (TSA-101S, ESPEC, Japan)
 - Integrating sphere(20") (LMS-200, Labsphere, America)
 - CAS140D (CAS140D, Instrument Systems, Germany)
- **Etc:** Blind test
- **Contact:** Lee, Ju Ho ☎ +82-31-789-7282 / leejuho@keti.re.kr

Introduction

- **Test apparatuses:**
 - 3D Digital optical microscope (KH-8700, Hirox, Japan)



Introduction

- **Test apparatuses:**
 - X-ray (XTV160, Nikon, Japan)



Introduction

- **Test apparatuses:**
 - Focused ion beam (Quanta 3D DualBeam, FEI, Netherland)



Introduction

- **Test apparatuses:**
 - Temperature and humidity test chamber (HT125L, Hantech, Korea)



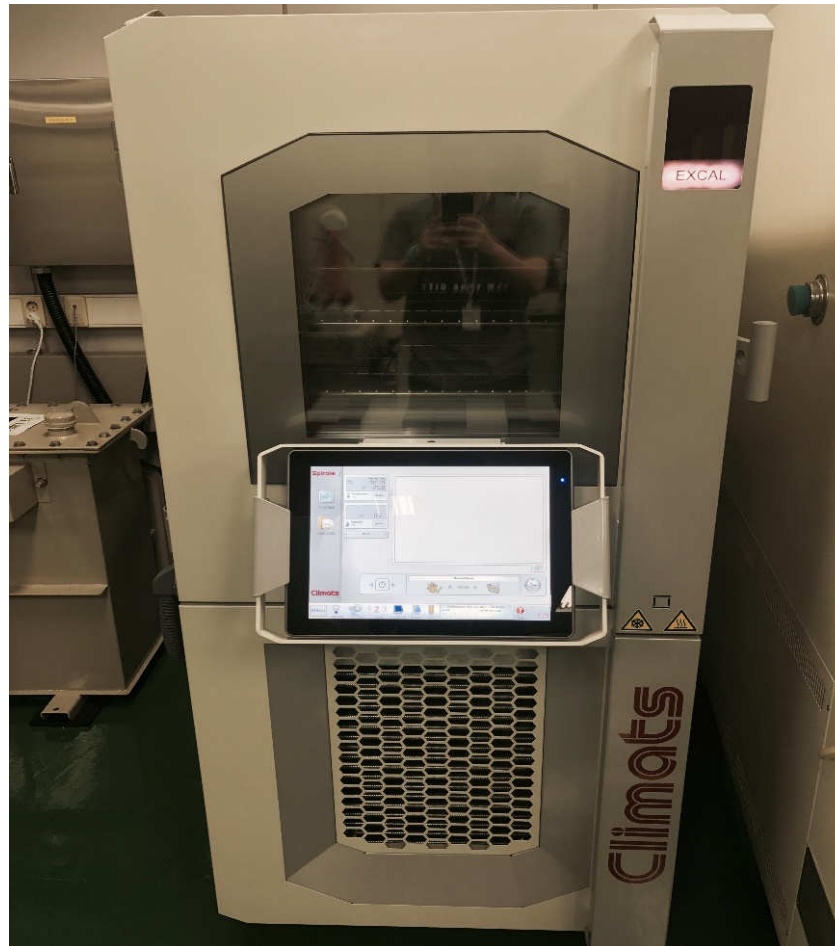
Introduction

- **Test apparatuses:**
 - Thermal change chamber (Excal 5425T, Climats, France)



Introduction

- **Test apparatuses:**
 - Temperature and humidity test chamber (Excal 1421-TA, Climats, France)



Introduction

- **Test apparatuses:**
 - Thermal shock chamber (TSA-101S, ESPEC, Japan)



Introduction

- **Test apparatuses:**
 - Integrating sphere(20") (LMS-200, Labsphere, America)

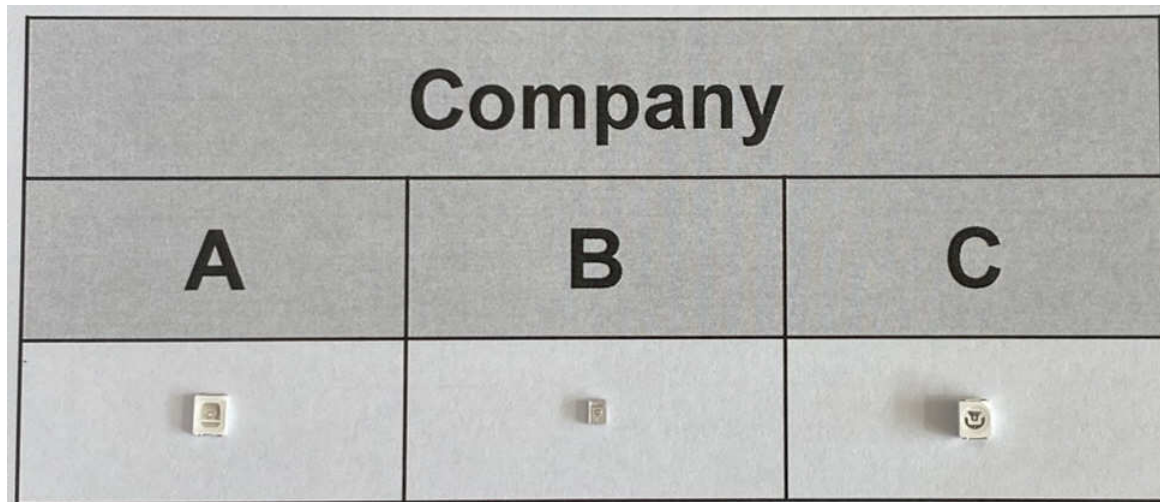


Introduction

- **Test apparatuses:**
 - CAS140D (CAS140D, Instrument Systems, Germany)



Specimens

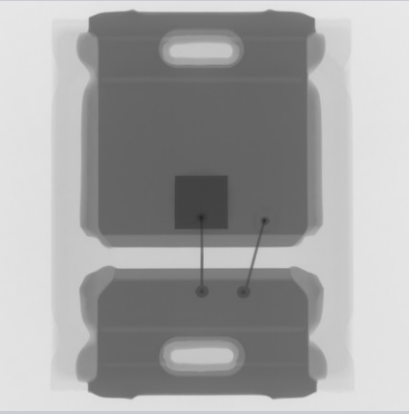

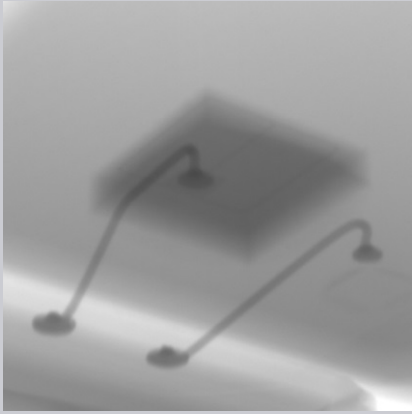
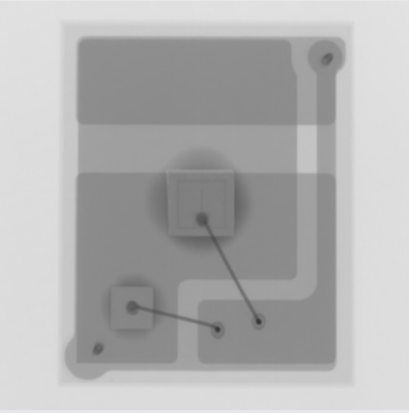
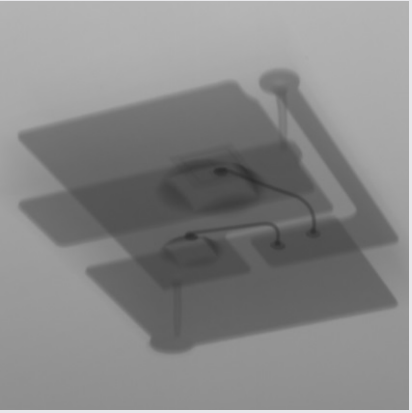
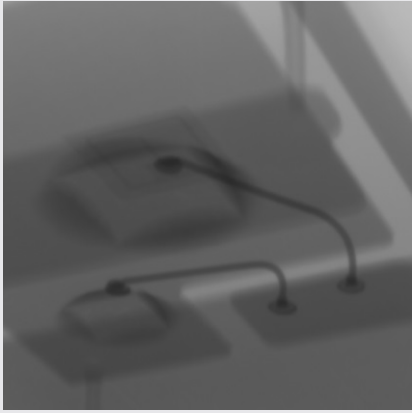
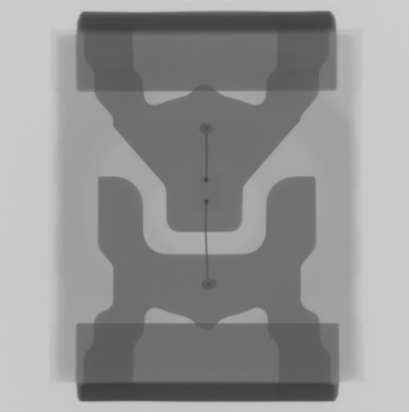
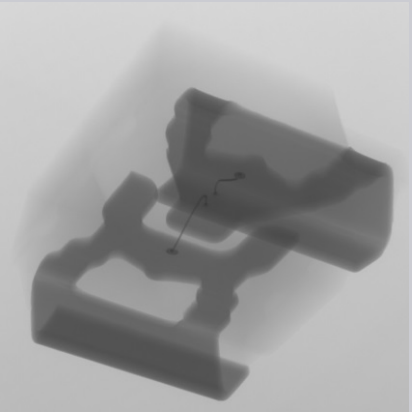
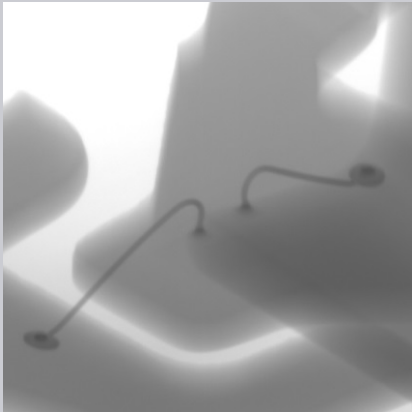


