# LAMPIRAN A
# PERHITUNGAN DATA

**Lampiran A.1** Perhitungan Data

## A.1 Contoh Perhitungan %*Recovery* Sampel

Berat Sampel *Dross* = 500 gram

Kandungan Sn *Dross* = 94,10%

Berat Kandungan Sn *Dross* =

= Berat Sampel *Dross* x Kandungan Sn *Dross*

= 500g x 94,10%

= 470,5 gram

Berat Logam Hasil (Sampel Kontrol) = 460 gram

Kandungan Logam Sn Logam Hasil (Sampel Kontrol) = 99,4798%

Berat Sn dalam Logam Hasil (Sampel Kontrol) =

= Berat Logam Hasil x Kandungan Logam Sn Logam Hasil

= 460g x 99,4798%

= 457,6070 gram

**%*Recovery*** (Sampel Kontrol) =

= (Berat Sn dalam Logam Hasil / Berat Kandungan Sn *Dross*) x 100%

= (457,6070g / 470,5g) x 100%

= 97,26%

## A.2 Contoh Perhitungan *Mass Balance* (Sampel Kontrol)

***Input***

- Berat Sampel *Dross* = 500 g
- Berat Arang = 150 g

**Total *Input*** = 500 + 150

= 650 g

***Output***

- Berat Logam Hasil = 460 g
- *Slag* = 17 g

- $CO_2$ dari reduksi SnO

  $SnO + C \rightarrow Sn + CO$

  $2CO + O_2 \rightarrow 2CO_2$

Setiap mol SnO menghasilkan 1 mol CO, dan CO selanjutnya teroksidasi:

Berat Mol SnO = 150,7 g/mol

Mol SnO Tereduksi $= \frac{\text{Kandungan SnO dalam Dross}}{\text{Berat Mol SnO}}$

$= \frac{470,5}{150,7}$

= 3,12 mol

Berat $CO_2$ dari hasil Reduksi = (mol $CO_2$ tereduksi) x (berat mol $CO_2$)

= 3,12 x 44,01

= 137,37 g

**Total *Output*** = Logam Hasil + *Slag* + $CO_2$

= 460 + 17 + 137,37

= 614,37 g

***Material Losses*** = *Input – Output*

= 650 – 614,37

= 35.63 g

## A.2 Contoh Perhitungan *Mass Balance* (Sampel A3)

***Input***

- Berat Sampel *Dross* = 500 g
- Berat Arang = 150 g
- Berat $CaCO_3$ = 15 g

**Total *Input*** = 500 + 150 + 15

= 665 g

***Output***

- Berat Logam Hasil = 470 g
- *Slag* = 25 g

  CaO = 88,1% x 25 = 22,03 g

  SnO = 9,8% x 25 = 2,45 g

- $CO_2$ dari $CaCO_3$

$CaCO_3 \rightarrow CaO + CO_2$

Mol $CaCO_3 = \frac{\text{Massa } CaCO_3}{\text{Berat Mol } CO_2} = \frac{15}{100} = 0{,}15$ mol

Massa $CO_2$ dari dekomposisi = 0,15 x 44

= 6,6 g

- $CO_2$ dari Reduksi SnO

  SnO tereduksi = 470,5 – 2,45 = 468,05 g

  Mol SnO tereduksi $= \frac{468{,}05}{150{,}7} = 3{,}11$ mol

  1 mol SnO = 1 mol $CO_2$

  $CO_2$ dari SnO = 3,11 x 44 = 136,84 g

- **Total $CO_2$** = 6,6 + 136,84 g

  = 143,44 g

**Total *Output*** = 470 + 25 + 143,44

= 638,44 g

***Material Losses*** = *Input – Output*

= 665 – 638,44

= 26,50 g

# LAMPIRAN B
# DATA HASIL PENELITIAN

**Lampiran B.1** Data Proses *Recovery*

**Tabel B.1** Data Proses *Recovery*

| No | Nama Sampel | Tanggal/ Waktu | Berat Sampel Koin (g) | Berat Product (g) | Total Finish Goods (g) | *Slag* (g) | Total Out (g) |
|---|---|---|---|---|---|---|---|
| 1 | Kontrol | 310124 / 10.20 | 77 | 383 | 460 | 17 | 477 |
| 2 | A1 | 310124 / 10.54 | 83 | 185 | 268 | 220 | 488 |
| 3 | A2 | 310124 / 11.20 | 99 | 334 | 433 | 48 | 481 |
| 4 | A3 | 310124 / 11.52 | 83 | 387 | 470 | 25 | 495 |
| 5 | B1 | 310124 / 14.50 | 89 | 150 | 239 | 248 | 487 |
| 6 | B2 | 310124 / 15.18 | 82 | 348 | 430 | 60 | 490 |
| 7 | B3 | 310124 / 15.40 | 87 | 339 | 426 | 39 | 465 |
| 8 | C1 | 310124 / 16.05 | 91 | 99 | 190 | 277 | 467 |
| 9 | C2 | 010224 / 09.52 | 86 | 324 | 410 | 77 | 487 |
| 10 | C3 | 010224 / 10.17 | 81 | 336 | 417 | 78 | 495 |

**Lampiran B.2** Data XRF Dross

## Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| Dross | SMART-Oxides | 6/1/2024 12:50 PM | 0.0000 | 1.4326 | 0.0000 | 0.8587 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.7917 | 0.4967 | 0.2997 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2560 | 0.0385 | 0.9471 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 94.1035 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.6685 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.1069 | 0.0000 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.3** Data XRF Sampel A1

## Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| A1 | SMART-Oxides | 6/1/2024 11:25 AM | 0.0000 | 1.3289 | 0.0000 | 0.6638 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.6731 | 0.6898 | 0.2248 | 0.0000 | 24.9201 | 0.0000 | 0.0000 | 0.0000 | 0.3835 | 0.0269 | 0.5444 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0314 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0044 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 70.2399 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2691 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.4** Data XRF Sampel A2

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| A2 | SMART-Oxides | 6/1/2024 11:35 AM | 0.0000 | 1.1847 | 0.0000 | 0.7628 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.6937 | 1.1678 | 0.2113 | 0.0000 | 48.5688 | 0.0000 | 0.0000 | 0.0000 | 0.4123 | 0.0362 | 0.8245 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0346 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0090 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 45.8272 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0905 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.1049 | 0.0718 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.5** Data XRF Sampel A3

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| A3 | SMART-Oxides | 6/1/2024 11:44 AM | 0.0000 | 0.7674 | 0.0000 | 0.7223 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.1985 | 0.1294 | 0.0000 | 88.0652 | 0.0000 | 0.0000 | 0.0000 | 0.0703 | 0.0115 | 0.1569 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0093 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0222 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0046 | 0.0000 | 0.0000 | 9.7693 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0271 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0460 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.6** Data XRF Sampel B1

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| B1 | SMART-Oxides | 6/1/2024 11:54 AM | 0.0000 | 0.5618 | 0.0000 | 0.7056 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.5387 | 0.5847 | 0.1738 | 0.0000 | 75.0270 | 0.0000 | 0.0000 | 0.0000 | 0.1175 | 0.0100 | 0.2927 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0094 | 0.0000 | 0.0000 | 0.0222 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0152 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 21.8285 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0652 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0477 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.7** Data XRF Sampel B2

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| B2 | SMART-Oxides | 6/1/2024 12:03 PM | 0.0000 | 0.8317 | 0.0000 | 0.6346 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.1559 | 0.1169 | 0.0000 | 81.5533 | 0.0000 | 0.0000 | 0.0000 | 0.0442 | 0.0098 | 0.1251 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0073 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0160 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 16.4541 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0190 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0322 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.8** Data XRF Sampel B3

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| B3 | SMART-Oxides | 6/1/2024 12:12 PM | 0.0000 | 1.4144 | 0.0000 | 0.6159 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.4177 | 0.1312 | 0.1137 | 0.0000 | 79.9927 | 0.0000 | 0.0000 | 0.0000 | 0.0630 | 0.0094 | 0.0982 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0063 | 0.0000 | 0.0000 | 0.0097 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0150 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 17.0629 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0163 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0337 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.9** Data XRF Sampel C1

