LAMPIRAN

Perhitungan Fraksi Volume Komposit

Berikut ini perhitungan yang digunakan untuk menentukan volume dan massa dari spesimen uji tarik komposit:

Diketahui :

Massa jenis serbuk kayu jati = 0,8 gr/cm^3

Massa jenis *Magnesium Oksida* (Mgo) = 3,58 gr/cm^3

Massa jenis kuningan = 8,4 gr/cm^3

Massa jenis *epoxyresin* = 1,20 gr/cm^3

Dimensi cetakan uji tarik = 6,13 cm^3

Dimensi cetakan uji keausan : panjang (p) = 30 mm

Lebar (L) = 30 mm

Tebal (t) = 5 mm

Perhitungan Perbandingan fraksi volume matriks dan *filler* 60% : 40% dengan fraksi perbandingan volume *filler* (50:30:20)

Volume cetakan, V_c = 6,13 cm^3

Volume matriks, V_m = $\frac{60\%}{100\%} x$ 6,13 cm^3

= 3,67 cm^3

Volume *filler*, V_f = $\frac{40\%}{100\%} x$ 6,13 cm^3

= 2,45 cm^3

Volume serbuk, V_s = $\frac{50\%}{100\%} x$ 2,45 cm^3

= 1,22 cm^3

Volume Kuningan, V_k = $\frac{30\%}{100\%} x$ 2,45 cm^3

= 0,73 cm^3

$V_{MgO,}$ V_M = $\frac{20\%}{100\%} x$ 2,45 cm^3

= 0,49 cm^3

Massa matriks, m_m = $V_m \, x \, \rho_m$

= 3,67 $cm^3 x$ 1,20 $gr/\, cm^3$

= 4,40 gr

Massa serbuk, m_s = $V_s \, x \, \rho_s$

= 1,22 $cm^3 x$ 0,8 $gr/\, cm^3$

$= 0{,}97 gr$

Massa Kuningan, m_k $= V_k \, x \, \rho_k$

$= 0{,}73 \, cm^3 x \, 8{,}4 \, gr/cm^3$

$= 6{,}13 \, gr$

Massa Magnesium oksida, $m_M = V_M \, x \, \rho_M$

$= 0{,}49 \, cm^3 x \, 3{,}58 \, gr/cm^3$

$= 1{,}75 \, gr$

Perhitungan Perbandingan fraksi volume matriks dan *filler* 60% : 40% dengan fraksi perbandingan volume *filler* (60:20:20)

Volume cetakan, V_c $= 6{,}13 \, cm^3$

Volume matriks, V_m $= \frac{60\%}{100\%} x \, 6{,}13 \, cm^3$

$= 3{,}67 \, cm^3$

Volume *filler*, V_f $= \frac{40\%}{100\%} x \, 6{,}13 \, cm^3$

$= 2{,}45 \, cm^3$

Volume serbuk, V_s $= \frac{60\%}{100\%} x \, 2{,}45 \, cm^3$

$= 1{,}47 \, cm^3$

Volume Kuningan, V_k $= \frac{20\%}{100\%} x \, 2{,}45 \, cm^3$

$= 0{,}49 \, cm^3$

$V_{MgO,} V_M$ $= \frac{20\%}{100\%} x \, 2{,}45 \, cm^3$

$= 0{,}49 \, cm^3$

Massa matriks, m_m $= V_m \, x \, \rho_m$

$= 3{,}67 \, cm^3 x \, 1{,}20 \, gr/cm^3$

$= 4{,}40 \, gr$

Massa serbuk, m_s $= V_s \, x \, \rho_s$

$= 1{,}47 \, cm^3 x \, 0{,}8 \, gr/cm^3$

$= 1{,}17 \, gr$

Massa Kuningan, m_k $= V_k \, x \, \rho_k$

$= 0{,}49 \, cm^3 x \, 8{,}4 \, gr/cm^3$

$= 4{,}11 gr$

Massa Magnesium oksida, $m_M = V_M \, x \, \rho_M$

$= 0{,}49\ cm^3 x\ 3{,}58\ gr/\ cm^3$

$= 1{,}75\ gr$

Perhitungan Perbandingan fraksi volume matriks dan *filler* 60% : 40% dengan fraksi perbandingan volume *filler* (70:10:20)