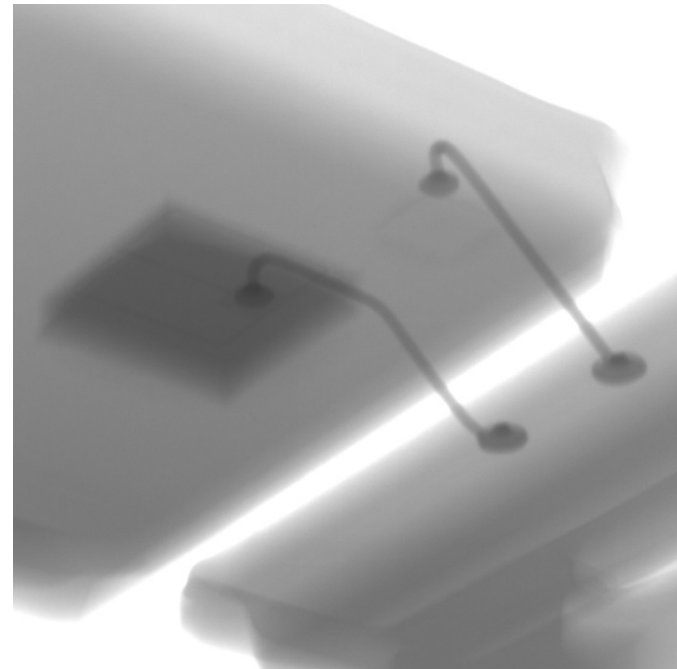
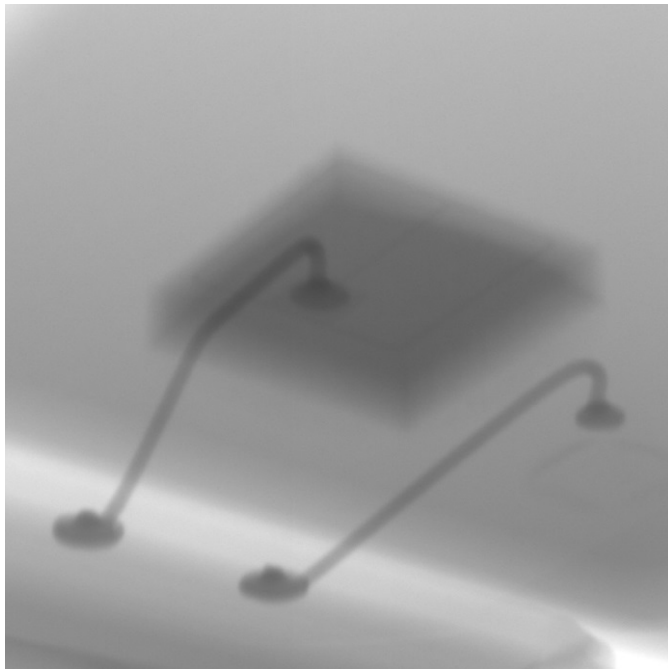
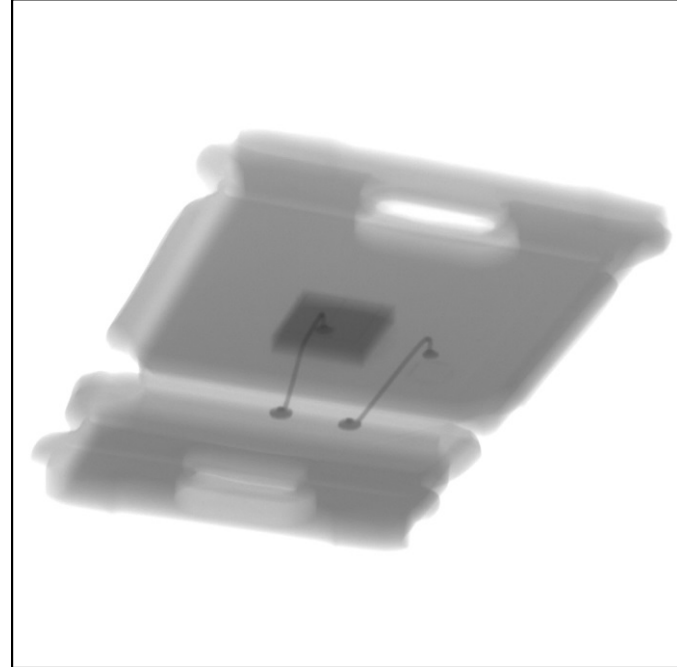
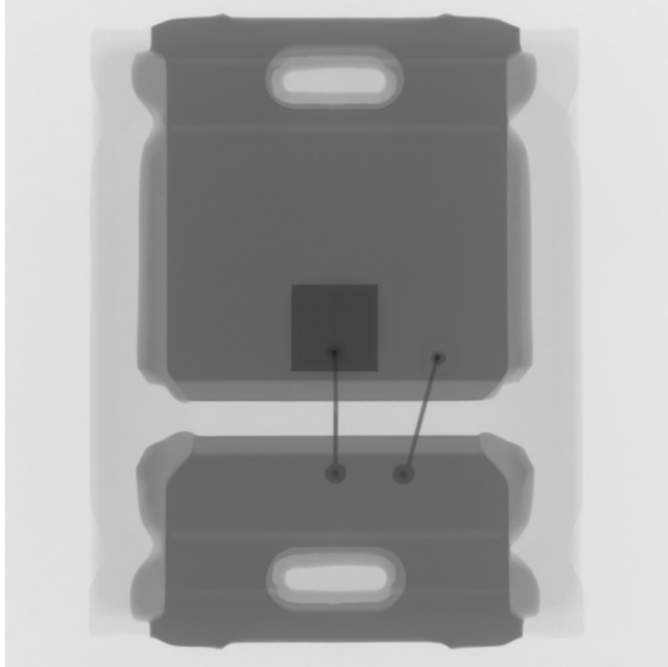
| Sample | Chip | Wavelength (nm) | I_f (mA) | V_f (V) | Package /size (mm) | Junction Temp. (°C) | Operating Temp. (°C) |
|--------|-------|-----------------|------------|-----------|--------------------|---------------------|----------------------|
| A | InGaN | 365 | 70 | 3.6 | PLCC /3528 | 90 | N/A |
| B | InGaN | 405 | 30 | N/A | PLCC /2016 | 105 | -40~+85 |
| C | InGaN | 405 | 30 | 3.2 | PLCC /3228 | 100 | -40~+80 |