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| C1 | SMART-Oxides | 6/1/2024 12:22 PM | 0.0000 | 1.3140 | 0.0000 | 0.8131 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.7303 | 0.5161 | 0.1966 | 0.0000 | 9.7121 | 0.0000 | 0.0000 | 0.0000 | 0.3732 | 0.0307 | 0.5914 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0023 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 85.3289 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.3914 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.10** Data XRF Sampel C2

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| C2 | SMART-Oxides | 6/1/2024 12:32 PM | 0.0000 | 0.7705 | 0.0000 | 0.7711 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.4376 | 0.1301 | 0.0000 | 83.9714 | 0.0000 | 0.0000 | 0.0000 | 0.1159 | 0.0168 | 0.1252 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0123 | 0.0000 | 0.0000 | 0.0181 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0176 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0072 | 0.0000 | 0.0000 | 13.5252 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0359 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0449 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.11** Data XRF Sampel C3

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| C3 | SMART-Oxides | 6/1/2024 12:41 PM | 0.0000 | 1.7875 | 0.0000 | 0.6551 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.4654 | 0.1301 | 0.1176 | 0.0000 | 77.6119 | 0.0000 | 0.0000 | 0.0000 | 0.1083 | 0.0109 | 0.1362 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0070 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0151 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 18.8827 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0296 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.0000 | 0.0427 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.12** Data XRF Sampel Kontrol

Table of results

| Sample ID | Measurement method | Measurement Finished | Na2O (%) | MgO (%) | Al2O3 (%) | SiO2 (%) |
|---|---|---|---|---|---|---|
| Kontrol | SMART-Oxides | 6/1/2024 1:00 PM | 0.0000 | 1.1556 | 0.8806 | 3.5272 |

| P2O5 (%) | SO3 (%) | Cl (%) | K2O (%) | CaO (%) | Sc2O3 (%) | TiO2 (%) | V2O5 (%) | Cr2O3 (%) | MnO (%) | Fe2O3 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.3299 | 1.2473 | 0.4657 | 0.0000 | 0.0000 | 0.0000 | 0.1692 | 0.0425 | 1.8142 | 0.1910 | 10.0936 |

| CoO (%) | NiO (%) | CuO (%) | ZnO (%) | Ga2O3 (%) | GeO2 (%) | As2O3 (%) | SeO2 (%) | Br (%) | Rb2O (%) | SrO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.1759 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Y2O3 (%) | ZrO2 (%) | Nb2O5 (%) | MoO3 (%) | RuO2 (%) | Rh2O3 (%) | CdO (%) | In2O3 (%) | SnO2 (%) | Sb2O3 (%) | TeO2 (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 77.7994 | 0.0000 | 0.0000 |

| I (%) | Cs2O (%) | BaO (%) | La2O3 (%) | HfO2 (%) | Ta2O5 (%) | WO3 (%) | IrO2 (%) | HgO (%) | Tl2O (%) | PbO (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0633 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.5736 |

| Bi2O3 (%) | Pt (%) | Au (%) | CeO2 (%) | Pr6O11 (%) | Nd2O3 (%) | Sm2O3 (%) | Eu2O3 (%) |
|---|---|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Gd2O3 (%) | Tb4O7 (%) | Dy2O3 (%) | Ho2O3 (%) |
|---|---|---|---|
| 0.0000 | 0.4710 | 0.0000 | 0.0000 |

| Er2O3 (%) | Tm2O3 (%) | Yb2O3 (%) | Lu2O3 (%) | ThO2 (%) | UO2 (%) |
|---|---|---|---|---|---|
| 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Lampiran B.13** Data *Arc* OES Sampel Kontrol

02/02/2024 08:50:55

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | Kontrol | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4604 | 0.0035 | 0.0083 | 0.0029 | 0.0006 | <0.0005 | 0.0002 | 0.0040 | <0.0005 | 0.0287 |
| 2. | 0.4687 | 0.0034 | 0.0085 | 0.0030 | 0.0011 | <0.0005 | 0.0002 | 0.0048 | <0.0005 | 0.0208 |
| 3. | 0.4787 | 0.0034 | 0.0081 | 0.0030 | 0.0006 | <0.0005 | 0.0002 | 0.0040 | <0.0005 | 0.0200 |
| Ø | **0.4693** | **0.0034** | **0.0083** | **0.0030** | **0.0008** | **<0.0005** | **0.0002** | **0.0043** | **<0.0005** | **0.0232** |
| σ | 0.0092 | 0.0001 | 0.0002 | 0.0001 | 0.0003 | | | 0.0005 | | 0.0048 |
| υ | 1.960 | 2.941 | 2.410 | 3.333 | 37.50 | | | 11.63 | | 20.69 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0046 | 0.0011 | <0.0010 | 99.4838 |
| 2. | 0.0047 | 0.0012 | <0.0010 | 99.4815 |
| 3. | 0.0047 | 0.0012 | <0.0010 | 99.4740 |
| Ø | **0.0047** | **0.0012** | **<0.0010** | **99.4798** |
| σ | 0.0001 | 0.0001 | | 0.0051 |
| υ | 2.128 | 8.333 | | 0.0051 |

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Bruker Elemental

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**Lampiran B.14** Data *Arc* OES Sampel A1

02/02/2024 09:07:53

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | A1 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4507 | 0.0036 | 0.0076 | 0.0027 | 0.0012 | <0.0005 | 0.0002 | 0.0043 | <0.0005 | 0.0265 |
| 2. | 0.4520 | 0.0035 | 0.0075 | 0.0027 | 0.0008 | <0.0005 | 0.0002 | 0.0028 | <0.0005 | 0.0260 |
| 3. | 0.4456 | 0.0038 | 0.0081 | 0.0028 | 0.0039 | <0.0005 | 0.0002 | 0.0043 | <0.0005 | 0.0243 |
| ∅ | **0.4494** | **0.0036** | **0.0077** | **0.0027** | **0.0020** | **<0.0005** | **0.0002** | **0.0038** | **<0.0005** | **0.0256** |
| σ | 0.0034 | 0.0002 | 0.0003 | 0.0001 | 0.0017 | | | 0.0009 | | 0.0012 |
| υ | 0.757 | 5.556 | 3.896 | 3.704 | 85.00 | | | 23.68 | | 4.687 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0044 | 0.0010 | <0.0010 | 99.4958 |
| 2. | 0.0044 | 0.0009 | <0.0010 | 99.4972 |
| 3. | 0.0044 | 0.0010 | <0.0010 | 99.4995 |
| ∅ | **0.0044** | **0.0010** | **<0.0010** | **99.4975** |
| σ | | 0.0001 | | 0.0019 |
| υ | | 10.00 | | 0.0019 |

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Bruker Elemental

Concentrations
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**Lampiran B.15** Data *Arc* OES Sampel A2

02/02/2024 09:21:58

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | A2 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4760 | 0.0033 | 0.0088 | 0.0029 | 0.0014 | <0.0005 | 0.0003 | 0.0047 | <0.0005 | 0.0378 |
| 2. | 0.4850 | 0.0035 | 0.0084 | 0.0029 | 0.0011 | <0.0005 | 0.0002 | 0.0046 | <0.0005 | 0.0345 |
| 3. | 0.4814 | 0.0035 | 0.0086 | 0.0030 | 0.0030 | <0.0005 | 0.0002 | 0.0044 | <0.0005 | 0.0381 |
| ∅ | **0.4808** | **0.0034** | **0.0086** | **0.0029** | **0.0018** | **<0.0005** | **0.0002** | **0.0046** | **<0.0005** | **0.0368** |
| σ | 0.0045 | 0.0001 | 0.0002 | 0.0001 | 0.0010 | | 0.0001 | 0.0002 | | 0.0020 |
| υ | 0.936 | 2.941 | 2.326 | 3.448 | 55.56 | | 50.00 | 4.348 | | 5.435 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0049 | 0.0012 | <0.0010 | 99.4568 |
| 2. | 0.0049 | 0.0010 | <0.0010 | 99.4519 |
| 3. | 0.0048 | 0.0012 | <0.0010 | 99.4497 |
| ∅ | **0.0049** | **0.0011** | **<0.0010** | **99.4528** |
| σ | 0.0001 | 0.0001 | | 0.0036 |
| υ | 2.041 | 9.091 | | 0.0036 |