Volume cetakan, V_c $= 6{,}13\ cm^3$

Volume matriks, V_m $= \frac{60\%}{100\%} x\ 6{,}13\ cm^3$

$= 3{,}67\ cm^3$

Volume *filler*, V_f $= \frac{40\%}{100\%} x\ 6{,}13\ cm^3$

$= 2{,}45\ cm^3$

Volume serbuk, V_s $= \frac{70\%}{100\%} x\ 2{,}45\ cm^3$

$= 1{,}71\ cm^3$

Volume Kuningan, V_k $= \frac{10\%}{100\%} x\ 2{,}45\ cm^3$

$= 0{,}24\ cm^3$

$V_{MgO,}\ V_M$ $= \frac{20\%}{100\%} x\ 2{,}45\ cm^3$

$= 0{,}49\ cm^3$

Massa matriks, m_m $= V_m\ x\ \rho_m$

$= 3{,}67\ cm^3 x\ 1{,}20\ gr/\ cm^3$

$= 4{,}40\ gr$

Massa serbuk, m_s $= V_s\ x\ \rho_s$

$= 1{,}71\ cm^3 x\ 0{,}8\ gr/\ cm^3$

$= 1{,}36\ gr$

Massa Kuningan, m_k $= V_k\ x\ \rho_k$

$= 0{,}24\ cm^3 x\ 8{,}4\ gr/\ cm^3$

$= 2{,}01 gr$

Massa Magnesium oksida, $m_M = V_M\ x\ \rho_M$

$= 0{,}49\ cm^3 x\ 3{,}58\ gr/\ cm^3$

$= 1{,}75\ gr$

Berikut ini perhitungan yang digunakan untuk menentukan volume dan massa dari spesimen uji keausan komposit:

Diketahui :

Massa jenis serbuk kayu jati = 0,8 gr/cm^3

Massa jenis *Magnesium Oksida* (Mgo) = 3,58 gr/cm^3

Massa jenis kuningan = 8,4 gr/cm^3

Massa jenis *epoxyresin* = 1,20 gr/cm^3

Dimensi cetakan uji tarik = 6,13 cm^3

Dimensi cetakan uji keausan : panjang (p) = 30 mm

Lebar (L) = 30 mm

Tebal (t) = 5 mm

Perbandingan fraksi volume matriks dan *filler* 60% : 40% dengan fraksi perbandingan volume *filler* (50:30:20)

Volume cetakan, V_c = 30x30x5 = 4500 mm^3 = 4,5cm^3

Volume matriks, V_m = $\frac{60\%}{100\%} x$ 4,5 cm^3

= 2,70 cm^3

Volume *filler*, V_f = $\frac{40\%}{100\%} x$ 4,5 cm^3

= 1,8 cm^3

Volume serbuk, V_s = $\frac{50\%}{100\%} x$ 1,8 cm^3

= 0,9 cm^3

Volume Kuningan, V_k = $\frac{30\%}{100\%} x$ 1,8 cm^3

= 0,54 cm^3

$V_{MgO,}$ V_M = $\frac{20\%}{100\%} x$ 1,8 cm^3

= 0,36cm^3

Massa matriks, m_m = $V_m \, x \, \rho_m$

= 2,70 $cm^3 x$ 1,20 $gr/\, cm^3$

= 3,24 gr

Massa serbuk, m_s = $V_s \, x \, \rho_s$

= 0,9 $cm^3 x$ 0,8 $gr/\, cm^3$

= 0,72gr

Massa Kuningan, m_k $= V_k \, x \, \rho_k$

$= 0{,}54 \; cm^3 x \; 8{,}4 \; gr / \; cm^3$

$= 4{,}53 \; gr$

Massa Magnesium oksida, $m_M = V_M \, x \, \rho_M$

$= 0{,}36 \; cm^3 x \; 3{,}58 \; gr / \; cm^3$

$= 1{,}29 \; gr$

Perbandingan fraksi volume matriks dan *filler* 60% : 40% dengan fraksi perbandingan volume *filler* (60:20:20)

