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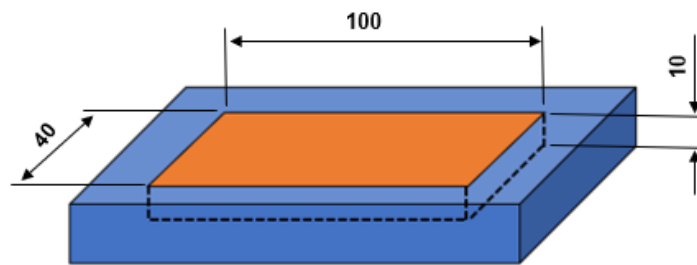
MAGNESIUM (Mg) WITH ALUMINA (AL<sub>2</sub>O<sub>3</sub>) REINFORCER IN ALUMINUM MATERIAL COMPOSITES ON THE MECHANICAL PROPERTIES AND MICRO STRUCTURES.” *Journal of Sustainable Technology and Applied Science (JSTAS)* 2(2): 7–13.

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## LAMPIRAN

### Lampiran 1 Perhitungan Beban Kompaksi

- a. Perhitungan beban kompaksi untuk sampel S1, S2, S3, S4 dan S5



Diketahui :

Panjang lubang cetakan ( $p$ ) = 100 mm

Lebar lubang cetakan ( $l$ ) = 40 mm

Maka  $A = p \times l = 100 \times 40 = 4000 \text{ mm}^2$

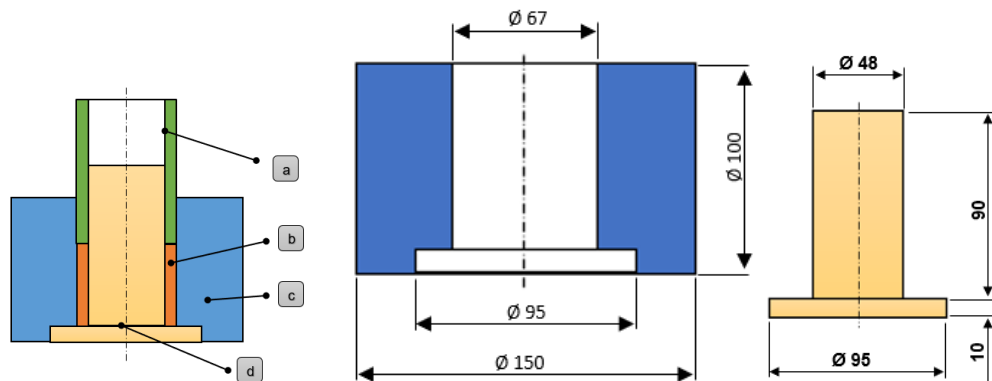
Tekanan kompaksi ( $P$ ) = 10 MPa = 10 N/mm<sup>2</sup>

Ditanyakan: Besar beban kompaksi (dalam Ton)

Penyelesaian sebagai berikut ;

$$\begin{aligned}
 F &= P \cdot A \\
 &= 10 \text{ N/mm}^2 \cdot 4000 \text{ mm}^2 \\
 &= 40.000 \text{ N} \\
 &= 4.000 \text{ Kg} \\
 &= 4 \text{ Ton}
 \end{aligned}$$

b. Perhitungan beban kompaksi untuk Bushing



Diketahui :

Diameter luar lubang cetakan ( $D$ ) = 67mm  $r = 33,5$ mm

Maka  $A_1 = \pi r^2 = 3,14 \times 33,5^2 = 3523,865 \text{ mm}^2$

Diameter dalam lubang cetakan ( $d$ ) = 48 mm  $r = 24$ mm

Maka  $A_2 = \pi r^2 = 3,14 \times 24^2 = 1808,64 \text{ mm}^2$

Jadi  $A = A_1 - A_2 = 3523,865 - 1808,64 = 1715,2 \text{ mm}^2$

Tekanan kompaksi 1 ( $P_1$ ) = 10 MPa = 10 N/mm<sup>2</sup>

Tekanan kompaksi 2 ( $P_2$ ) = 20 MPa = 20 N/mm<sup>2</sup>

Tekanan Kompaksi 3 ( $P_3$ ) = 30 MPa = 30 N/mm<sup>2</sup>

Ditanyakan: Besar beban kompaksi (dalam Ton) untuk  $P_1$ ,  $P_2$  dan  $P_3$

Penyelesaian sebagai berikut ;

$$P_1 \rightarrow F = P_1 \times A = 10 \text{ N/mm}^2 \times 1715,2 \text{ mm}^2$$

$$= 17152 \text{ N}$$

$$= 1715,2 \text{ Kg} = 1,7152 \text{ Ton}$$

$$P_2 \rightarrow F = P_2 \times A = 20 \text{ N/mm}^2 \times 1715,2 \text{ mm}^2$$

$$= 34304 \text{ N}$$

$$= 3430,4 \text{ Kg} = 3,4304 \text{ Ton}$$

$$P_3 \rightarrow F = P_3 \times A = 30 \text{ N/mm}^2 \times 1715,2 \text{ mm}^2$$

$$= 51456 \text{ N}$$

$$= 5145,6 \text{ Kg} = 5,1456 \text{ Ton}$$

### Lampiran 2 Perhitungan Komposisi Campuran

Fraksi komposisi campuran dalam fraksi berat

No	Kode	komposisi	Fraksi Berat (gram)			
			Total AMC %	AL %	Mg %	CNT %
1	S1	Pure AL	100%	100	0	0
2	S2	Al+0Mg+1CNT	100%	99	0	1
3	S3	Al+2Mg+1CNT	100%	97	2	1
4	S4	Al+4Mg+1CNT	100%	95	4	1
5	S5	Al+6Mg+1CNT	100%	93	6	1
6	Bushing	Al+6Mg+1CNT	100%	93	6	1

Fraksi komposisi campuran sampel dalam fraksi berat

No	Kode	komposisi	Fraksi Berat (gram)			
			Berat campuran AMC	AL	Mg	CNT %
1	S1	Pure AL	152,80	152,80	0,00	0,00
2	S2	Al+0Mg+1CNT	180,50	178,70	0,00	1,81
3	S3	Al+2Mg+1CNT	185,80	180,23	3,72	1,86
4	S4	Al+4Mg+1CNT	192,60	182,97	7,70	1,93
5	S5	Al+6Mg+1CNT	198,40	184,51	11,90	1,98

Fraksi komposisi campuran Bushing dalam fraksi berat

No	Kode	komposisi	Fraksi Berat (gram)			
			Berat campuran AMC	AL	Mg	CNT %
1	Bushing 10 MPa	Al+6Mg+1CNT	300,70	279,65	18,04	3,01
2	Bushing 20 MPa	Al+6Mg+1CNT	321,30	298,81	19,28	3,21
3	Bushing 30 MPa	Al+6Mg+1CNT	362,09	336,74	21,73	3,62



**Lampiran 3** Resume Tabulasi Data Densitas Sampel S1, S2, S3, S4 dan S5

Hasil pengujian Densitas							
No	Kode Sampel	Komposisi AMC	massa sampel diudara (wu)	Volume Sampel			Densitas sampel (g/cm <sup>3</sup> )
			massa	Volume Air	Volume air + benda	Volume Benda	
1	S1	Al+Mg0% +CNT0%+10MPa	6,743	20	22,5	2,5	2,70
2	S2	Al+Mg0% +CNT1%+10MPa	6,802	20	22,5	2,5	2,72
3	S3	Al+Mg2% +CNT1%+10MPa	6,879	20	22,5	2,5	2,75
4	S4	Al+Mg4% +CNT1%+10MPa	6,948	20	22,5	2,5	2,78
5	S5	Al+Mg6% +CNT1%+10MPa	6,999	20	22,5	2,5	2,80

**Lampiran 4** Resume Tabulasi Data Porositas Sampel S1, S2, S3, S4 dan S5

Hasil pengujian porositas					
No	Kode Sampel	Komposisi AMC	Berat kering (gram)	Berat basa (gram)	Porositas $\epsilon$ (%)
1	S1	Al-0%Mg-0%CNT-0MPa	6,944	6,949	0,072
2	S2	Al-Mg0% -CNT1%-10Mpa	7,020	7,024	0,057
3	S3	Al-Mg2% -CNT1%-10Mpa	6,879	6,882	0,044
4	S4	Al-Mg4% -CNT1%-10Mpa	6,681	6,683	0,030
5	S5	Al-Mg6% -CNT1%-10Mpa	7,246	7,248	0,028

**Lampiran 5** Resume Tabulasi Data Kekerasan Sampel S1, S2, S3, S4 dan S5

Hasil pengujian Kekerasan Sampel variasi Mg						
Kode sampel	Titik	Al 6063	Al+Mg0%+ CNT1%	Al+Mg2%+ CNT1%	Al+Mg4%+ CNT1%	Al+Mg6%+ CNT1%
S1	A	24,9	36,1	36,0	50,7	46,9
S2	B	28,3	36,9	34,4	43,7	45,9
S3	C	27,2	34,9	33,6	32,9	53,1
S4	D	29,8	30,7	34,1	33,3	49,1
S5	E	29,4	28,2	35,8	40,4	49,0
Nilai Rata-rata (HV)		27,9	33,4	34,8	40,2	48,8