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**Lampiran B.16** Data *Arc* OES Sampel A3

02/02/2024 09:26:33

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | A3 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4313 | 0.0031 | 0.0071 | 0.0030 | 0.0009 | 0.0010 | 0.0002 | 0.0029 | <0.0005 | 0.0651 |
| 2. | 0.4452 | 0.0036 | 0.0073 | 0.0030 | 0.0044 | 0.0010 | 0.0002 | 0.0031 | <0.0005 | 0.0643 |
| 3. | 0.4499 | 0.0032 | 0.0071 | 0.0030 | 0.0006 | 0.0010 | 0.0002 | 0.0030 | <0.0005 | 0.0598 |
| ∅ | **0.4421** | **0.0033** | **0.0072** | **0.0030** | **0.0020** | **0.0010** | **0.0002** | **0.0030** | **<0.0005** | **0.0631** |
| σ | 0.0097 | 0.0003 | 0.0001 | | 0.0021 | | | 0.0001 | | 0.0029 |
| υ | 2.194 | 9.091 | 1.389 | | 105.00 | | | 3.333 | | 4.596 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0042 | 0.0037 | <0.0010 | 99.4759 |
| 2. | 0.0043 | 0.0039 | <0.0010 | 99.4581 |
| 3. | 0.0043 | 0.0038 | <0.0010 | 99.4625 |
| ∅ | **0.0043** | **0.0038** | **<0.0010** | **99.4655** |
| σ | 0.0001 | 0.0001 | | 0.0093 |
| υ | 2.326 | 2.632 | | 0.0093 |

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**Lampiran B.17** Data *Arc* OES Sampel B1

02/02/2024 09:33:34

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | B1 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4845 | 0.0035 | 0.0084 | 0.0031 | 0.0007 | 0.0011 | 0.0002 | 0.0033 | <0.0005 | 0.0242 |
| 2. | 0.4836 | 0.0035 | 0.0087 | 0.0031 | <0.0005 | 0.0011 | 0.0003 | 0.0046 | <0.0005 | 0.0233 |
| 3. | 0.4851 | 0.0036 | 0.0084 | 0.0031 | 0.0006 | 0.0011 | 0.0003 | 0.0040 | <0.0005 | 0.0253 |
| Ø | **0.4844** | **0.0035** | **0.0085** | **0.0031** | **0.0006** | **0.0011** | **0.0003** | **0.0040** | **<0.0005** | **0.0243** |
| σ | 0.0008 | 0.0001 | 0.0002 | | 0.0001 | | 0.0001 | 0.0007 | | 0.0010 |
| υ | 0.165 | 2.857 | 2.353 | | 16.67 | | 33.33 | 17.50 | | 4.115 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0045 | 0.0016 | <0.0010 | 99.4634 |
| 2. | 0.0045 | 0.0017 | <0.0010 | 99.4637 |
| 3. | 0.0045 | 0.0017 | <0.0010 | 99.4609 |
| Ø | **0.0045** | **0.0017** | **<0.0010** | **99.4627** |
| σ | | 0.0001 | | 0.0015 |
| υ | | 5.882 | | 0.0015 |

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**Lampiran B.18** Data *Arc* OES Sampel B2

02/02/2024 09:50:41

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | B2 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4619 | 0.0035 | 0.0079 | 0.0036 | 0.0006 | 0.0012 | 0.0002 | 0.0031 | <0.0005 | 0.0458 |
| 2. | 0.4606 | 0.0034 | 0.0080 | 0.0035 | 0.0008 | 0.0012 | 0.0002 | 0.0035 | <0.0005 | 0.0502 |
| 3. | 0.4565 | 0.0034 | 0.0077 | 0.0035 | 0.0011 | 0.0012 | 0.0002 | 0.0027 | <0.0005 | 0.0529 |
| ∅ | **0.4597** | **0.0034** | **0.0079** | **0.0035** | **0.0008** | **0.0012** | **0.0002** | **0.0031** | **<0.0005** | **0.0496** |
| σ | 0.0028 | 0.0001 | 0.0002 | 0.0001 | 0.0003 | | | 0.0004 | | 0.0036 |
| υ | 0.609 | 2.941 | 2.532 | 2.857 | 37.50 | | | 12.90 | | 7.258 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0045 | 0.0064 | <0.0010 | 99.4598 |
| 2. | 0.0045 | 0.0065 | <0.0010 | 99.4562 |
| 3. | 0.0044 | 0.0064 | <0.0010 | 99.4585 |
| ∅ | **0.0045** | **0.0064** | **<0.0010** | **99.4582** |
| σ | 0.0001 | 0.0001 | | 0.0018 |
| υ | 2.222 | 1.563 | | 0.0018 |

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**Lampiran B.19** Data *Arc* OES Sampel B3

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# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | B3 | | Operator | Tsabat | | Shift | 2 |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4604 | 0.0033 | 0.0076 | 0.0050 | <0.0005 | 0.0023 | 0.0002 | 0.0031 | <0.0005 | 0.0793 |
| 2. | 0.4588 | 0.0033 | 0.0078 | 0.0050 | <0.0005 | 0.0022 | 0.0002 | 0.0022 | <0.0005 | 0.0805 |
| 3. | 0.4371 | 0.0033 | 0.0079 | 0.0048 | <0.0005 | 0.0021 | 0.0002 | 0.0028 | <0.0005 | 0.0816 |
| Ø | **0.4521** | **0.0033** | **0.0078** | **0.0049** | **<0.0005** | **0.0022** | **0.0002** | **0.0027** | **<0.0005** | **0.0805** |
| σ | 0.0130 | | 0.0002 | 0.0001 | | 0.0001 | | 0.0005 | | 0.0012 |
| υ | 2.875 | | 2.564 | 2.041 | | 4.545 | | 18.52 | | 1.491 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0045 | 0.0236 | <0.0010 | 99.4087 |
| 2. | 0.0044 | 0.0238 | <0.0010 | 99.4097 |
| 3. | 0.0043 | 0.0228 | <0.0010 | 99.4312 |
| Ø | **0.0044** | **0.0234** | **<0.0010** | **99.4165** |
| σ | 0.0001 | 0.0005 | | 0.0127 |
| υ | 2.273 | 2.137 | | 0.013 |

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**Lampiran B.20** Data *Arc* OES Sampel C1

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# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | C1 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4642 | 0.0036 | 0.0075 | 0.0024 | 0.0006 | <0.0005 | 0.0002 | 0.0047 | <0.0005 | 0.0091 |
| 2. | 0.4566 | 0.0035 | 0.0079 | 0.0024 | <0.0005 | <0.0005 | 0.0002 | 0.0042 | <0.0005 | 0.0090 |
| 3. | 0.4776 | 0.0035 | 0.0069 | 0.0024 | 0.0006 | <0.0005 | 0.0002 | 0.0036 | <0.0005 | 0.0090 |
| ∅ | **0.4661** | **0.0035** | **0.0074** | **0.0024** | **0.0006** | **<0.0005** | **0.0002** | **0.0042** | **<0.0005** | **0.0090** |
| σ | 0.0106 | 0.0001 | 0.0005 | | 0.0001 | | | 0.0006 | | 0.0001 |
| υ | 2.274 | 2.857 | 6.757 | | 16.67 | | | 14.29 | | 1.111 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0046 | 0.0023 | <0.0010 | 99.4988 |
| 2. | 0.0044 | 0.0021 | <0.0010 | 99.5073 |
| 3. | 0.0047 | 0.0022 | <0.0010 | 99.4872 |
| ∅ | **0.0046** | **0.0022** | **<0.0010** | **99.4978** |
| σ | 0.0002 | 0.0001 | | 0.0101 |
| υ | 4.348 | 4.545 | | 0.010 |

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**Lampiran B.21** Data *Arc* OES Sampel C2