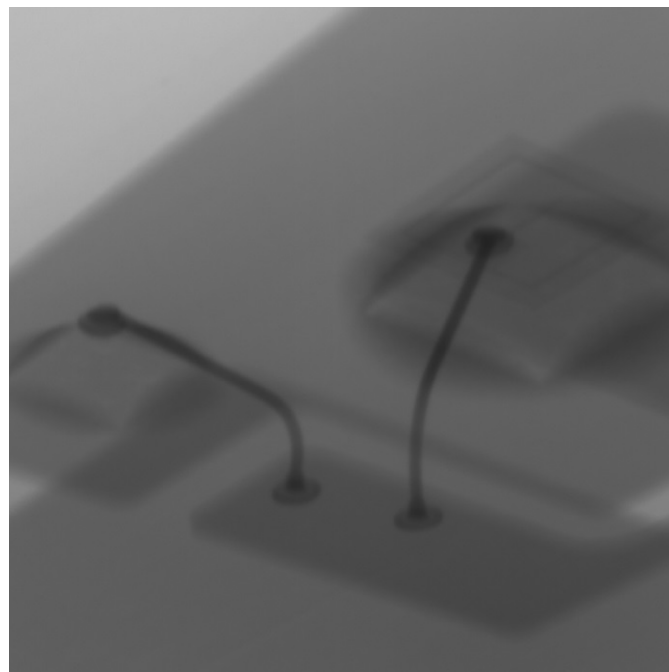
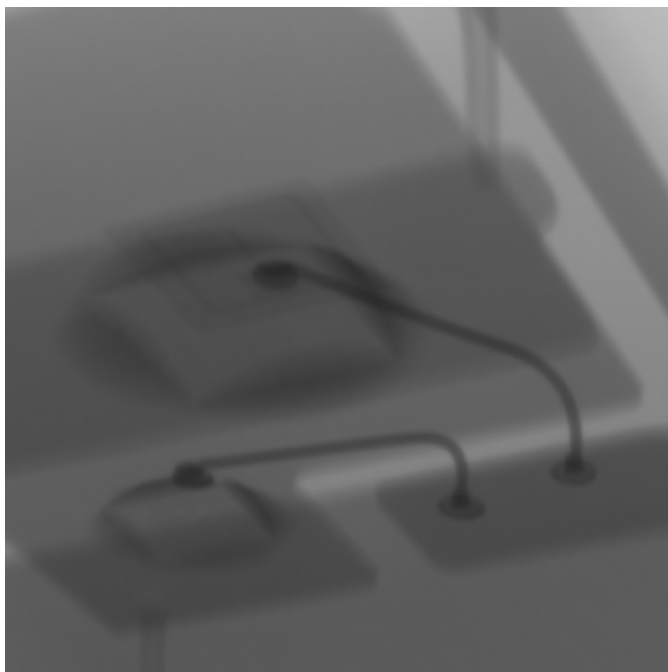
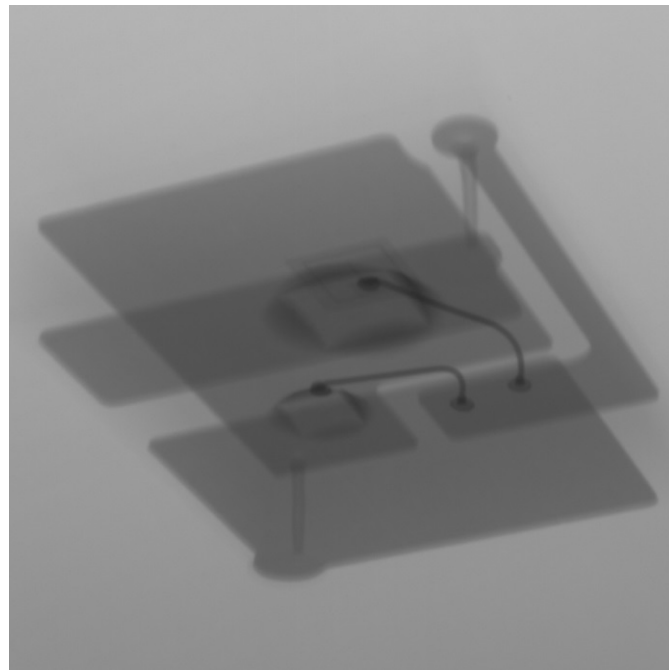
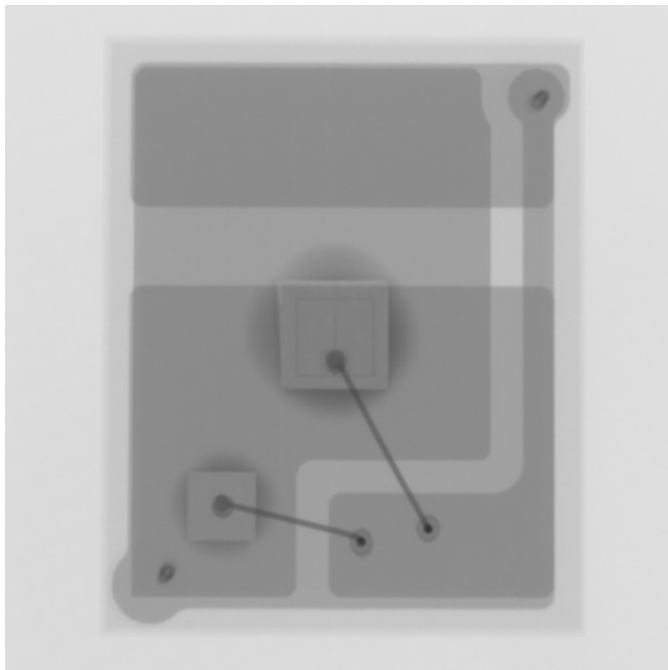
・ A社 : Seoul Viosys (韓国) B社: Everlight Electronics (台湾) C: Vishay(アメリカ)

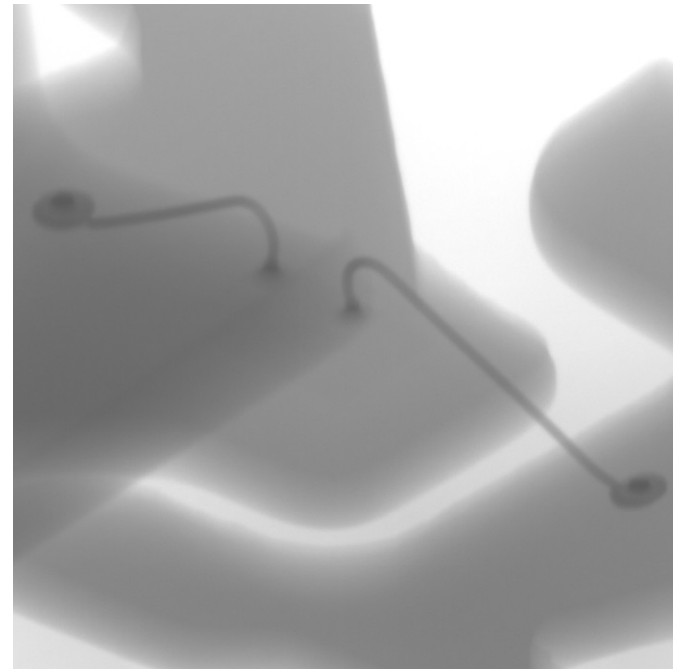
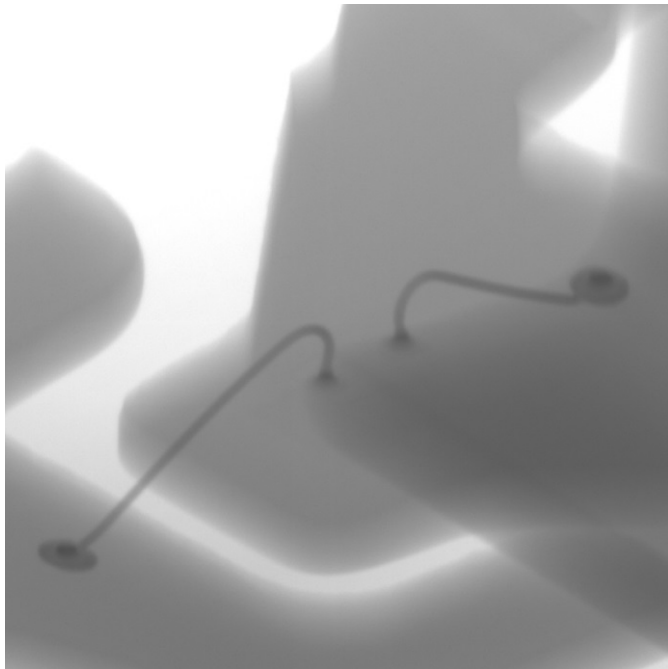
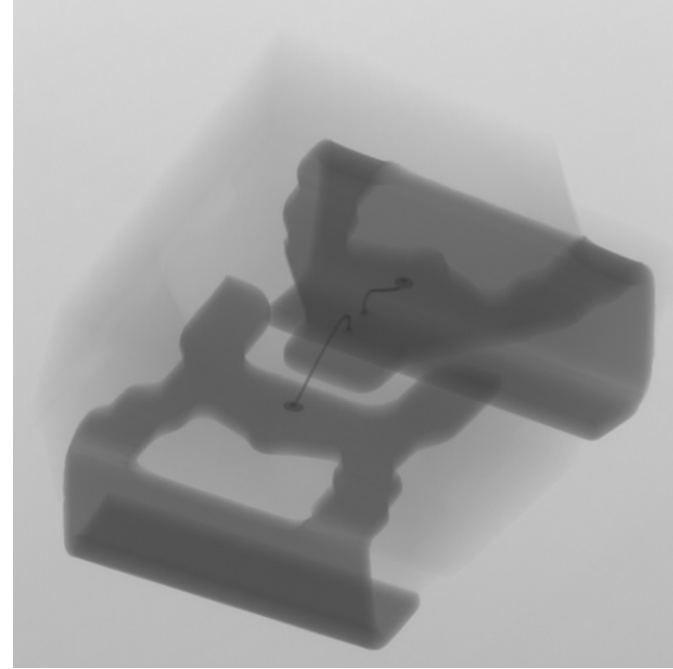
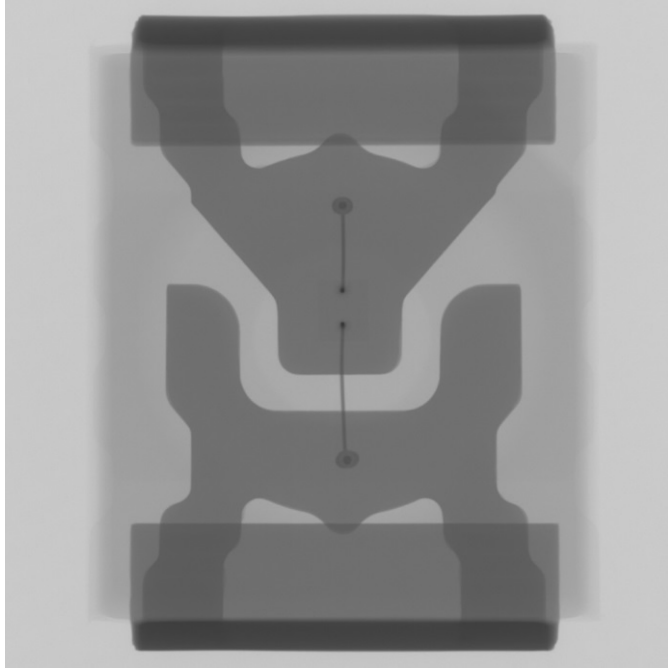
II. X-ray analyses (内部構造観察)