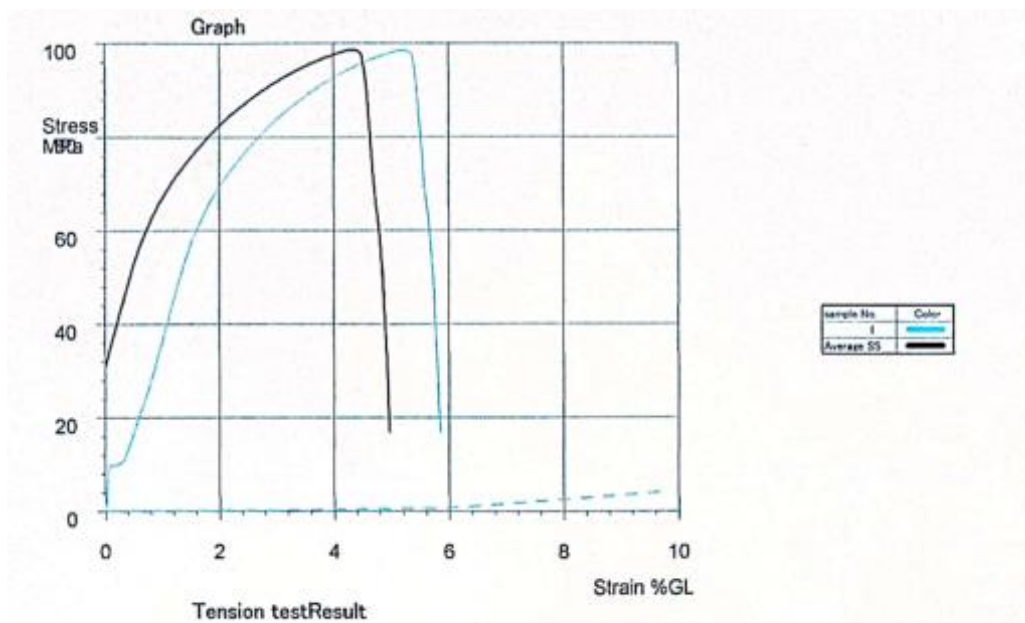
**Lampiran 6** Resume Data Kekerasan Bushing

Hasil pengujian Kekerasan Bushing			
	Tekanan 10 MPA	Tekanan 20 MPA	Tekanan 30 MPA
Titik	Nilai (HL)	Nilai (HL)	Nilai (HL)
1	243	241	262
2	240	221	218
3	228	252	264
4	218	257	252
5	222	245	269
6	205	245	268
7	233	244	256
8	216	246	257
9	253	218	258
10	220	248	248
11	171	256	255
12	242	237	256
Kekerasan rata-rata (HL)	224	243	255

### Lampiran 7 Resume Data Pengujian Tarik Sampel S1, S2, S3, S4 dan S5

Hasil pengujian Tarik					
Simbol	Komposisi AMC	Maximum point Load (MPa)			
		1	2	3	Rata-rata
S1	Al 6063	98,52	116,59	99,874	105,00
S2	Al+CNT 1%+ Mg 0%	107,78	108,73	125,26	113,92
S3	Al+CNT 1%+ Mg 2%	154,97	157,06	169,79	160,61
S4	Al+CNT 1%+ Mg 4%	235,47	234,230	213,23	227,64
S5	Al+CNT 1%+ Mg 6%	268,12	223,910	231,08	241,04

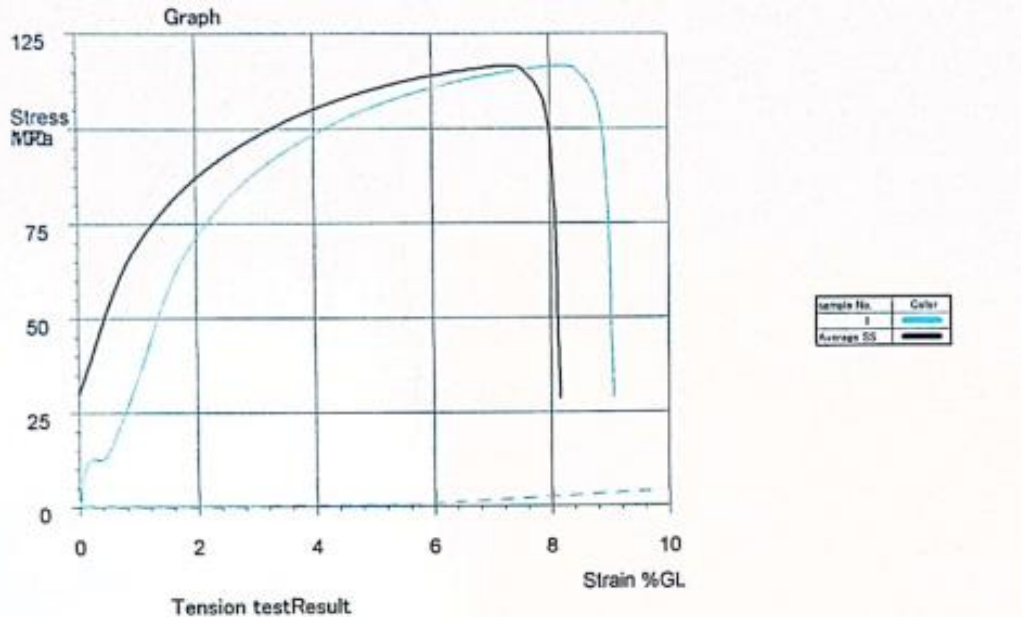
#### a. Hasil uji tari untuk S1 (Raw Material / AL 6063)



Machine name	RTF	Test type	Tension
Strain input 1	Not used	Test speed	5.0 mm/min
Chart speed	OFF	Machine rigidity	0 mm/kN
Point data(Stress)	572.23    0    572.23	Point data(Strain)	0    0    0
MPa	0    0    0	%GL	0    0    0
Elastic modulus anal.	Interval    1E-006    0.0001	Initial sample length	Distance    75 mm
Stress	Pitch    5E-006 MPa	Origin of elongation	Init. load    0.3 %RO
Elong adjust	No	Break point measurement	0.5 N
Save SS curve	Yes		

Test date	2023/09/01	Temperature	25 C
Humidity	60 %RH	Sample name	Aluminium 606
Lot No.		Preparation	
Operator	Epafroditus Pakiding, ST	User	Suhardi
Comment 1	Raw Material 10 Mpa	Comment 2	Sample 1

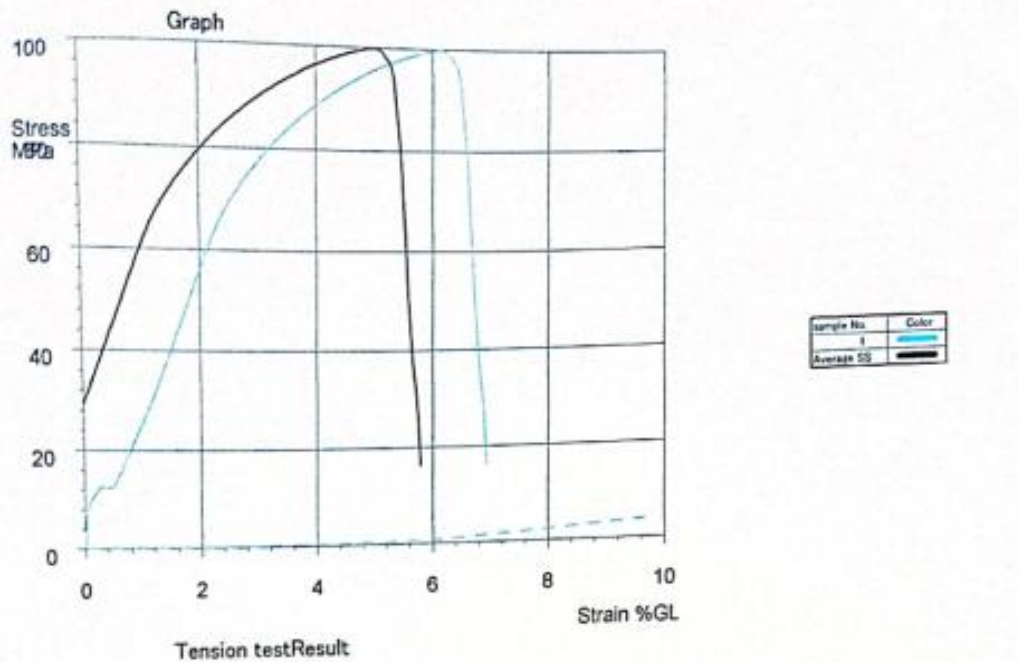
TestID=1644	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation
Test No	mm	mm	mm <sup>2</sup>	MPa	mm
1	6.0700	4.0400	24.523	98.522	3.2878



Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	5.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Stress) MPa	572.23	0	572.23	Point data(Strain) %GL	0	0	0
	0	0	0		0	0	0
Elastic modulus anal. Stress	Interval	1E-006 0.0001		Initial sample length	Distance	75 mm	
	Pitch	5E-006 MPa		Origin of elongation	Init. load	0.3 %RO	
Elong adjust	No			Break point measurement	0.5 N		
Save SS curve	Yes						

Test date	2023/09/01		Temperature	25 C	
Humidity	60 %RH		Sample name	Almunium 606	
Lot No.			Preparation		
Operator	Epafrditus Pakiding, ST		User	Suhardi	
Comment 1	Row Material 10 Mpa		Comment 2	Sample 2	