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# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | C2 | | Operator | Tsabat | Shift | 2 | |
| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4476 | 0.0035 | 0.0099 | 0.0033 | 0.0027 | 0.0007 | 0.0003 | 0.0049 | <0.0005 | 0.0447 |
| 2. | 0.4509 | 0.0037 | 0.0092 | 0.0034 | 0.0040 | 0.0007 | 0.0003 | 0.0051 | <0.0005 | 0.0504 |
| 3. | 0.4428 | 0.0041 | 0.0104 | 0.0034 | 0.0040 | 0.0008 | 0.0002 | 0.0062 | <0.0005 | 0.0423 |
| ∅ | **0.4471** | **0.0038** | **0.0098** | **0.0034** | **0.0036** | **0.0007** | **0.0003** | **0.0054** | **<0.0005** | **0.0458** |
| σ | 0.0041 | 0.0003 | 0.0006 | 0.0001 | 0.0008 | 0.0001 | 0.0001 | 0.0007 | | 0.0042 |
| υ | 0.917 | 7.895 | 6.122 | 2.941 | 22.22 | 14.29 | 33.33 | 12.96 | | 9.170 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0045 | 0.0036 | <0.0010 | 99.4728 |
| 2. | 0.0045 | 0.0036 | <0.0010 | 99.4628 |
| 3. | 0.0043 | 0.0035 | <0.0010 | 99.4765 |
| ∅ | **0.0044** | **0.0036** | **<0.0010** | **99.4707** |
| σ | 0.0001 | 0.0001 | | 0.0071 |
| υ | 2.273 | 2.778 | | 0.0071 |

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Bruker Elemental

Concentrations
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**Lampiran B.22** Data *Arc* OES Sampel C3

02/02/2024 10:12:16

# QMatrix Analysis Results

| Sample Identification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample No. | Dross Snpb 0.3 | | Lot No | C3 | | Operator | Tsabat | Shift | 2 | |

| | Pb | Bi | Sb | Cu | Zn | Ag | Al | As | Cd | Fe |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % | % |
| 1. | 0.4665 | 0.0036 | 0.0078 | 0.0033 | 0.0046 | 0.0014 | 0.0002 | 0.0037 | <0.0005 | 0.0596 |
| 2. | 0.4838 | 0.0034 | 0.0077 | 0.0034 | 0.0009 | 0.0014 | 0.0002 | 0.0030 | <0.0005 | 0.0527 |
| 3. | 0.4662 | 0.0037 | 0.0080 | 0.0033 | 0.0040 | 0.0014 | 0.0002 | 0.0040 | <0.0005 | 0.0604 |
| ∅ | **0.4722** | **0.0036** | **0.0078** | **0.0033** | **0.0032** | **0.0014** | **0.0002** | **0.0036** | **<0.0005** | **0.0576** |
| σ | 0.0101 | 0.0002 | 0.0002 | 0.0001 | 0.0020 | | | 0.0005 | | 0.0042 |
| υ | 2.139 | 5.556 | 2.564 | 3.030 | 62.50 | | | 13.89 | | 7.292 |

| | In | Ni | Ge | Sn |
|---|---|---|---|---|
| | % | % | % | % |
| 1. | 0.0043 | 0.0027 | <0.0010 | 99.4408 |
| 2. | 0.0045 | 0.0028 | <0.0010 | 99.4347 |
| 3. | 0.0045 | 0.0028 | <0.0010 | 99.4400 |
| ∅ | **0.0044** | **0.0028** | **<0.0010** | **99.4385** |
| σ | 0.0001 | 0.0001 | | 0.0033 |
| υ | 2.273 | 3.571 | | 0.0033 |

SN102
Bruker Elemental

Concentrations
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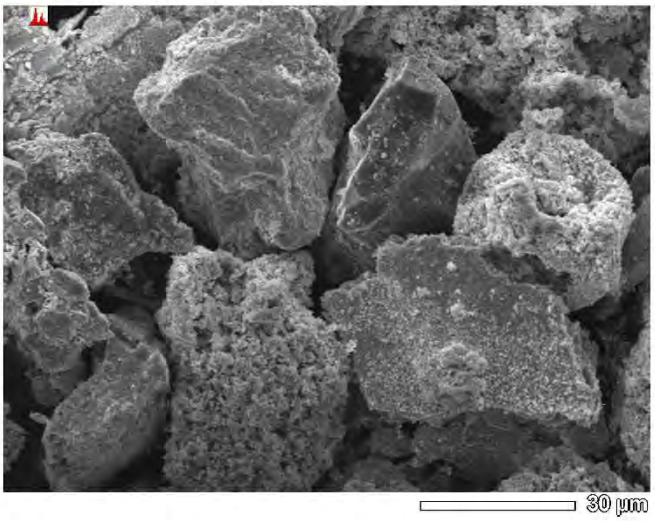
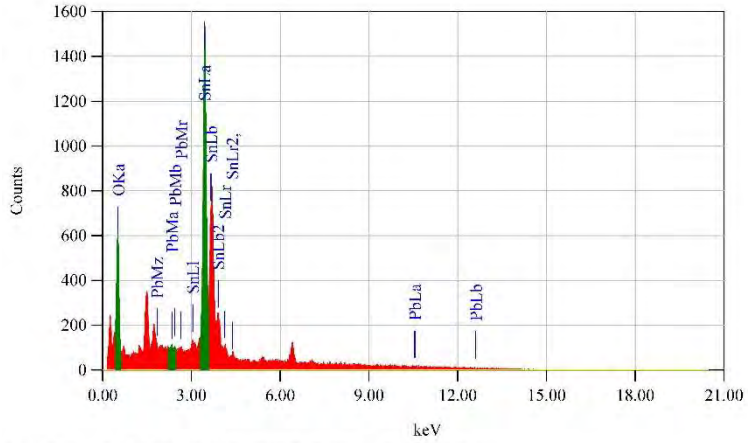
**Lampiran B.23** Data FESEM-EDX *Slag* Sampel Kontrol

KONTROL






```
Title        : IMC2
-------------------------
-
Instrument   :
Volt         : 15,00 kV
Mag.         : x 1,000
Date         : 2024/05/28
Pixel        : 640 x 480
```

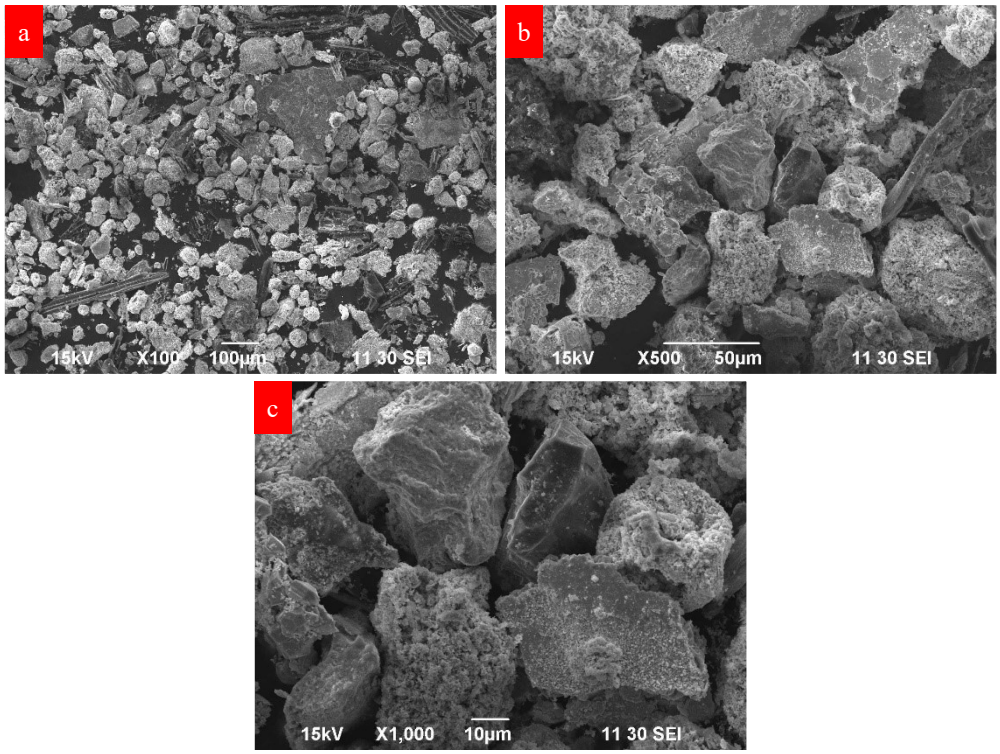



```
Acquisition Parameter
Instrument    : 6390(LA)
Acc. Voltage  : 15.0 kV
Probe Current: 1.00000 nA
PHA mode      : T3
Real Time     : 64.64 sec
Live Time     : 50.00 sec
Dead Time     : 22 %
Counting Rate: 1945 cps
Energy Range  :  0 - 20 keV
```