| Sample | X-ray analyses | | |
|--------|---|---|---|
| A |  |  |  |
| B |  |  |  |
| C |  |  |  |

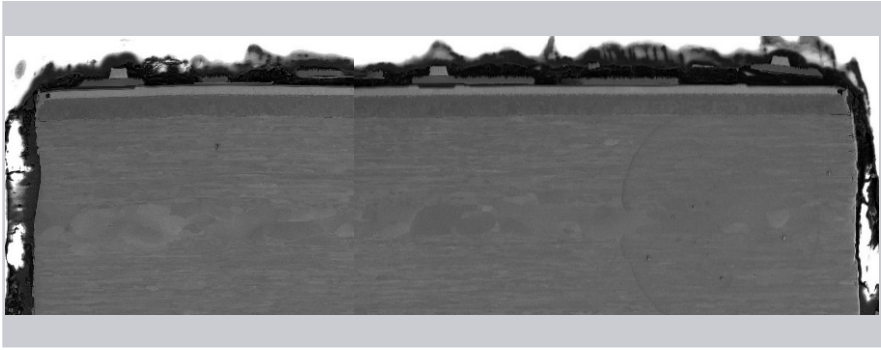
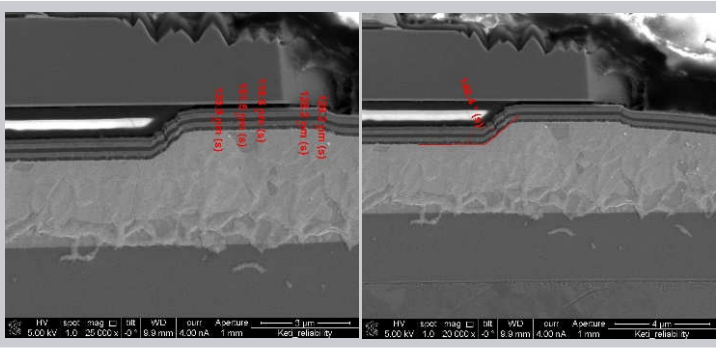
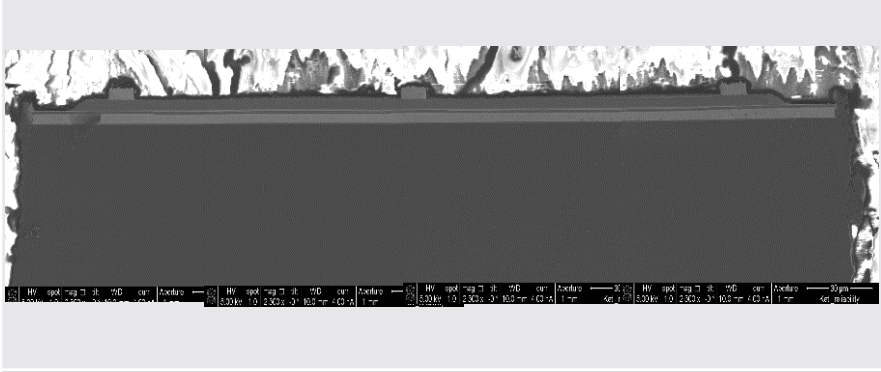
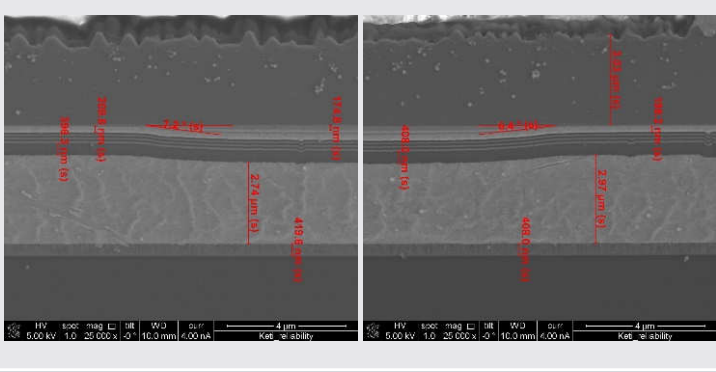
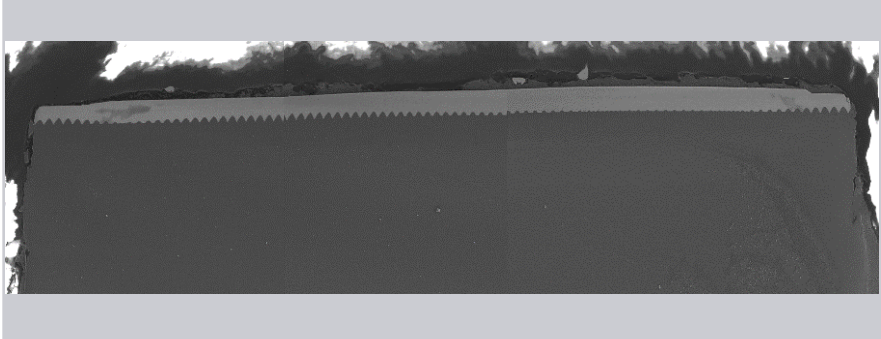
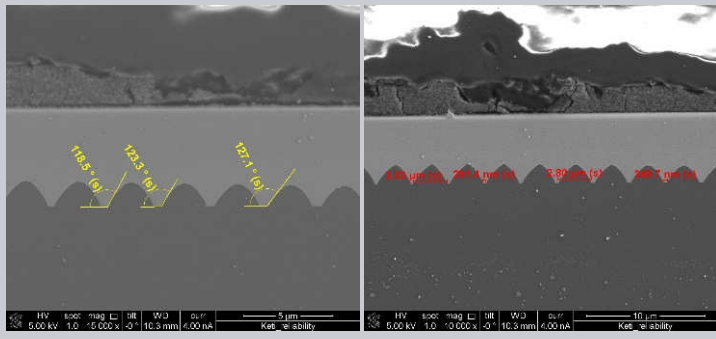