TestID=1645	Width	Thickness	Sectional ar	Maximum poin Stress MPa	Break point Elongation mm
Test No	mm	mm	mm2		
1	6.0400	4.3000	25.972	116.59	-0.4781

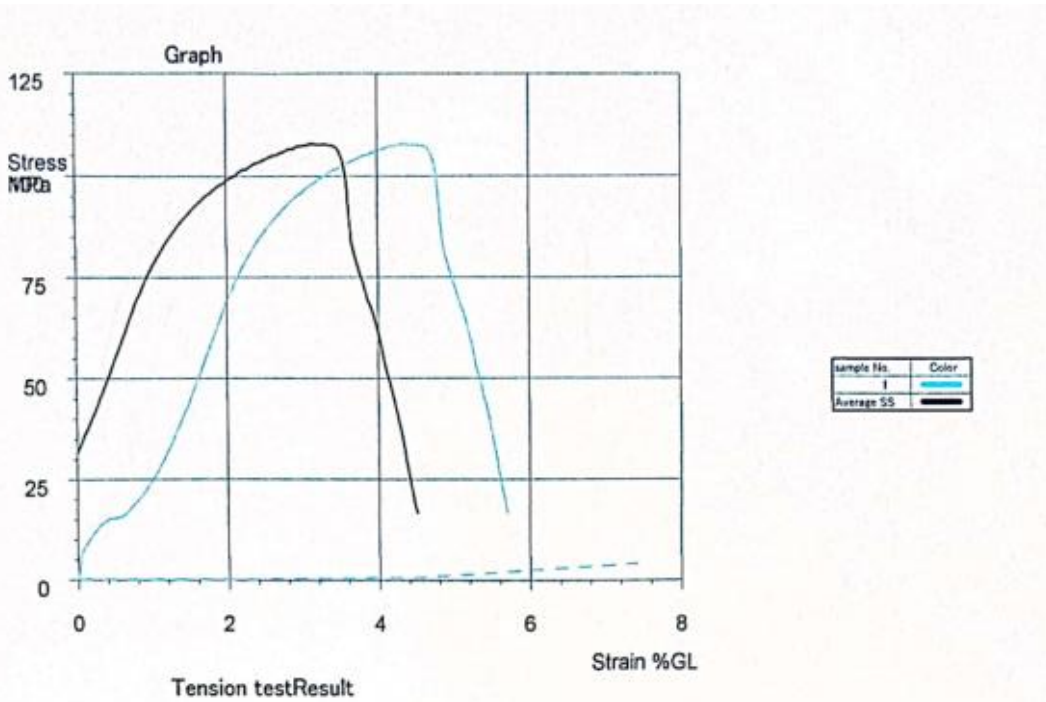


Machine name	RTF		Test type	Tension	
Strain input 1	Not used		Test speed	5.0 mm/min	
Chart speed	OFF		Machine rigidity	0 mm/kN	
Point data(Stress)	572.23	0	Point data(Strain)	0	0
	MPa	0		%GL	0
Elastic modulus anal.	Interval	1E-006	0.0001	Initial sample length	Distance
	Stress	Pitch	5E-006 MPa	Origin of elongation	Init. load
Elong adjust	No		Break point measurem	0.5 N	
Save SS curve	Yes				

Test date	2023/09/01	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 606
Lot No.		Preparation	
Operator	Epafroditus Pakiding, ST	User	Suhardi
Comment 1	Row Material 10 Mpa	Comment 2	Sample 3

TestID=1646	Width	Thickness	Sectional ar	Maximum poin	Break point
Test No	mm	mm	mm2	Stress	Elongation
				MPa	mm
1	6.0400	4.3000	25.972	99.874	-0.6177

b. Hasil uji tari untuk Material S2 ( Al+Mg 0%+CNT 1%)



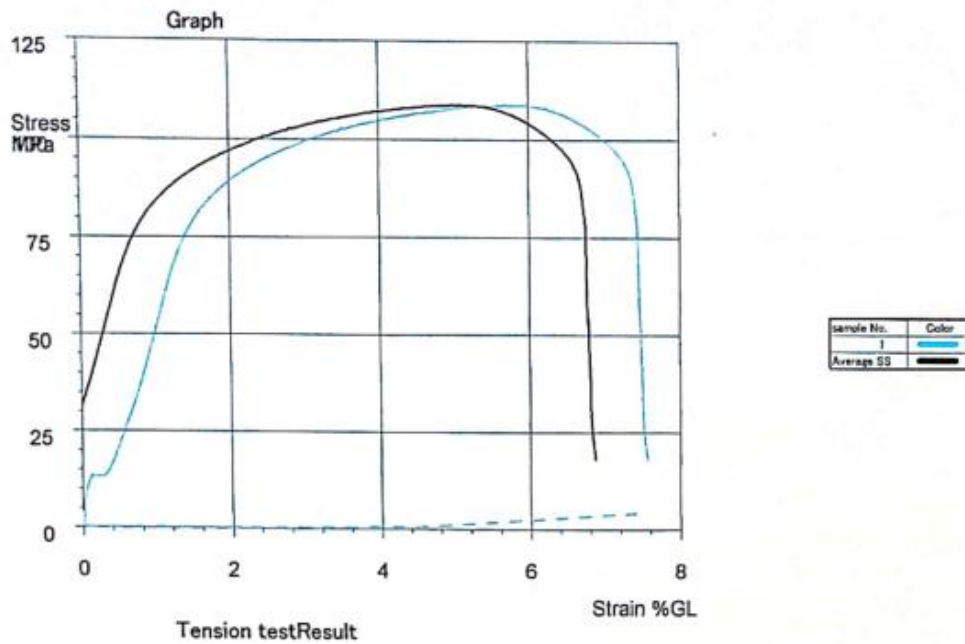
Machine name	RTF		Test type	Tension	
Strain input 1	Not used		Test speed	2.0 mm/min	
Chart speed	OFF		Machine rigidity	0 mm/kN	
Point data(Load)	0	0	Point data(Elong)	0	0
	N	0	mm	0	0
Elastic modulus anal.	Interval	1	100	Initial sample length	Distance
Load	Pitch	5 N		Origin of elongation	Init. load
Elong adjust	No		Break point measurem	0.0005 kN	
Save SS curve	Yes				

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding ST	User	Suhardi
Comment 1	CNT 1% Mg 0% Tekanan 10MPa	Comment 2	Sample 1

TestID=1612	Width	Thickness	Sectional ar	Maximum poin	Break point	Upper yield	Lower yield	Elastic modu	Young
Test No	mm	mm	mm2	Stress	Elongation	Load	Load	N/mm2	N/mm2
1	6.0000	4.0000	24.000	107.78	2.5893	2.5868	*****	13774.	13774.

TestID=1612	Upper yield	Lower yield	ElasticSlope	ElasticSlic
Test No	Stress	Stress	N/mm	N
	N/mm2	N/mm2		
1	107.78	*****	3373.3	5.9308



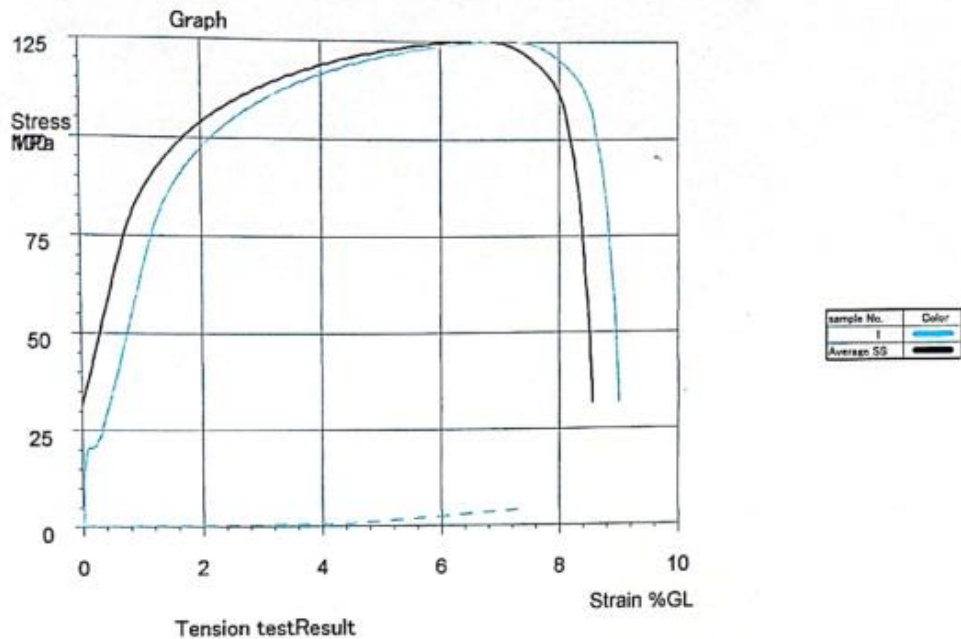


Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	2.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Load)	0	0	0	Point data(Elong)	0	0	0
	N	0	0	mm	0	0	0
Elastic modulus anal.	Interval	1	100	Initial sample length	Distance 98 mm		
Load	Pitch	5 N		Origin of elongation	Init. load	0.3 %RO	
Elong adjust	No			Break point measurem	0.0005 kN		
Save SS curve	Yes						

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding.ST	User	Suhardi
Comment 1	CNT 1% Mg 0% Tekanan 10 MPa	Comment 2	Sample 2

TestID=1613	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation	Upper yield Load	Lower yield Load	Elastic modu	Young
Test No	mm	mm	mm2	MPa	mm	kN	N	N/mm2	N/mm2
1	6.0000	4.0000	24.000	108.73	-0.5377	2.5697	2567.8	28265.	28265.