Volume cetakan, V_c = 30x30x5 = 4500 mm^3 = 4,5cm^3

Volume matriks, V_m $= \frac{60\%}{100\%} x \; 4{,}5 \; cm^3$

$= 2{,}70 \; cm^3$

Volume *filler*, V_f $= \frac{40\%}{100\%} x \; 4{,}5 \; cm^3$

$= 1{,}8 \; cm^3$

Volume serbuk, V_s $= \frac{60\%}{100\%} x \; 1{,}8 \; cm^3$

$= 1{,}08 \; cm^3$

Volume Kuningan, V_k $= \frac{20\%}{100\%} x \; 1{,}8 \; cm^3$

$= 0{,}36 \; cm^3$

$V_{MgO,}$ V_M $= \frac{20\%}{100\%} x \; 1{,}8 \; cm^3$

$= 0{,}36 cm^3$

Massa matriks, m_m $= V_m \, x \, \rho_m$

$= 2{,}70 \; cm^3 x \; 1{,}20 \; gr / \; cm^3$

$= 3{,}24 \; gr$

Massa serbuk, m_s $= V_s \, x \, \rho_s$

$= 1{,}08 \; cm^3 x \; 0{,}8 \; gr / \; cm^3$

$= \; 0{,}86 gr$

Massa Kuningan, m_k $= V_k \, x \, \rho_k$

$= 0{,}36 \; cm^3 x \; 8{,}4 \; gr / \; cm^3$

$= 3{,}02 \; gr$

Massa Magnesium oksida, $m_M = V_M \, x \, \rho_M$

$= 0{,}36\ cm^3 x\ 3{,}58\ gr/\ cm^3$

$= 1{,}29\ gr$

Perbandingan fraksi volume matriks dan *filler* 60% : 40% dengan fraksi perbandingan volume *filler* (70:10:20)

Volume cetakan, V_c = 30x30x5 = 4500 mm^3 = $4{,}5 cm^3$

Volume matriks, V_m $= \frac{60\%}{100\%} x\ 4{,}5\ cm^3$

$= 2{,}70\ cm^3$

Volume *filler*, V_f $= \frac{40\%}{100\%} x\ 4{,}5\ cm^3$

$= 1{,}8\ cm^3$

Volume serbuk, V_s $= \frac{70\%}{100\%} x\ 1{,}8\ cm^3$

$= 1{,}26\ cm^3$

Volume Kuningan, V_k $= \frac{10\%}{100\%} x\ 1{,}8\ cm^3$

$= 0{,}18\ cm^3$

$V_{MgO,}$ V_M $= \frac{20\%}{100\%} x\ 1{,}8\ cm^3$

$= 0{,}36 cm^3$

Massa matriks, m_m $= V_m\ x\ \rho_m$

$= 2{,}70\ cm^3 x\ 1{,}20\ gr/\ cm^3$

$= 3{,}24\ gr$

Massa serbuk, m_s $= V_s\ x\ \rho_s$

$= 1{,}26\ cm^3 x\ 0{,}8\ gr/\ cm^3$

$= 1{,}00\ gr$

Massa Kuningan, m_k $= V_k\ x\ \rho_k$

$= 0{,}18\ cm^3 x\ 8{,}4\ gr/\ cm^3$

$= 1{,}51\ gr$

Massa Magnesium oksida, m_M = $V_M\ x\ \rho_M$

$= 0{,}36\ cm^3 x\ 3{,}58\ gr/\ cm^3$

$= 1{,}29\ gr$

LAMPIRAN 1

Lampirsn 1

Tabel pemilihan beban dan panjang lintasan uji keausan *ogoshi*

Tabel pemilihan panjang lintasan

Gear ratio D/C	36/108	48/96	72/72	96/48	108/36
Abrasion Distance (m)	66.6	100	200	400	600