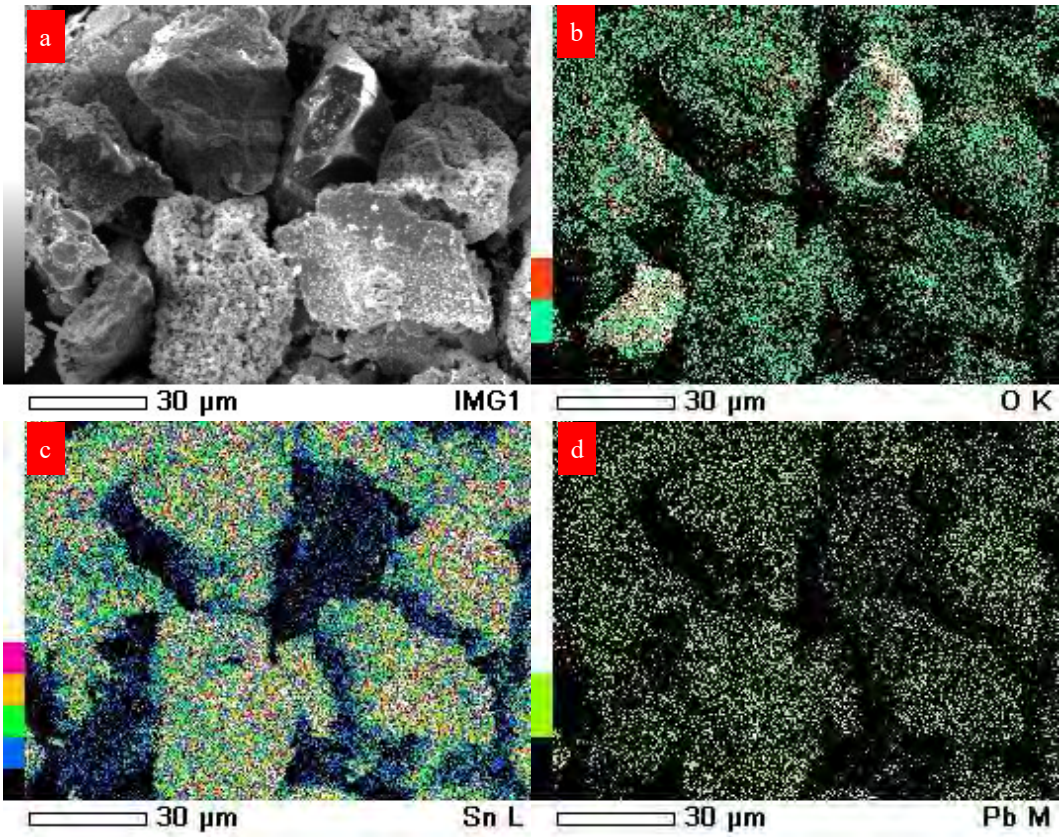
ZAF Method Standardless Quantitative Analysis
Fitting Coefficient : 0.3782

| Element | (keV) | Mass% | Error% | Atom% | Compound | Mass% | Cation | K |
|---|---|---|---|---|---|---|---|---|
| O K | 0.525 | 20.33 | 0.22 | 65.48 | | | | 12.3032 |
| Sn L | 3.442 | 79.27 | 0.42 | 34.42 | | | | 87.2866 |
| Pb M | 2.342 | 0.40 | 0.44 | 0.10 | | | | 0.4102 |
| Total | | 100.00 | | 100.00 | | | | |

JED-2300 AnalysisStation JEOL



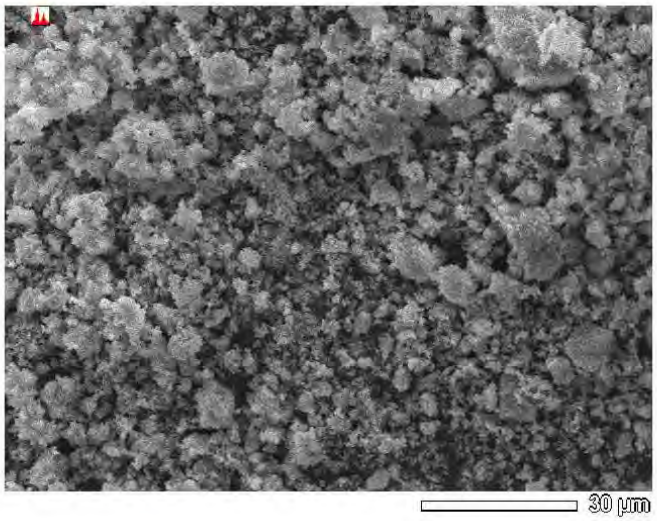

**Gambar B.1** *Image* FESEM Sampel Kontrol, (a) Pembesaran 100x, (b) 500x, (c) 1000x



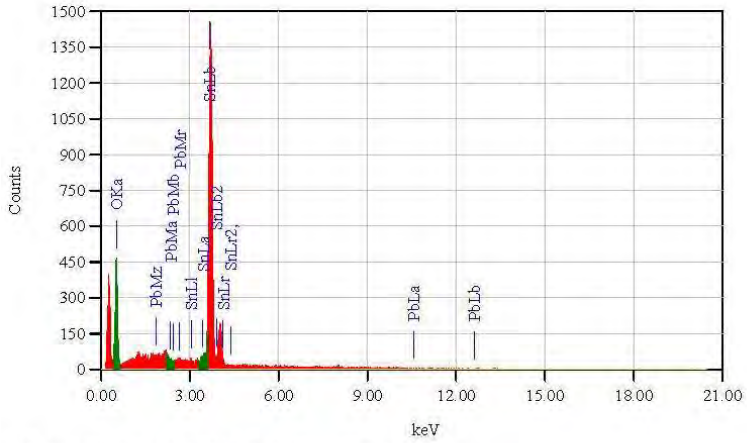

**Gambar B.2** *Mapping* EDX Sampel Kontrol (a) Pembesaran 1000x, (b) Unsur O, (c) Unsur Sn, (d) Unsur Pb

**Lampiran B.24** Data FESEM-EDX *Slag* Sampel A3

A3 1/1




Title : IMG2
---
Instrument :
Volt : 15,00 kV
Mag. : x 1,000
Date : 2024/05/28
Pixel : 640 x 480