TestID=1613	Upper yield Stress	Lower yield Stress	ElasticSlope	ElasticSloe
Test No	N/mm2	N/mm2	N/mm	N
1	107.07	106.99	6922.0	1.3113



Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	2.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Load)	0	0	0	Point data(Elong)	0	0	0
	N	0	0		mm	0	0
Elastic modulus anal. Load	Interval	1	100	Initial sample length	Distance 98 mm		
	Pitch	5 N		Origin of elongation	Init. load 0.3 %RO		
Elong adjust	No			Break point measurem	0.0005 kN		
Save SS curve	Yes						

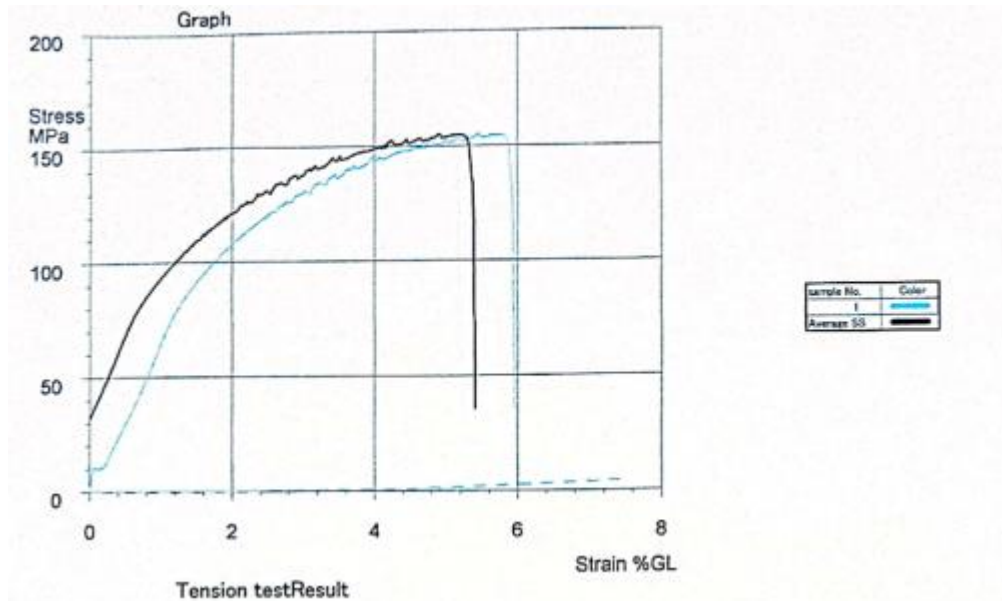
Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding.ST	User	Suhardi
Comment 1	CNT 1% Mg 0% Tekanan 10 MPa	Comment 2	Sample 3

TestID=1614	Width	Thickness	Sectional ar	Maximum poin	Break point	Upper yield	Lower yield	Elastic modu	Young
Test No	mm	mm	mm2	Stress	Elongation	Load	Load	N/mm2	N/mm2
1	6.0000	4.0000	24.000	125.26	2.9477	3.0043	2996.9	25390.	25390.

TestID=1614	Upper yield	Lower yield	ElasticSlope	ElasticSlic
Test No	Stress	Stress	N/mm	N
	N/mm2	N/mm2		
1	125.18	124.87	6217.9	1.8627



c. Hasil uji tari untuk Material S3 ( Al+Mg 2%+CNT 1%)

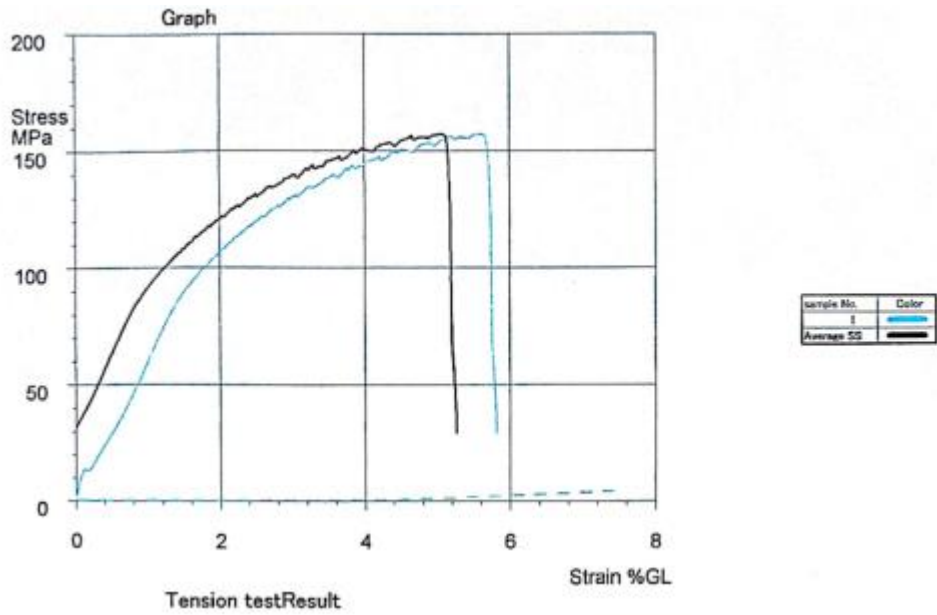


Machine name	RTF		Test type	Tension	
Strain input 1	Not used		Test speed	2.0 mm/min	
Chart speed	OFF		Machine rigidity	0 mm/kN	
Point data(Load)	0	0	Point data(Elong)	0	0
	0	0		0	0
Elastic modulus anal.	Interval	1	100	Initial sample length	Distance 98 mm
Load	Pitch	5 N		Origin of elongation	Init. load 0.3 %RO
Elong adjust	No		Break point measurem	0.0005 kN	
Save SS curve	Yes				

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding,ST	User	Suhardi
Comment 1	CNT 1% Mg 2% Tekanan 10 MPa	Comment 2	Sample 1

TestID=1615	Width	Thickness	Sectional ar	Maximum poin	Break point	Upper yield	Lower yield	Elastic modu	Young
Test No	mm	mm	mm <sup>2</sup>	Stress	Elongation	Load	Load	N/mm <sup>2</sup>	N/mm <sup>2</sup>
1	6.0000	4.0000	24.000	154.97	-0.458	3.3022	3258.0	18255.	18255.

TestID=1615	Upper yield	Lower yield	ElasticSlope	ElasticSloe
Test No	Stress	Stress	N/mm	N
	N/mm <sup>2</sup>	N/mm <sup>2</sup>		
1	137.59	135.75	4470.7	3.4348

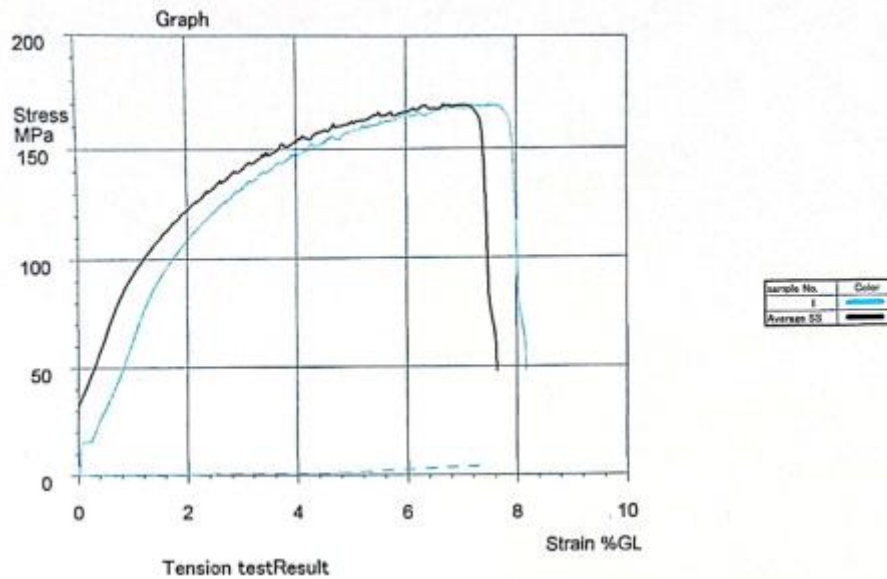


Machine name	RTF	Test type	Tension
Strain input 1	Not used	Test speed	2.0 mm/min
Chart speed	OFF	Machine rigidity	0 mm/kN
Point data(Load)	0 0 0	Point data(Elong)	0 0 0
N	0 0 0	mm	0 0 0
Elastic modulus anal.	Interval 1 100	Initial sample length	Distance 98 mm
Load	Pitch 5 N	Origin of elongation	Init. load 0.3 %RO
Elong adjust	No	Break point measurem	0.0005 kN
Save SS curve	Yes		

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding.ST	User	Suhardi
Comment 1	CNT 1% Mg 2% Tekanan 10 MPa	Comment 2	Sample 2

TestID=1616	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation	Upper yield Load	Lower yield Load	Elastic modu	Young
Test No	mm	mm	mm2	MPa	mm	kN	N	N/mm2	N/mm2
1	6.0000	4.0000	24.000	157.06	-0.3983	3.4511	3413.8	17453.	17453.