Tabel pemilihan beban

Gear ratio E/F	36/108	48/96	72/72	96/48	108/36
Final load (Po) (Kg)	2.12	3.18	6.36	12.72	19.08

Hasil data uji keausan dan perhitungan data uji keausan

Tabel 1 Data uji keausan

spesimen 1	A1	A1	A1
lebar gores 1	31	20	48
lebar gores 2	30	33	38
lebar gores 3	29	36	50
lebar gores 4	30	16	49
lebar gores 5	27	24	13
Rata-rata lebar goresan	29,4	25,8	39,6
Rata-rata lebar goresan (mm) pada mikroskop perbesaran 100x	0,77	0,68	1,04
spesimen 2	A2	A2	A2
lebar gores 1	24	48	18
lebar gores 2	18	44	48
lebar gores 3	47	38	50
lebar gores 4	42	31	48
lebar gores 5	39	25	48
Rata-rata lebar goresan	34	37,2	42,4
Rata-rata lebar goresan (mm) pada mikroskop perbesaran 100x	0,89	0,98	1,12
spesimen 3	A3	A3	A3
lebar gores 1	17	48	50
lebar gores 2	42	38	45
lebar gores 3	43	48	38
lebar gores 4	50	40	42
lebar gores 5	32	38	33
Rata-rata lebar goresan	36,8	42,4	41,6
Rata-rata lebar goresan (mm) pada mikroskop perbesaran 100x	0,97	1,12	1,09
spesimen 1, 2, dan 3	A1	A2	A3
Rata-rata lebar goresan	31,6	37,86667	40,26667
Rata-rata lebar goresan (mm) pada mikroskop perbesaran 100x	0,83	1,00	1,06

Berdasarkan data tabel 1 maka nilai keausan spesifik bisa dihitung, sehingga nilai rata-rata keausan spesimen sebagai berikut:

Nilai keausan spesimen uji A1 :

$$Ws = \frac{B.bo^3}{8.r.Po.Lo} \qquad \left(\frac{mm^2}{kg}\right)$$

$$Ws = \frac{3.0{,}83^3}{8.14.2{,}12.666000} \quad \left(\frac{mm^2}{kg}\right)$$

Ws =1,09E-08 (mm^2/kg)

Nilai Keausan Spesimen Uji A2 :

$$Ws = \frac{B.bo^3}{8.r.Po.Lo} \qquad \left(\frac{mm^2}{kg}\right)$$

$$Ws = \frac{3.1{,}00^3}{8.14.2{,}12.666000} \quad \left(\frac{mm^2}{kg}\right)$$

Ws =1,88E-08 (mm^2/kg)

Nilai Keausan Spesimen Uji A3 :

$$Ws = \frac{B.bo^3}{8.r.Po.Lo} \qquad \left(\frac{mm^2}{kg}\right)$$

$$Ws = \frac{3.1{,}06^3}{8.14.2{,}12.666000} \quad \left(\frac{mm^2}{kg}\right)$$

Ws =2,26E-08 (mm^2/kg)

Untuk keseluruhan hasil perhitungan ditunjukan pada tabel 2 dibawah ini:

Tabel 2. Hasil perhitungan nilai dari keausan spesifik

Benda uji		Jarak Piringan Yang Ditempuh Lo (mm)	Lebar Hasil Goresan bo (mm)	bo^3	Beban Po (kg)	Jari-jari r (mm)	Tebal B (mm)	Nilai Keausan Spesifik Ws (mm^2/kg)
A1	1	666000	0,77	0,46	2,12	14	3	8,78586E-09