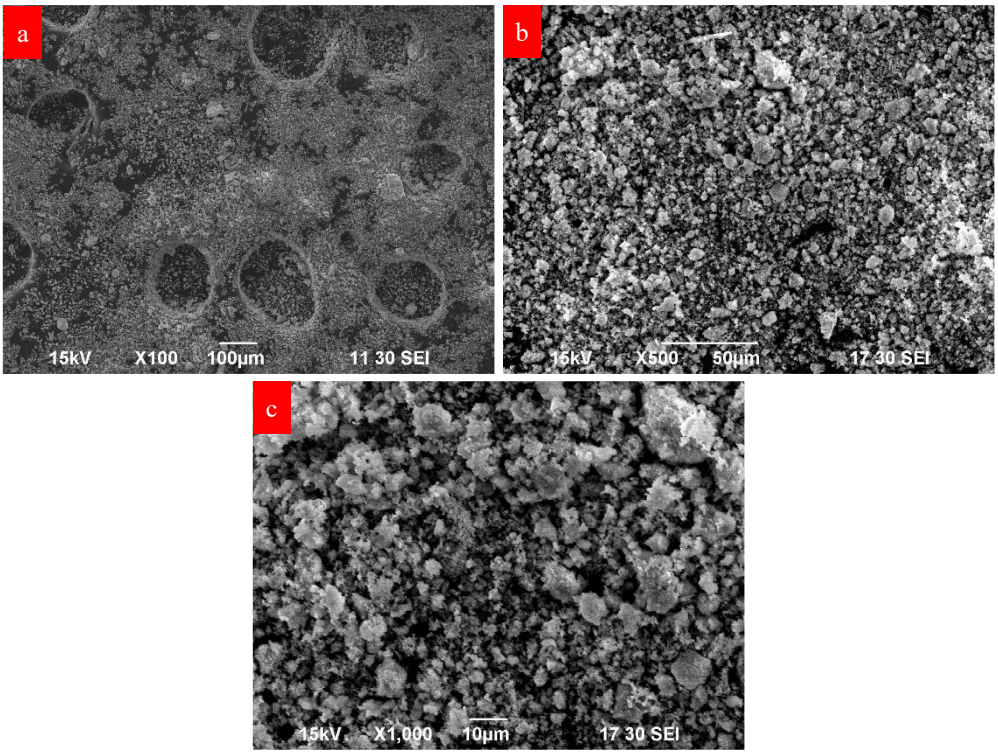



Acquisition Parameter
Instrument : 6390(LA)
Acc. Voltage : 15.0 kV
Probe Current: 1.00000 nA
PHA mode : T3
Real Time : 63.60 sec
Live Time : 50.00 sec
Dead Time : 21 %
Counting Rate: 1023 cps
Energy Range : 0 - 20 keV

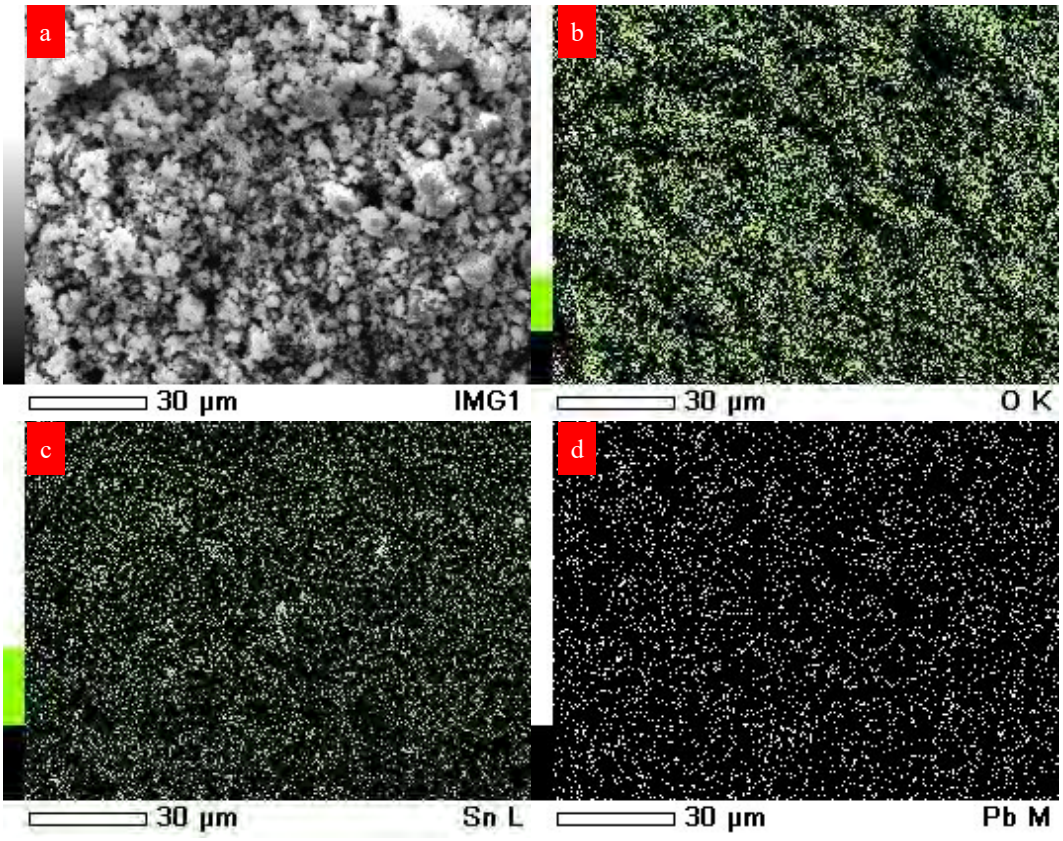
ZAF Method Standardless Quantitative Analysis
Fitting Coefficient : 0.9495

| Element | (keV) | Mass% | Error% | Atom% | Compound | Mass% | Cation | K |
|---|---|---|---|---|---|---|---|---|
| O K | 0.525 | 36.39 | 1.58 | 80.95 | | | | 26.4256 |
| Sn L | 3.442 | 63.44 | 3.40 | 19.02 | | | | 73.3862 |
| Pb M | 2.342 | 0.17 | 3.50 | 0.03 | | | | 0.1882 |
| Total | | 100.00 | | 100.00 | | | | |

JED-2300 AnalysisStation JEOL



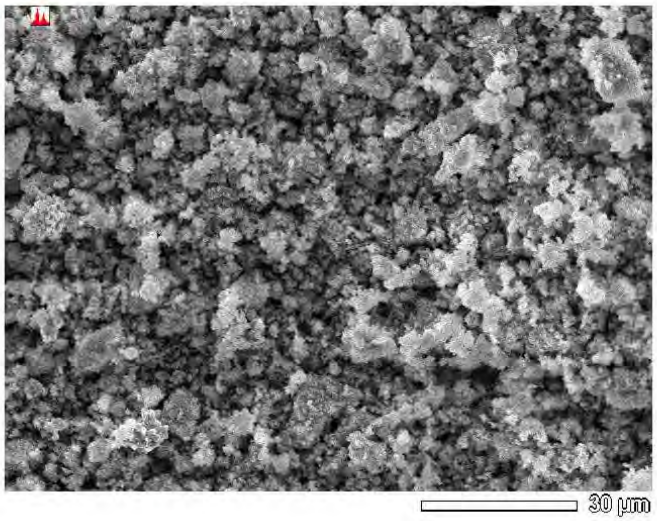

**Gambar B.3** *Image* FESEM Sampel A3, (a) Pembesaran 100x, (b) 500x, (c) 1000x



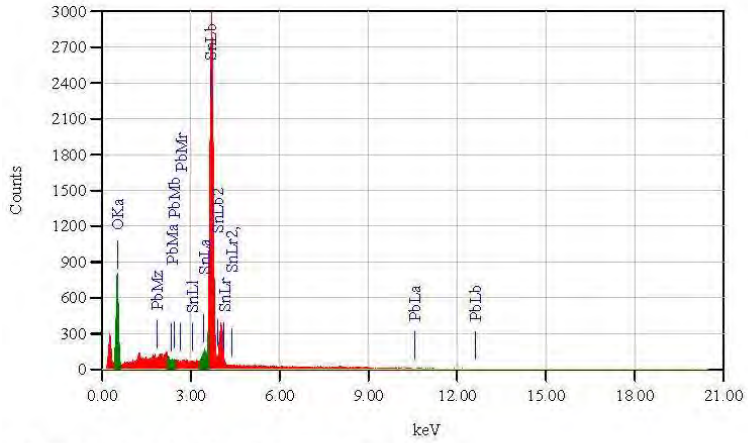

**Gambar B.4** *Mapping* EDX Sampel A3 (a) Pembesaran 1000x, (b) Unsur O, (c) Unsur Sn, (d) Unsur Pb

**Lampiran B.25** Data FESEM-EDX *Slag* Sampel B3

B3 1/1




Title : IMG2
---
-
Instrument :
Volt : 15,00 kV
Mag. : x 1,000
Date : 2024/05/28
Pixel : 640 x 480