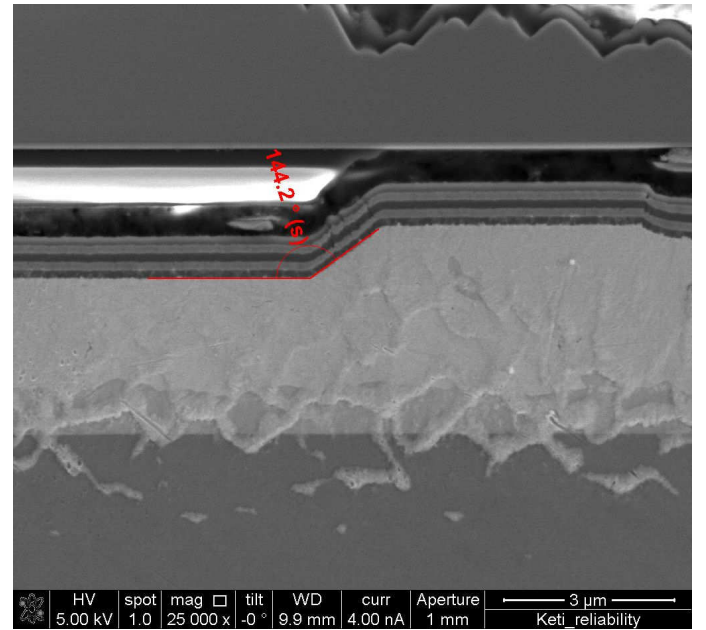
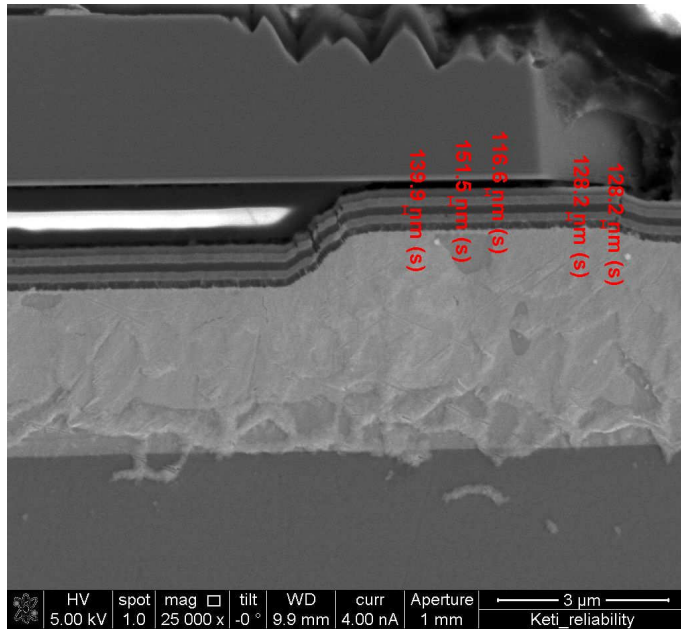
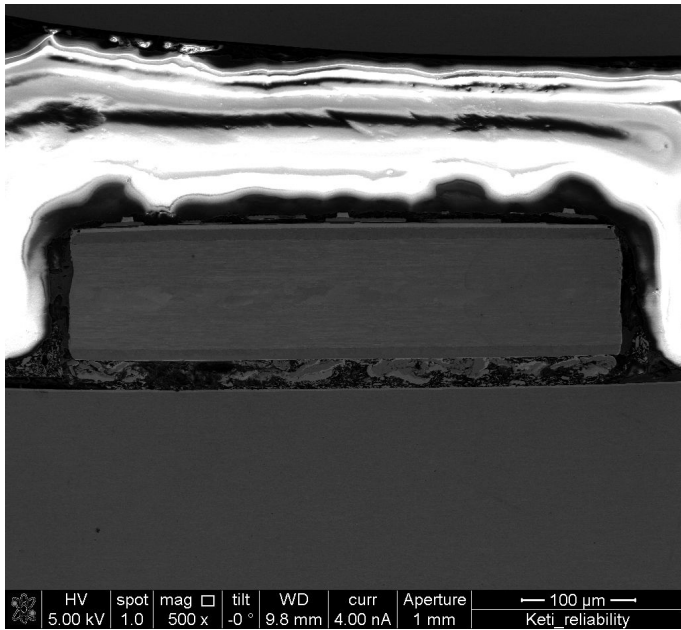
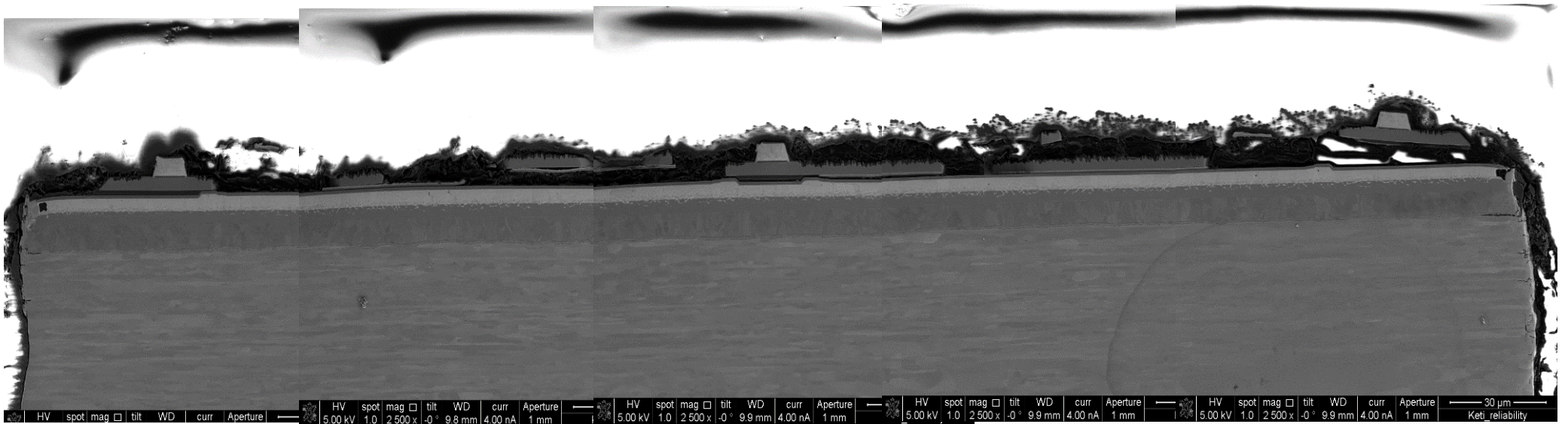


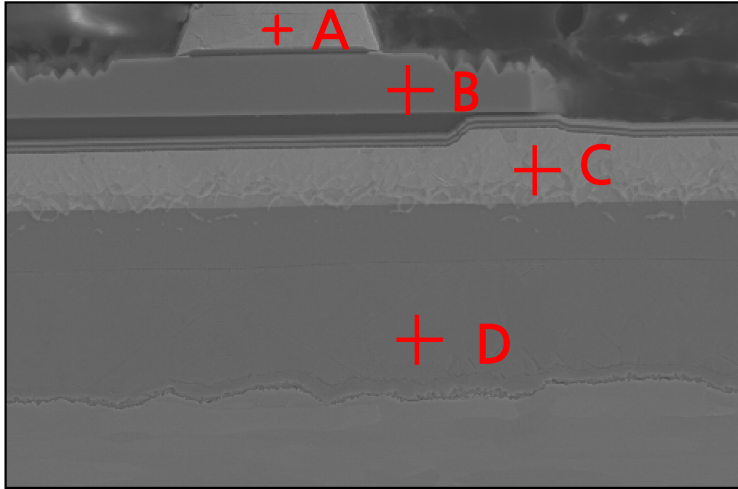


III. SEM analyses



| Sample | SEM analyses | |
|--------|--|---|
| A |  |  |
| B |  |  |
| C |  |  |