TestID=1616	Upper yield Stress	Lower yield Stress	ElasticSlope	ElasticSloe
Test No	N/mm2	N/mm2	N/mm	N
1	143.80	142.24	4274.3	4.6343



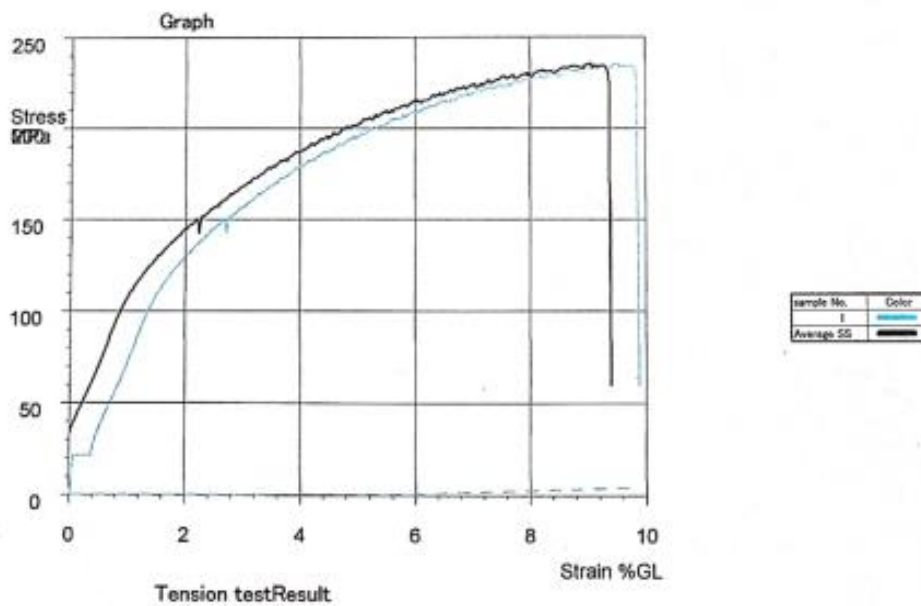
Machine name	RTF	Test type	Tension
Strain input 1	Not used	Test speed	2.0 mm/min
Chart speed	OFF	Machine rigidity	0 mm/kN
Point data(Load)	0 0 0	Point data(Elong)	0 0 0
	N 0 0 0	mm	0 0 0
Elastic modulus anal.	Interval 1 100	Initial sample length	Distance 96 mm
Load	Pitch 5 N	Origin of elongation	Init. load 0.3 %RO
Elong adjust	No	Break point measurem	0.0005 kN
Save SS curve	Yes		

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding.ST	User	Suhardi
Comment 1	CNT 1% Mg 2% Tekanan 10 MPa	Comment 2	Sample 3

TestID=1617	Width	Thickness	Sectional ar	Maximum poin	Break point	Upper yield	Lower yield	Elastic modu	Young
Test No	mm	mm	mm <sup>2</sup>	Stress	Elongation	Load	Load	N/mm <sup>2</sup>	N/mm <sup>2</sup>
1	6.0000	4.0000	24.000	169.79	2.3304	3.4566	3436.4	20074.	20074.

TestID=1617	Upper yield	Lower yield	ElasticSlope	ElasticSlo
Test No	Stress	Stress	N/mm	N
	N/mm <sup>2</sup>	N/mm <sup>2</sup>		
1	144.02	143.18	4916.1	6.7354

d. Hasil uji tari untuk Material S4 ( Al+Mg 4%+CNT 1%)



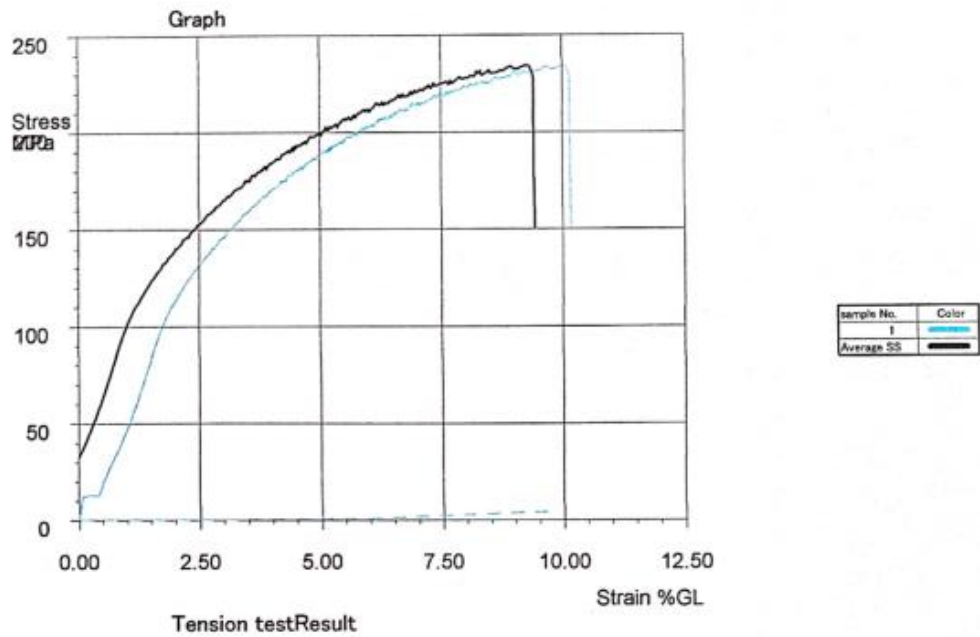
Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	2.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Stress)	572.23	0	572.23	Point data(Strain)	0	0	0
	MPa	0	0		%GL	0	0
Elastic modulus anal.	Interval	1E-006	0.0001	Initial sample length	Distance	75 mm	
	Stress	Pitch	5E-006 MPa	Origin of elongation	Init. load	0.3 %RO	
Elong adjust	No			Break point measurem	0.5 N		
Save SS curve	Yes						

Test date	2023/12/01	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding,ST	User	Suhardi
Comment 1	CNT 1% Mg 4 % Tekanan 10 MP	Comment 2	Sample 1

TestID=1880	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation	Upper yield Stress	Lower yield Stress	Elastic modu	Young
Test No	mm	mm	mm2	MPa	mm	N/mm2	N/mm2	N/mm2	N/mm2
1	5.9800	3.9600	23.681	235.47	-0.2568	215.80	213.91	21154.	21154.

TestID=1880	ElasticSlope	ElasticS/ce
Test No	N/mm	N
1	6679.3	5.5433



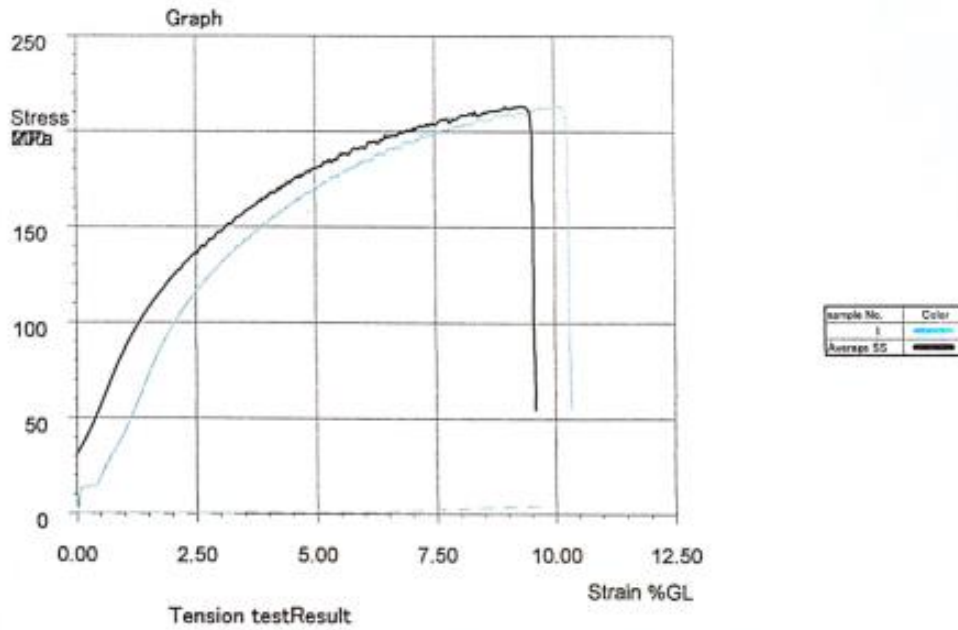


Machine name	RTF		Test type	Tension	
Strain input 1	Not used		Test speed	2.0 mm/min	
Chart speed	OFF		Machine rigidity	0 mm/kN	
Point data(Stress)	572.23	0	572.23	0	0
	MPa	0	0	%GL	0
Elastic modulus anal.	Interval	1E-006	0.0001	Initial sample length	Distance
Stress	Pitch	5E-006	MPa	Origin of elongation	Init. load
Elong adjust	No		Break point measurem	0.5 N	
Save SS curve	Yes				

Test date	2023/12/01	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding,ST	User	Suhardi
Comment 1	CNT 1% Mg 4 % Tekanan 10 MP	Comment 2	Sample 2

TestID=1881	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation	Upper yield Stress	Lower yield Stress	Elastic modu	Young
Test No	mm	mm	mm2	MPa	mm	N/mm2	N/mm2	N/mm2	N/mm2
1	6.0000	3.9800	23.880	234.23	-0.478	214.87	213.56	16565.	16565.