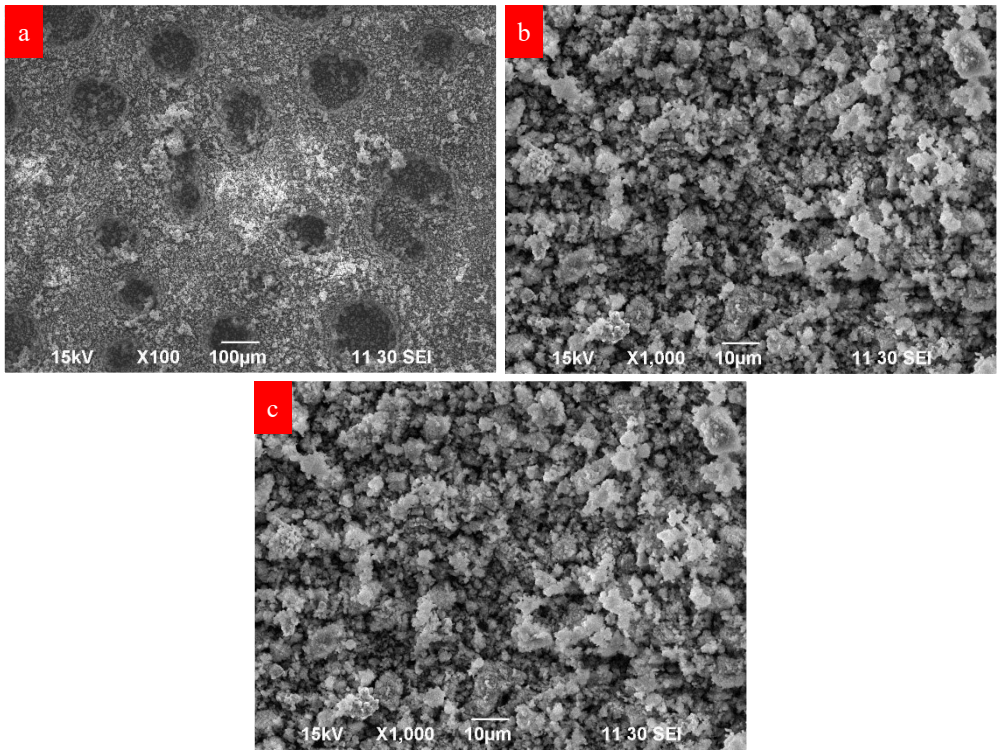



Acquisition Parameter
Instrument : 6390(LA)
Acc. Voltage : 15.0 kV
Probe Current: 1.00000 nA
PHA mode : T3
Real Time : 64.73 sec
Live Time : 50.00 sec
Dead Time : 22 %
Counting Rate: 1872 cps
Energy Range : 0 - 20 keV

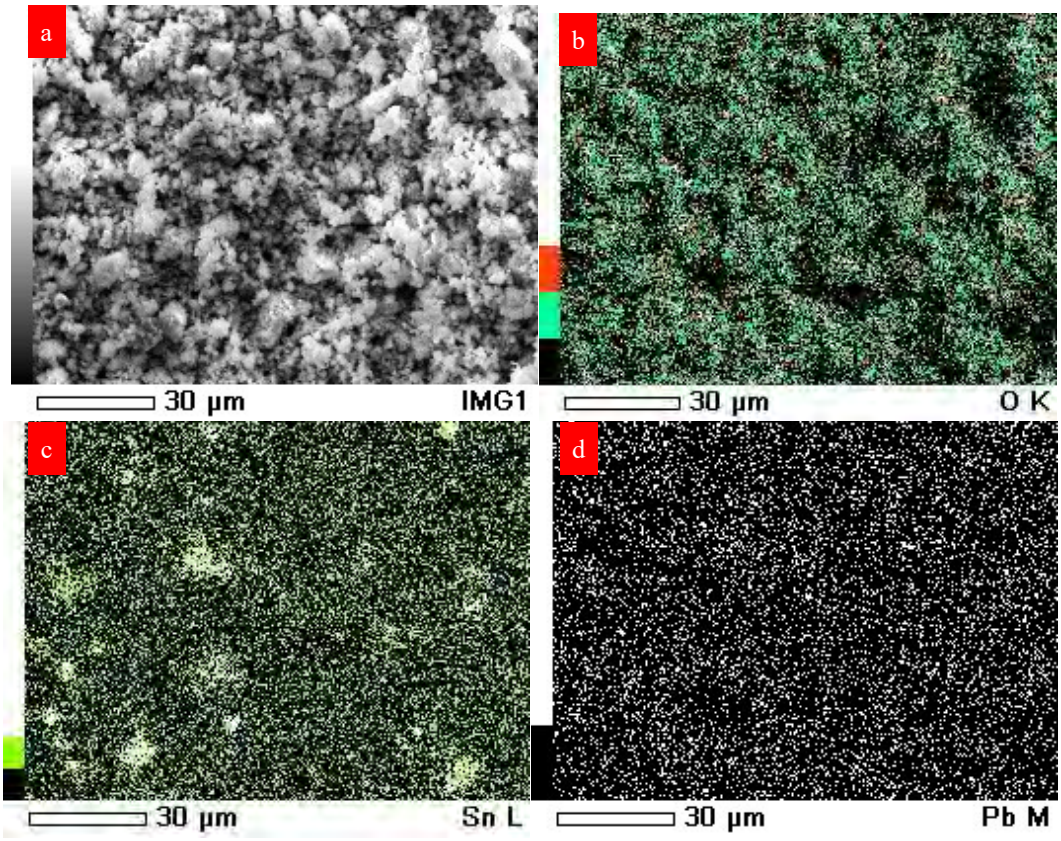
ZAF Method Standardless Quantitative Analysis
Fitting Coefficient : 0.9570

| Element | (keV) | Mass% | Error% | Atom% | Compound | Mass% | Cation | K |
|---|---|---|---|---|---|---|---|---|
| O K | 0.525 | 31.62 | 1.67 | 77.43 | | | | 21.6460 |
| Sn L | 3.442 | 68.36 | 3.42 | 22.56 | | | | 78.3320 |
| Pb M | 2.342 | 0.02 | 3.54 | 0.00 | | | | 0.0219 |
| Total | | 100.00 | | 100.00 | | | | |

JED-2300 AnalysisStation JEOL




**Gambar B.5** *Image* FESEM Sampel B3, (a) Pembesaran 100x, (b) 500x, (c) 1000x

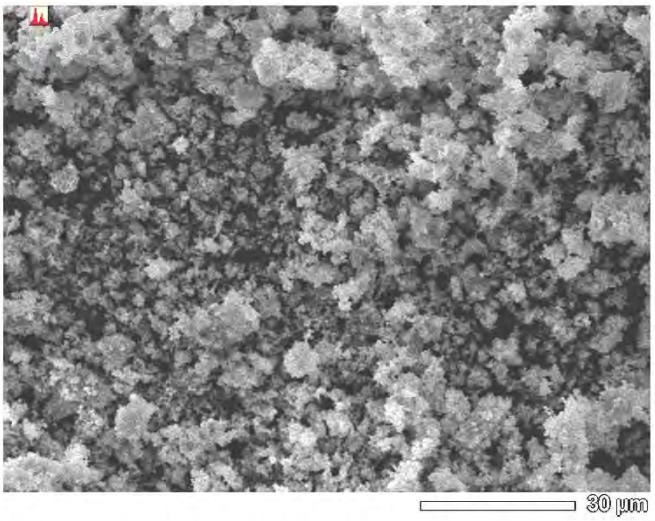



**Gambar B.6** *Mapping* EDX Sampel B3 (a) Pembesaran 1000x, (b) Unsur O, (c) Unsur Sn, (d) Unsur Pb

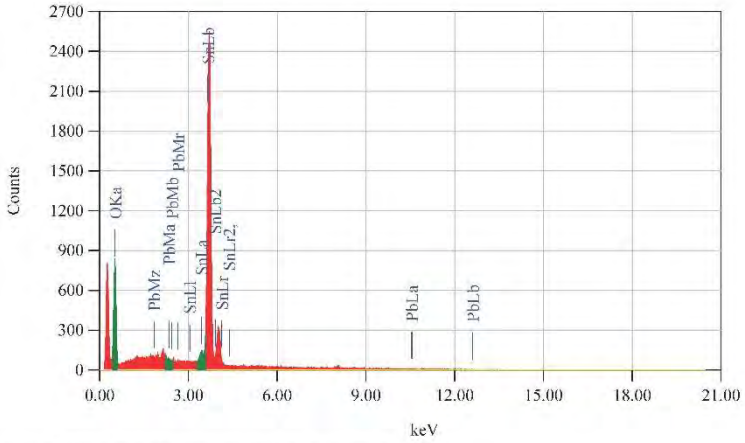
**Lampiran B.26** Data FESEM-EDX *Slag* Sampel C3