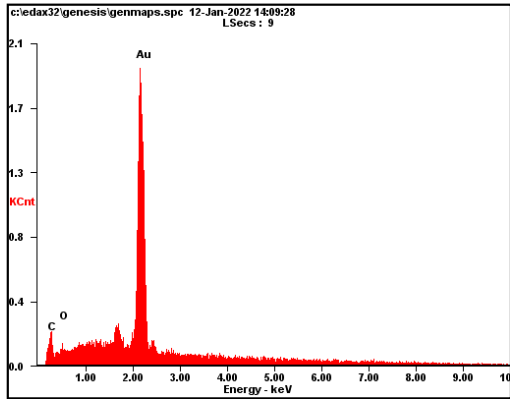


A

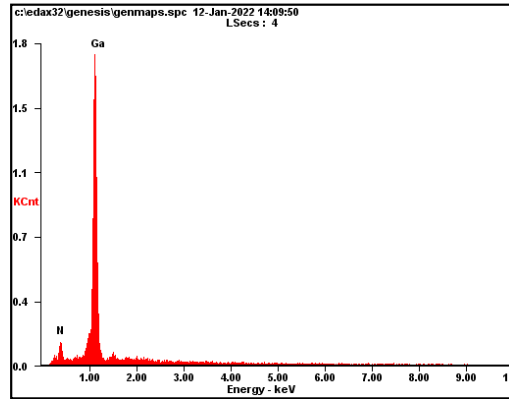
B

C

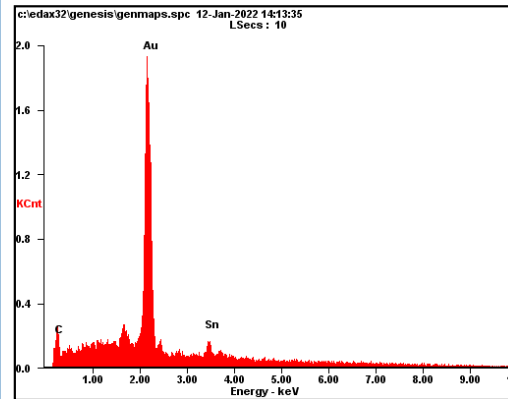
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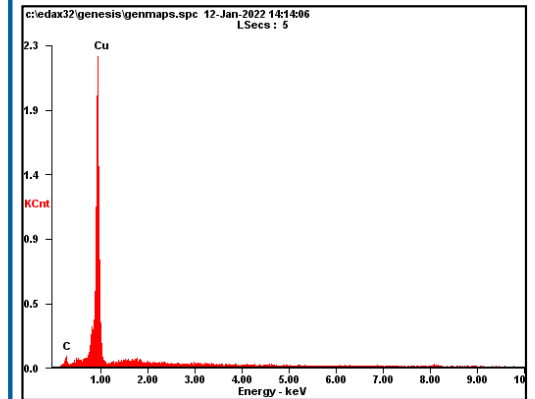
| Element | Wt% | At% |
|---------|-------|-------|
| C | 07.25 | 51.18 |
| O | 01.82 | 09.64 |
| Au | 90.94 | 39.17 |



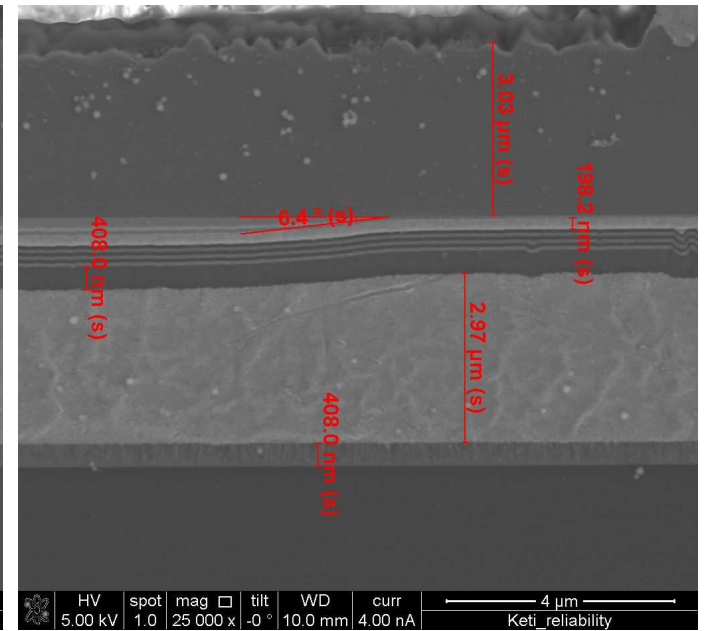
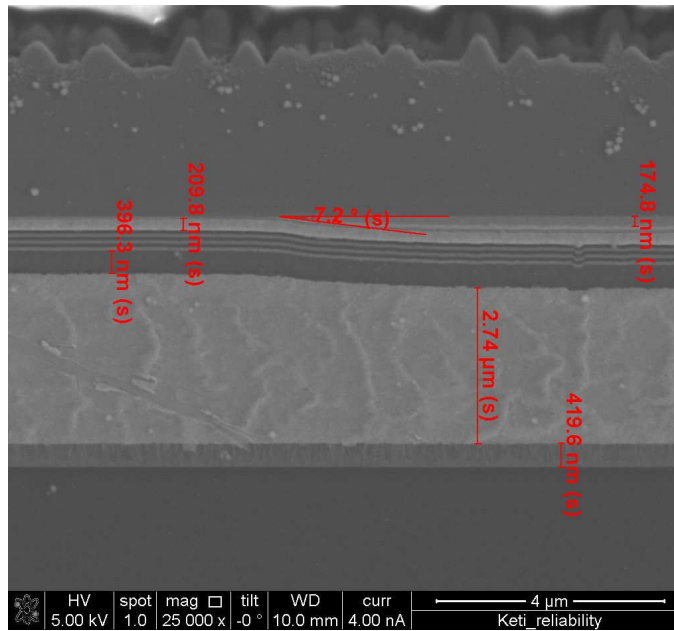
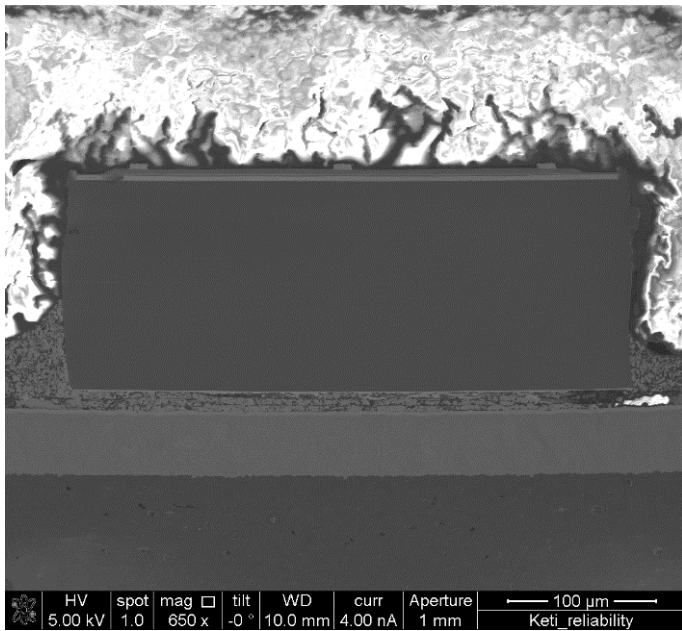
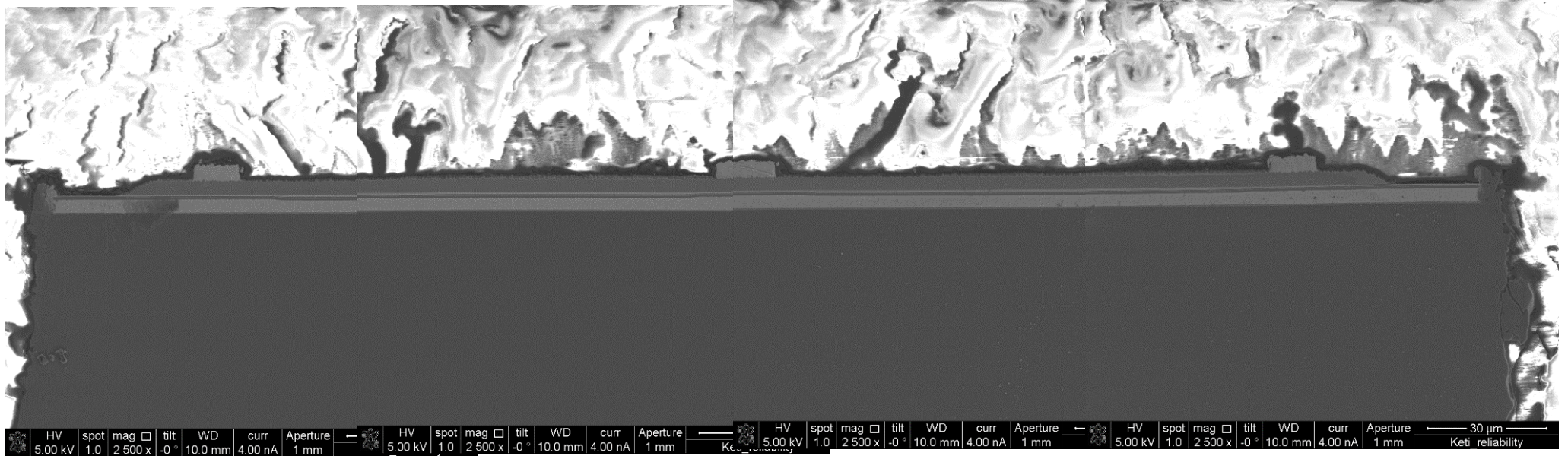
| Element | Wt% | At% |
|---------|-------|-------|
| N | 14.05 | 44.87 |
| Ga | 85.95 | 55.13 |