TestID=1881	ElasticSlope	ElasticSlice
Test No	N/mm	N
1	5274.4	8.0467



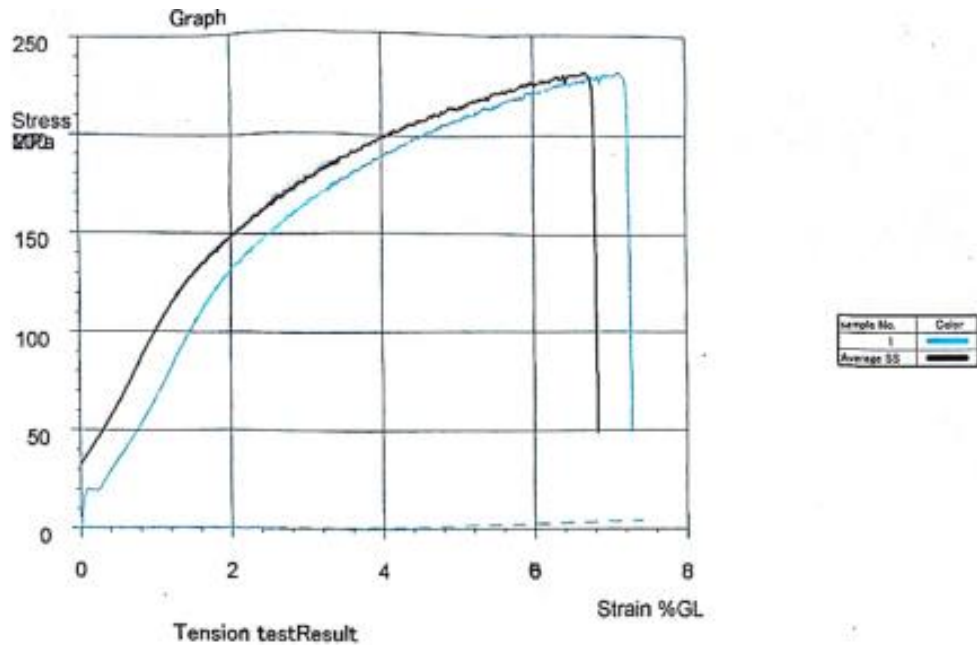
Machine name	RTF		Test type	Tension	
Strain input 1	Not used		Test speed	2.0 mm/min	
Chart speed	OFF		Machine rigidity	0 mm/kN	
Point data(Stress)	572.23	0	Point data(Strain)	0	0
	MPa	0		%GL	0
Elastic modulus anal.	Interval	1E-006	0.0001	Initial sample length	Distance
	Stress	Pitch	5E-006 MPa	Origin of elongation	Init. load
Elong adjust	No		Break point measurem	0.5 N	
Save SS curve	Yes				

Test date	2023/12/01	Temperature	25 C
Humidity	60 %RH	Sample name	Aluminium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding,ST	User	Suhardi
Comment 1	CNT 1% Mg 4 % Tekanan 10 MP	Comment 2	Sample 3

TestID=1882	Width	Thickness	Sectional ar	Maximum poin	Break point	Upper yield	Lower yield	Elastic modu	Young
Test No	mm	mm	mm2	Stress	Elongation	Stress	Stress	N/mm2	N/mm2
1	6.0200	4.0200	24.200	213.23	-0.3983	188.59	187.49	15363.	15363.

TestID=1882	ElasticSlope	ElasticSloe
Test No	N/mm	N
1	4957.1	4.5996

e. Hasil uji tari untuk Material S5 ( Al+Mg 6%+CNT 1%)

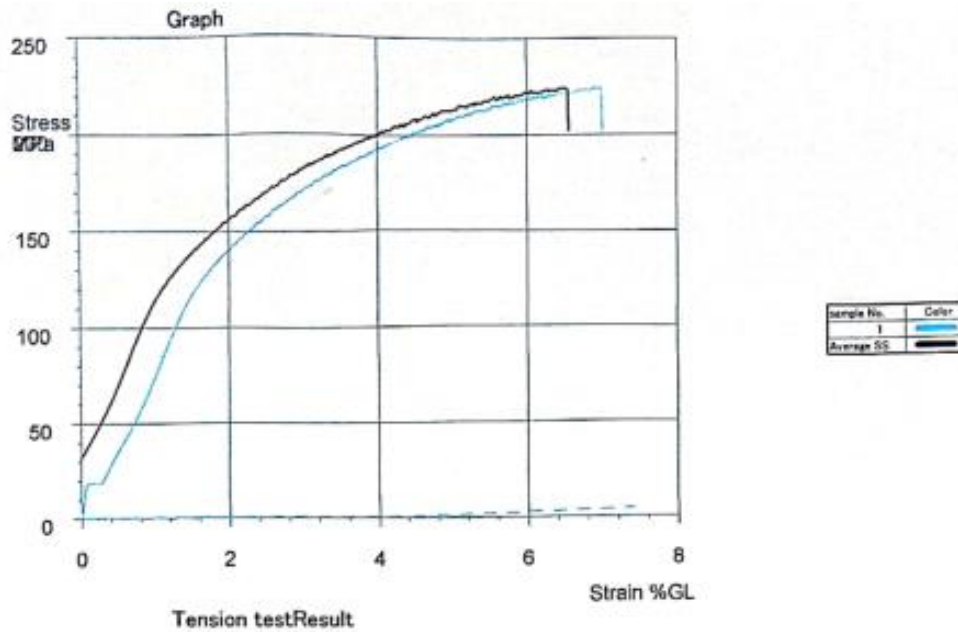


Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	2.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Load)		0	0	Point data(Elong)	0	0	0
	N	0	0		mm	0	0
Elastic modulus anal. Load	Interval	1	100	Initial sample length	Distance	98 mm	
	Pitch	5 N		Origin of elongation	Init. load	0.3 %RO	
Elong adjust	No			Break point measurem	0.0005 kN		
Save SS curve	Yes						

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Almunium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding,ST	User	Suhardi
Comment 1	CNT 1% Mg 6 % Tekanan 10 MP	Comment 2	Sample 3

TestID=1623	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation	Upper yield Load	Lower yield Load	Elastic modu	Young
Test No	mm	mm	mm2	MPa	mm	kN	N	N/mm2	N/mm2
1	6.0000	4.0000	24.0000	231.08	-0.3186	5.1407	5110.5	35808.	35808.

TestID=1623	Upper yield Stress	Lower yield Stress	ElasticSlope	ElasticSloca
Test No	N/mm2	N/mm2	N/mm	N
1	214.20	212.94	8769.3	6.6535



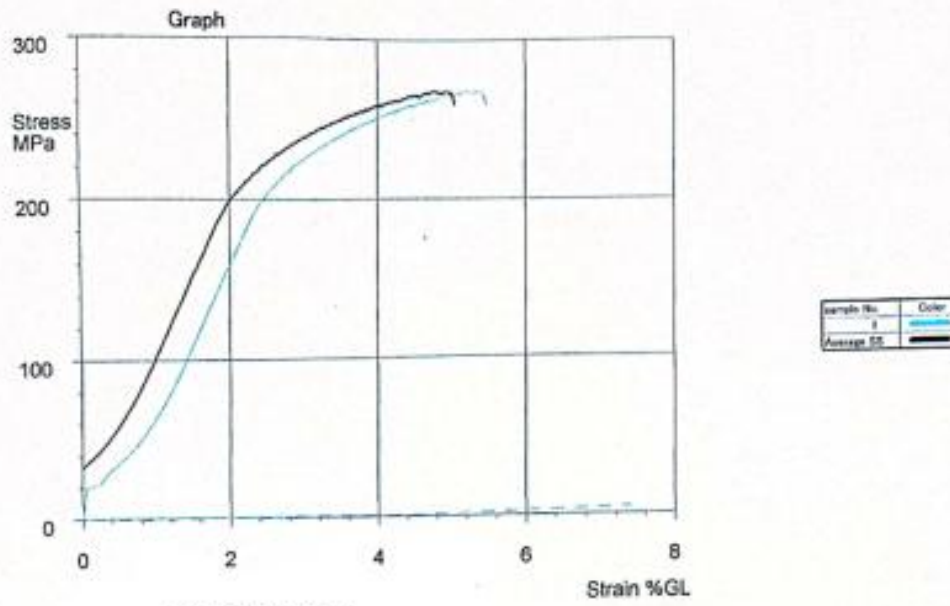
Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	2.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Load)	0	0	0	Point data(Elong)	0	0	0
	N	0	0		mm	0	0
Elastic modulus anal.	Interval	1	100	Initial sample length	Distance	98 mm	
Load	Pitch	5 N		Origin of elongation	init. load	0.3 %RO	
Elong adjust	No			Break point measure	0.0005 kN		
Save SS curve	Yes						

Test date	2023/08/13	Temperature	25 C
Humidity	60 %RH	Sample name	Aluminium 6063
Lot No.		Preparation	
Operator	Epafroditus Pakiding ST	User	Suhardi
Comment 1	CNT 1% Mg 6 % Tekanan 10 MP	Comment 2	Sample 2

TestID=1622	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongafon	Upper yield Load	Lower yield Load	Elastic modu	Young
Test No	mm	mm	mm2	MPa	mm	kN	N	N/mm2	N/mm2
1	6.0000	4.0000	24.000	223.91	-0.2987	5.1693	5146.3	22881.	22881.