C3

1/1




Title : IMC2
---
Instrument :
Volt : 15,00 kV
Mag. : x 1,000
Date : 2024/05/28
Pixel : 640 x 480

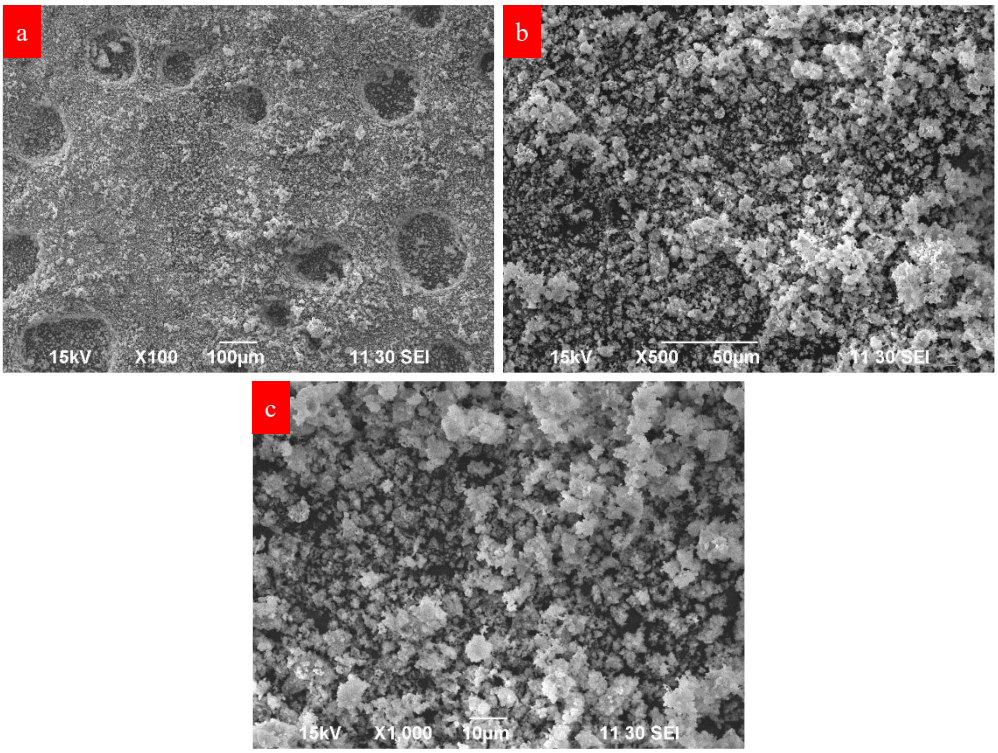



Acquisition Parameter
Instrument : 6390(LA)
Acc. Voltage : 15.0 kV
Probe Current: 1.00000 nA
PHA mode : T3
Real Time : 63.89 sec
Live Time : 50.00 sec
Dead Time : 21 %
Counting Rate: 1834 cps
Energy Range : 0 - 20 keV

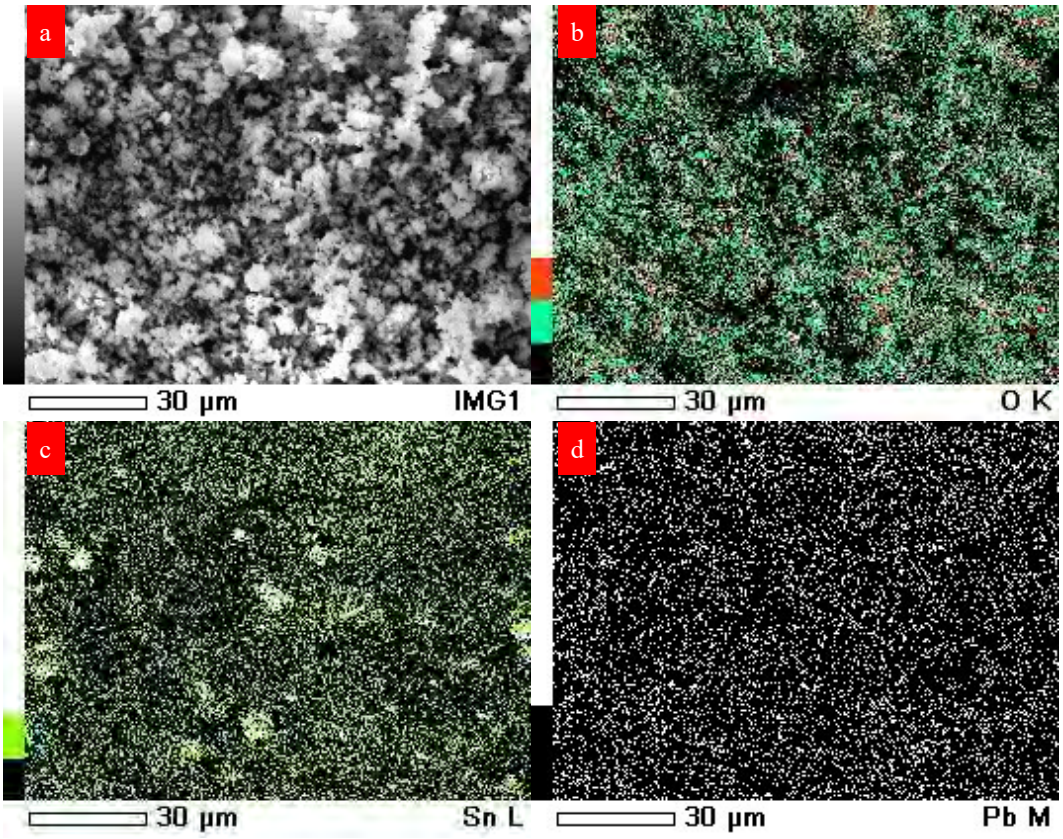
ZAF Method Standardless Quantitative Analysis
Fitting Coefficient : 0.9495

| Element | (keV) | Mass% | Error% | Atom% | Compound | Mass% | Cation | K |
|---|---|---|---|---|---|---|---|---|
| O K | 0.525 | 35.15 | 1.59 | 80.08 | | | | 25.0945 |
| Sn L | 3.442 | 64.84 | 3.38 | 19.91 | | | | 74.8893 |
| Pb M | 2.342 | 0.01 | 3.49 | 0.00 | | | | 0.0162 |
| Total | | 100.00 | | 100.00 | | | | |

JED-2300 AnalysisStation JEOL




**Gambar B.7** *Image* FESEM Sampel C3, (a) Pembesaran 100x, (b) 500x, (c) 1000x




**Gambar B.8** *Mapping* EDX Sampel C3 (a) Pembesaran 1000x, (b) Unsur O, (c) Unsur Sn, (d) Unsur Pb

# LAMPIRAN C
# GAMBAR ALAT DAN BAHAN

**Lampiran C.1** Gambar Alat

**Gambar C.1** *Propane Foundry*

**Gambar C.2** *Crucible* Keramik

**Gambar C.3** Ayakan diameter 4mm

**Gambar C.4** Cetakan Sampel

**Gambar C.5** Neraca Digital

**Gambar C.6** *Stopwatch*

**Gambar C.7** *Thermocouple*

**Gambar C.8** Alat Pengujian XRF (Bruker S2 Puma)

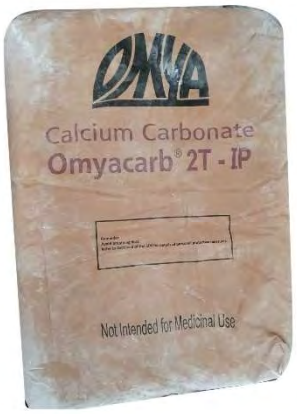

**Gambar C.9** Alat Pengujian *Arc OES (Bruker Q8 Magellan)*

**Gambar C.10** Alat Pengujian FESEM (Jeol JSM IT-200)

**Lampiran C.2** Gambar Bahan

**Gambar C.11** *Dross* $SnPb_{0,3}$

**Gambar C.12** Arang Kayu




**Gambar C.13** $CaCO_3$ Teknis


**Gambar C.14** Bahan Bakar LPG