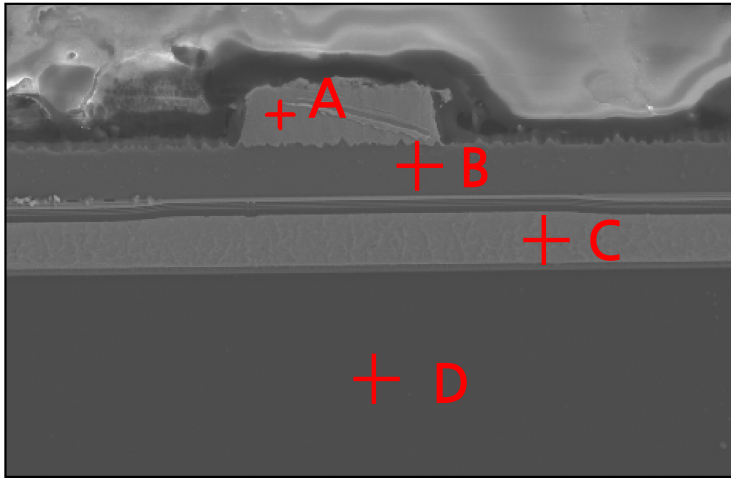


| Element | Wt% | At% |
|---------|-------|-------|
| C | 06.44 | 51.08 |
| Au | 82.20 | 39.79 |
| Sn | 11.37 | 09.13 |



| Element | Wt% | At% |
|---------|-------|-------|
| C | 05.92 | 24.97 |
| Cu | 94.08 | 75.03 |



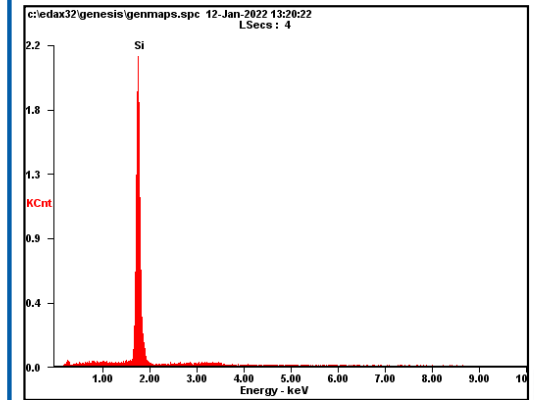
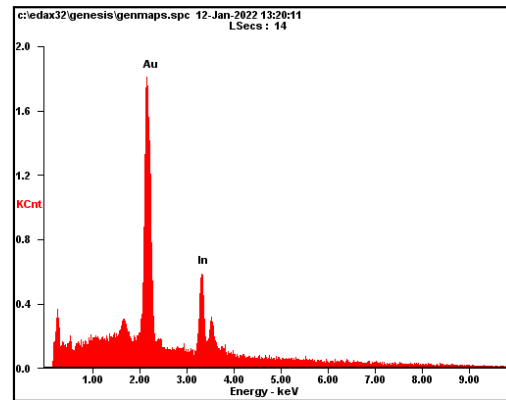
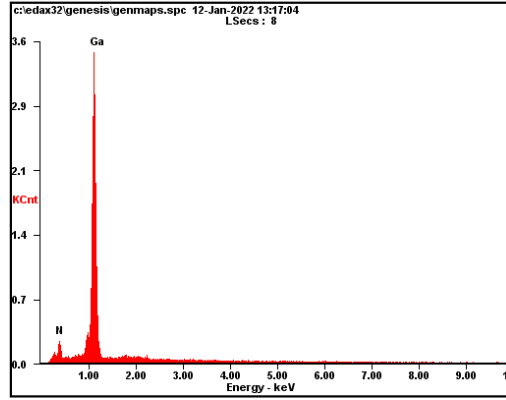
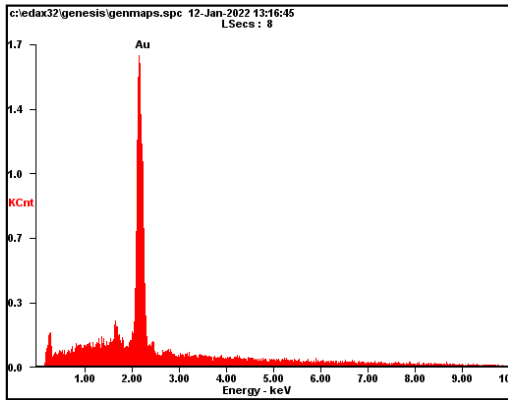


A

B

C

D

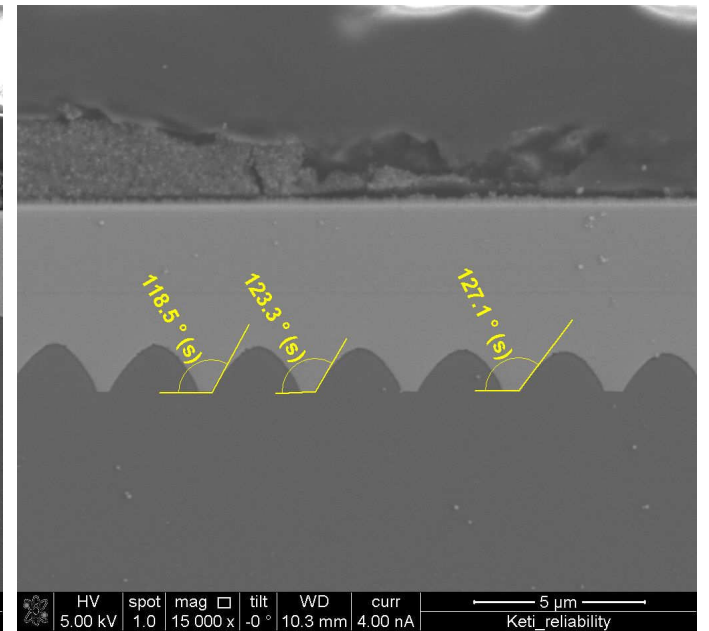
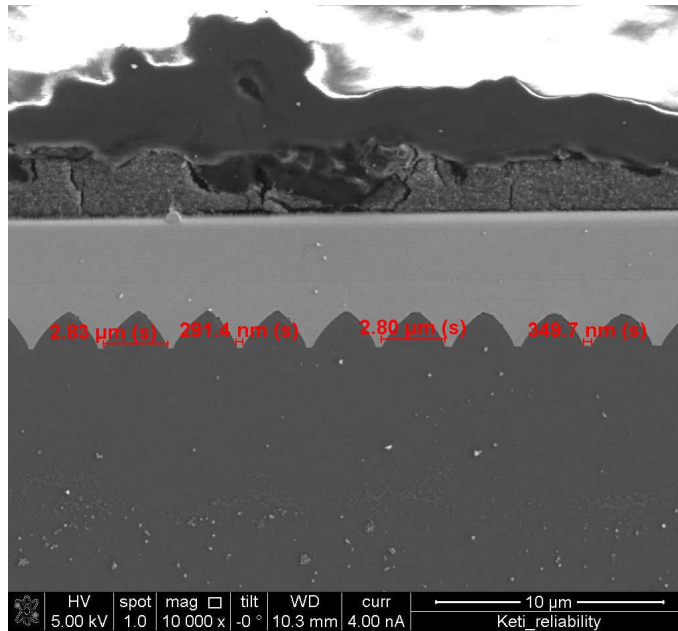
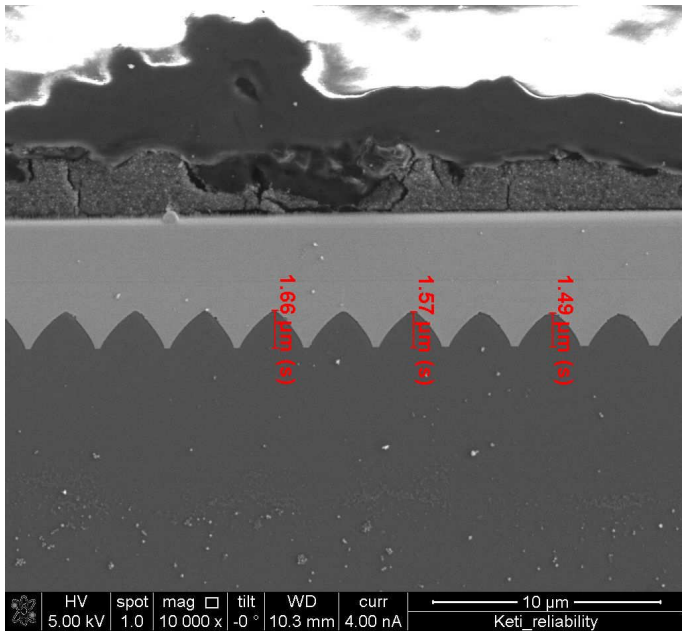
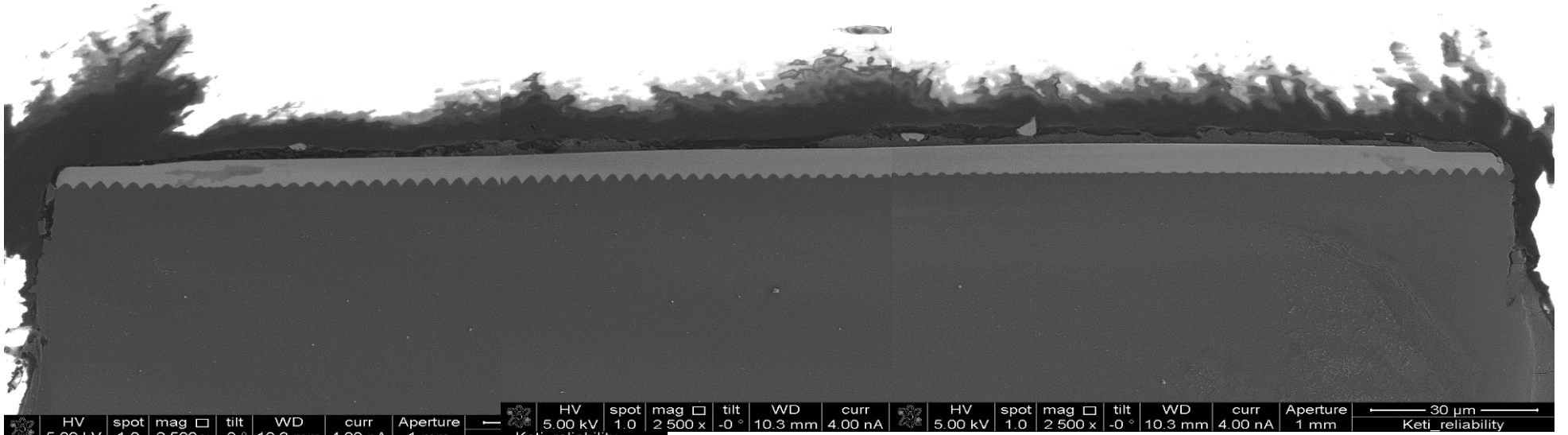