TestID=1622	Upper yield Stress	Lower yield Stress	ElasticSlope	ElasticSlce
Test No	N/mm2	N/mm2	N/mm	N
1	215.39	214.43	5603.4	4.2916





Tension testResult

Machine name	RTF			Test type	Tension		
Strain input 1	Not used			Test speed	2.0 mm/min		
Chart speed	OFF			Machine rigidity	0 mm/kN		
Point data(Load)		0	0	Point data(Elong)	0	0	0
	N	0	0		mm	0	0
Elastic modulus anal. Load	Interval	1		Initial sample length	Distance 98 mm		
	Pitch	5 N		Origin of elongation	Init. load 0.3 %RO		
Elong adjust	No			Break point measurem	0.0005 kN		
Save SS curve	Yes						

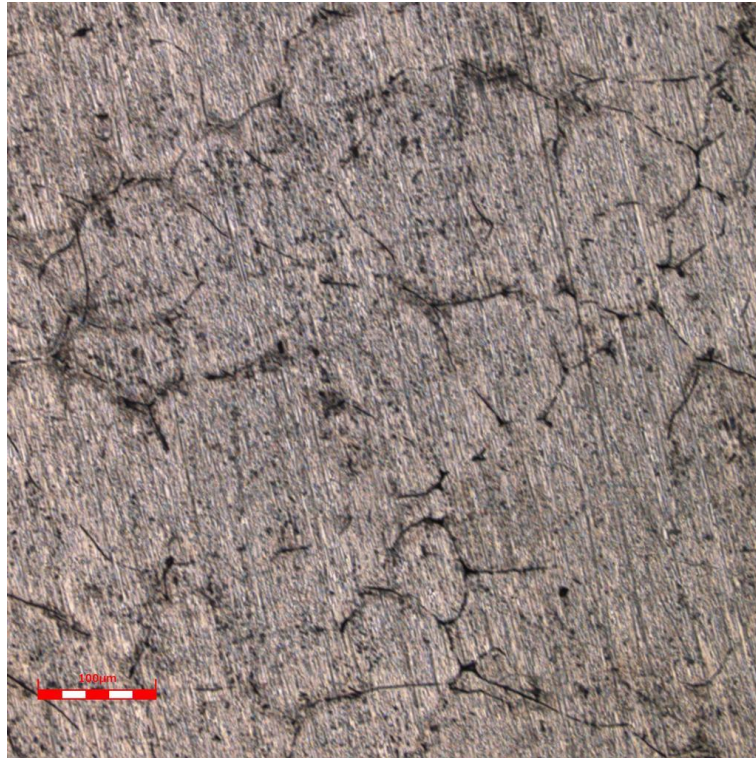
Test date	2023/08/13			Temperature	25 C		
Humidity	60 %RH			Sample name	Aluminium 6063		
Lot No.				Preparation			
Operator	Epafrditus Pakiding.ST			User	Suhardi		
Comment 1	CNT 1% Mg 6 % Tekanan 10 MP			Comment 2	Sample 1		

TestID=1621	Width	Thickness	Sectional ar	Maximum poin Stress	Break point Elongation	Upper yield Load	Lower yield Load	Elastic modu	Young
Test No	mm	mm	mm <sup>2</sup>	MPa	mm	kN	N	N/mm <sup>2</sup>	N/mm <sup>2</sup>
1	6.0000	4.0000	24.000	268.12	3.5853	6.4350	*****	42900.	42900.

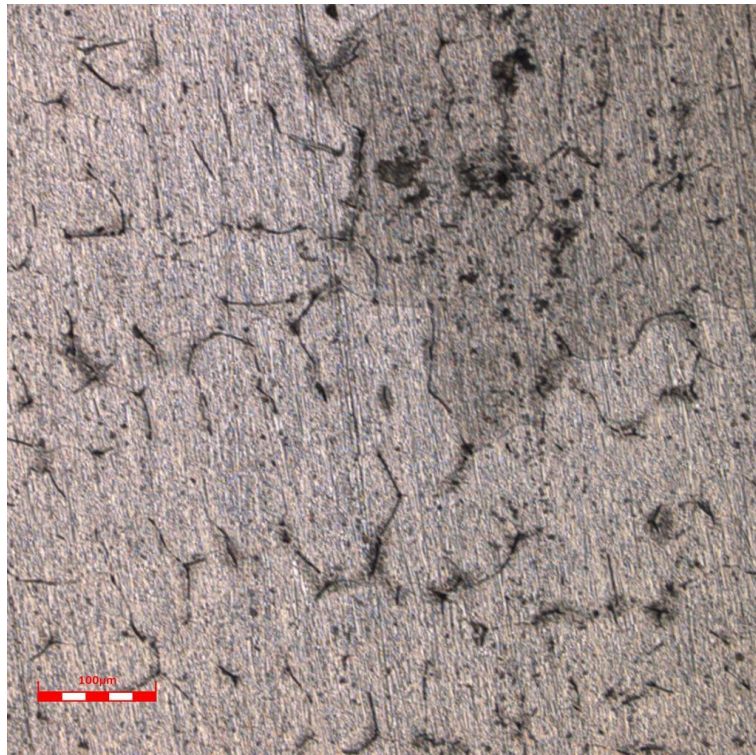
TestID=1621	Upper yield Stress	Lower yield Stress	ElasticSlope	ElasticSlin
Test No	N/mm <sup>2</sup>	N/mm <sup>2</sup>	N/mm	N
1	268.12	*****	10506.	6.2809

**Lampiran 8** Pengamatan Mikroskop Optik Sampel S1,S2,S3,S4 dan S5

**a.** Sampel S1 (Raw Material / 6063)

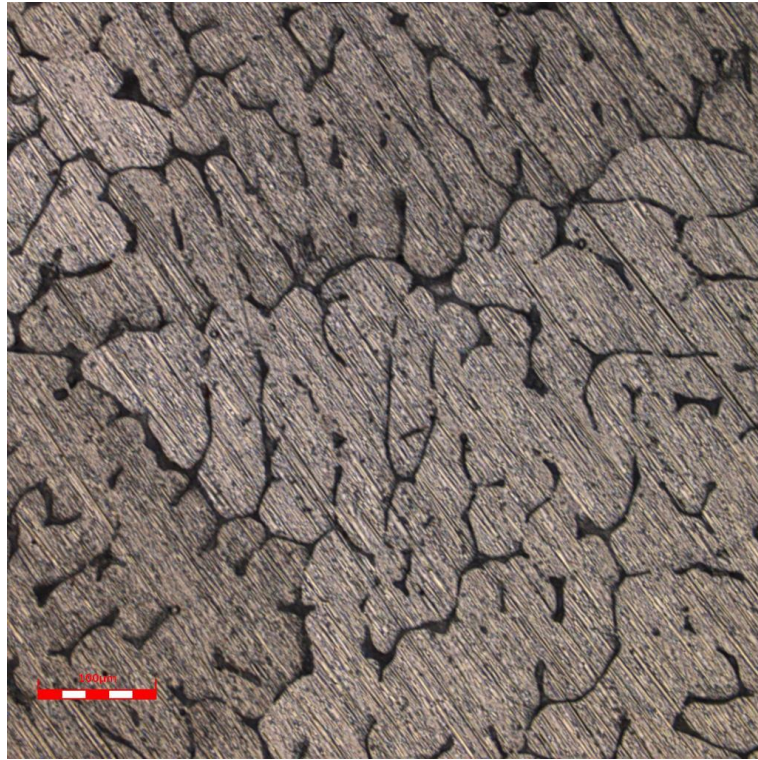


**b.** Sampel S2 (Al+Mg0%+CNT1%)

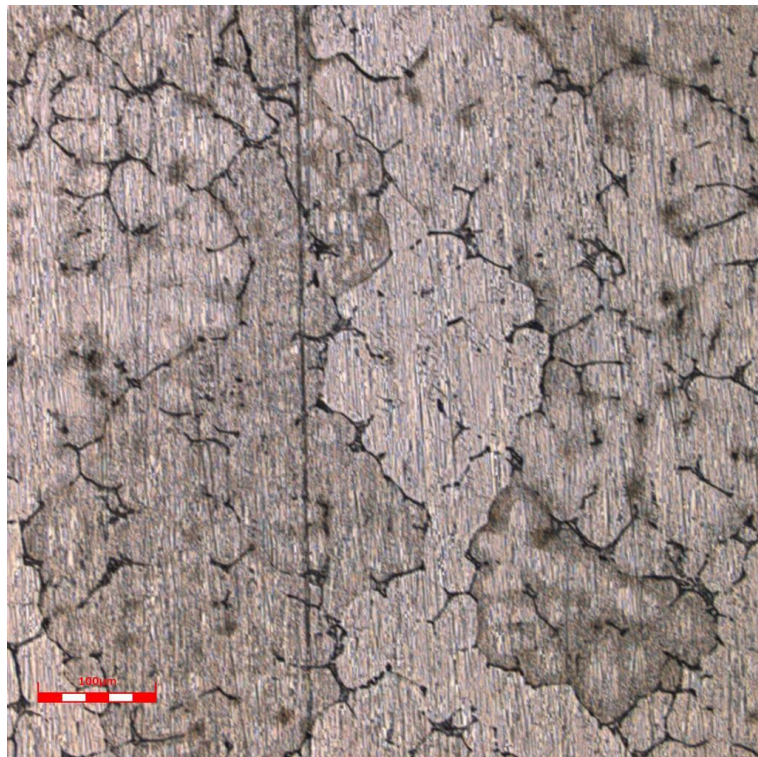




c. Sampel S3 (Al+Mg2%+CNT1%)