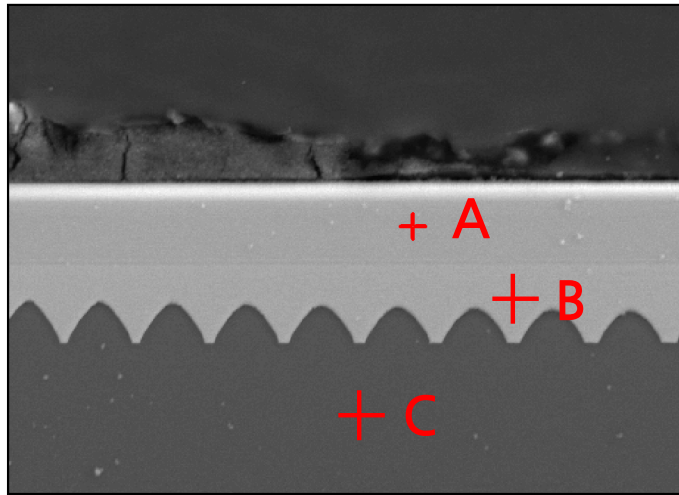
| Element | Wt% | At% |
|---------|--------|--------|
| Au | 100.00 | 100.00 |
| | | 0 |

| Element | Wt% | At% |
|---------|-------|-------|
| N | 12.96 | 42.57 |
| Ga | 87.04 | 57.43 |

| Element | Wt% | At% |
|---------|-------|-------|
| Au | 65.06 | 52.04 |
| In | 34.94 | 47.96 |

| Element | Wt% | At% |
|---------|--------|--------|
| Si | 100.00 | 100.00 |
| | | 0 |

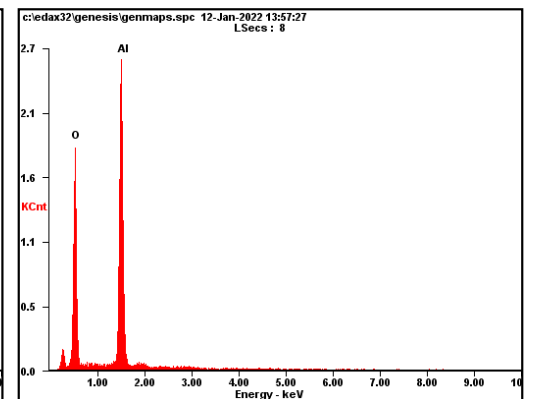
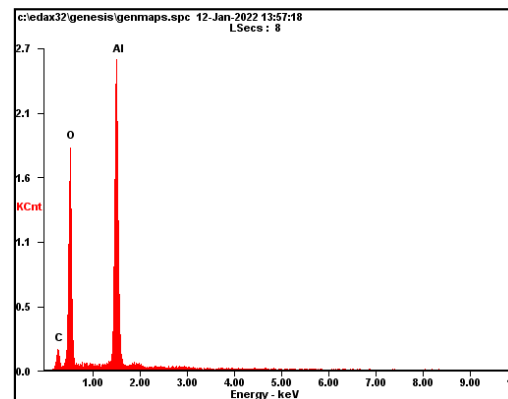
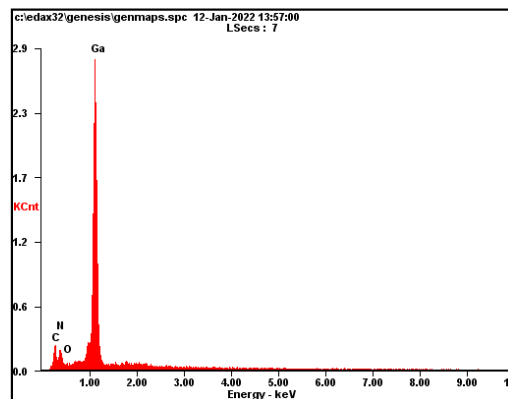
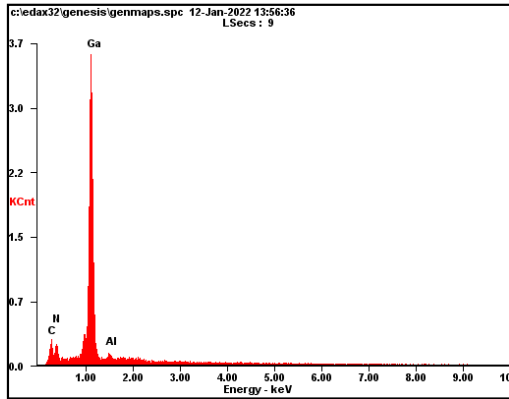




A

B

C



| Element | Wt% | At% |
|---------|-------|-------|
| C | 13.75 | 36.72 |
| N | 12.25 | 28.05 |
| Ga | 72.38 | 33.30 |
| Al | 01.63 | 01.93 |

| Element | Wt% | At% |
|---------|-------|-------|
| C | 13.37 | 36.66 |
| N | 11.63 | 27.35 |
| O | 00.34 | 00.70 |
| Ga | 74.66 | 35.28 |

| Element | Wt% | At% |
|---------|-------|-------|
| C | 11.70 | 18.36 |
| O | 41.58 | 49.00 |
| Al | 46.72 | 32.64 |

| Element | Wt% | At% |
|---------|-------|-------|
| O | 43.88 | 56.87 |
| Al | 56.12 | 43.13 |