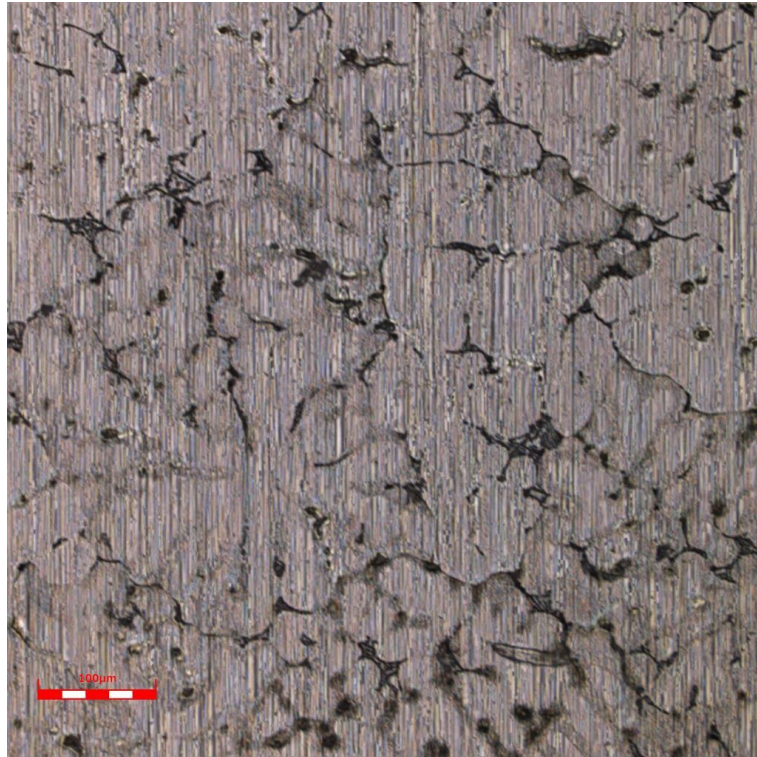


d. Sampel S4 (Al+Mg4%+CNT1%)



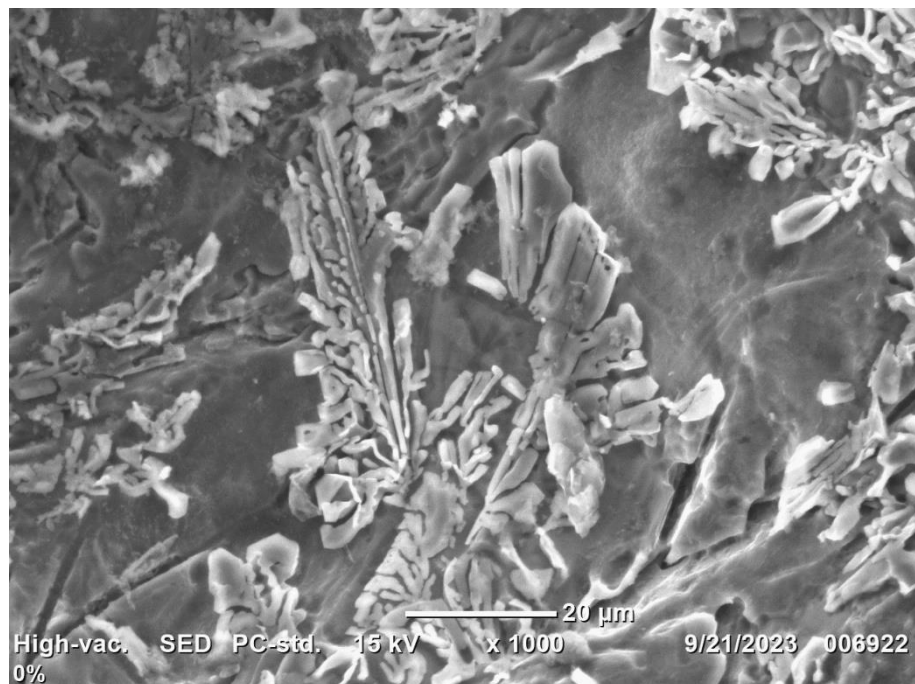


e. Sampel S5 (Al+Mg6%+CNT1%)



**Lampiran 9** pengamatan SEM-EDS untuk sampel S2 dan S5

a. Sampel S2 (Al+Mg0%+CNT1%)



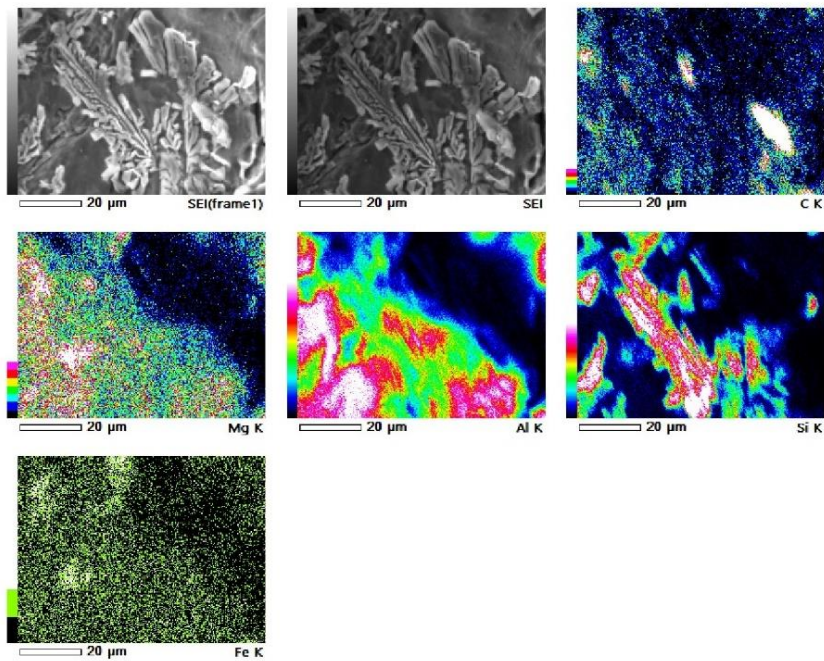
b. Sampel S2 (Al+Mg0%+CNT1%)



**Lampiran 10** Hasil pengamatan SEM Mapping untuk sampel S2 dan S5

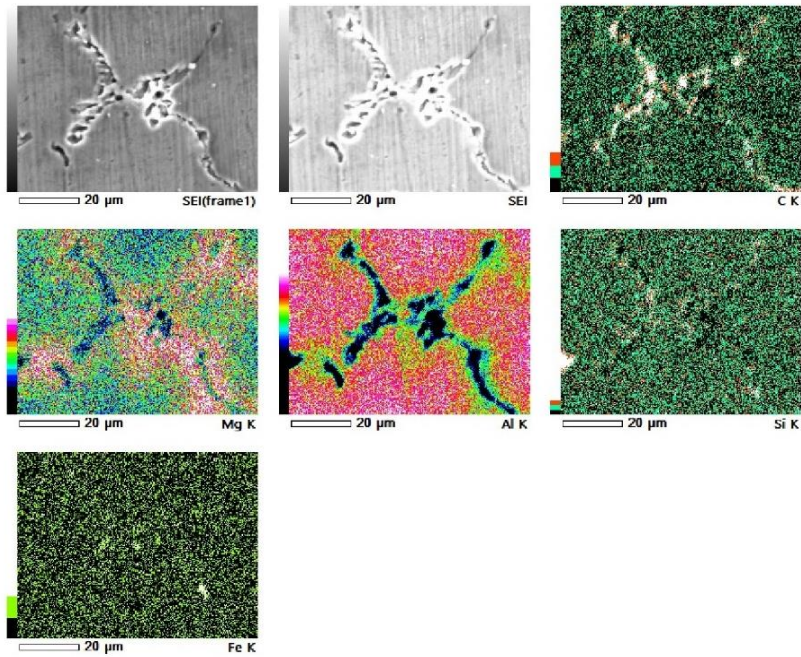
a. Sampel S2 (Al+Mg0%+CNT1%)

View003





## b. Sampel S5 (Al+Mg6%+CNT1%)

View002**Lampiran 11** Daftar mesin dan perlengkapan penelitian

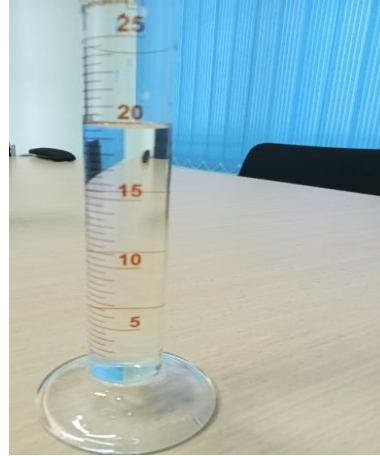
Furnace Lindberg Blue M-Thermo



Timbangan Elektronik, 0,001 gram



Hydraulic Press Type 16T



Gelas Ukur 25ml  $\pm 0.25$ ml



Mesin Uji Tarik Tensilon RTF-2425



X-MET 8000 Handheld XRF Analyzer



Hardness Tester TH170





OM Raxvision MM10A with optilab



SEM (Jeol JCM-6000 Plus with EDS)