	2	666000	0,68	0,31	2,12	14	3	5,93747E-09
	3	666000	1,04	1,13	2,12	14	3	2,14698E-08
	Rata-rata	666000	0,83	0,58	2,12	14	3	1,09095E-08
A2	1	666000	0,89	0,72	2,12	14	3	1,35887E-08
	2	666000	0,98	0,94	2,12	14	3	1,7798E-08
	3	666000	1,12	1,39	2,12	14	3	2,63536E-08
	Rata-rata	666000	1,00	0,99	2,12	14	3	1,87721E-08
A3	1	666000	0,97	0,91	2,12	14	3	1,723E-08
	2	666000	1,12	1,39	2,12	14	3	2,63536E-08
	3	666000	1,09	1,31	2,12	14	3	2,48899E-08
	Rata-rata	666000	1,06	1,19	2,12	14	3	2,25725E-08

LAMPIRAN 2

KUAT TARIK

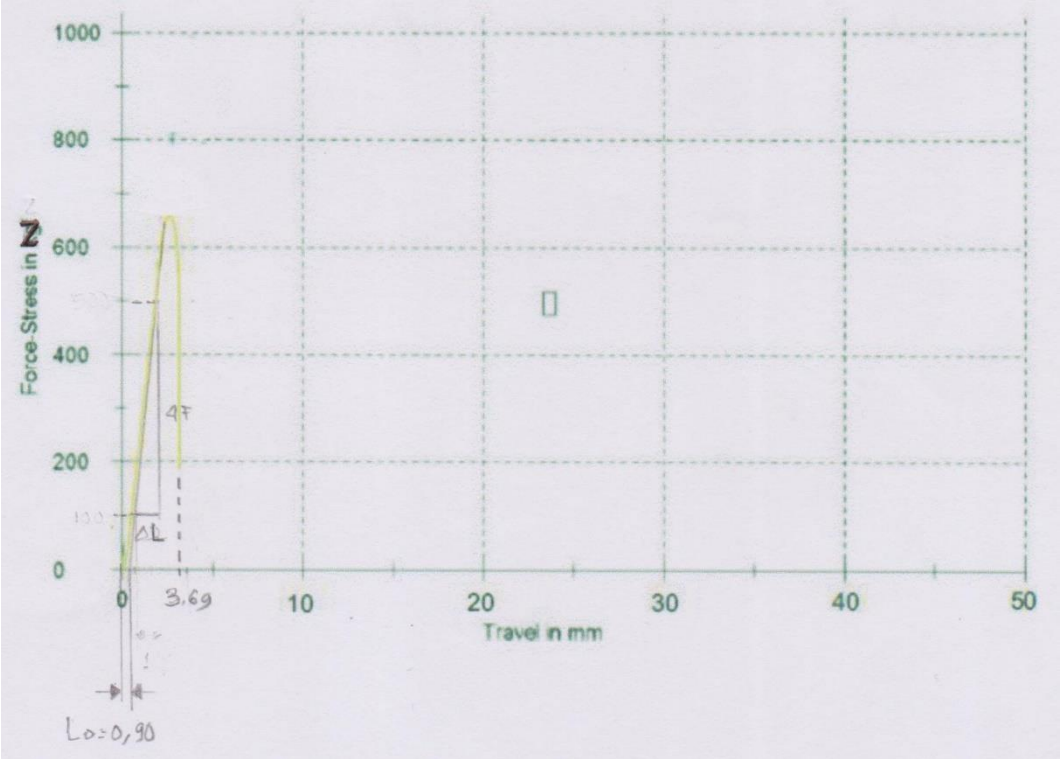
Parameter Table:

Headline	: KUAT TARIK
Custumer	: 374/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	1	66,102	3,69

Series graph :



KUAT TARIK

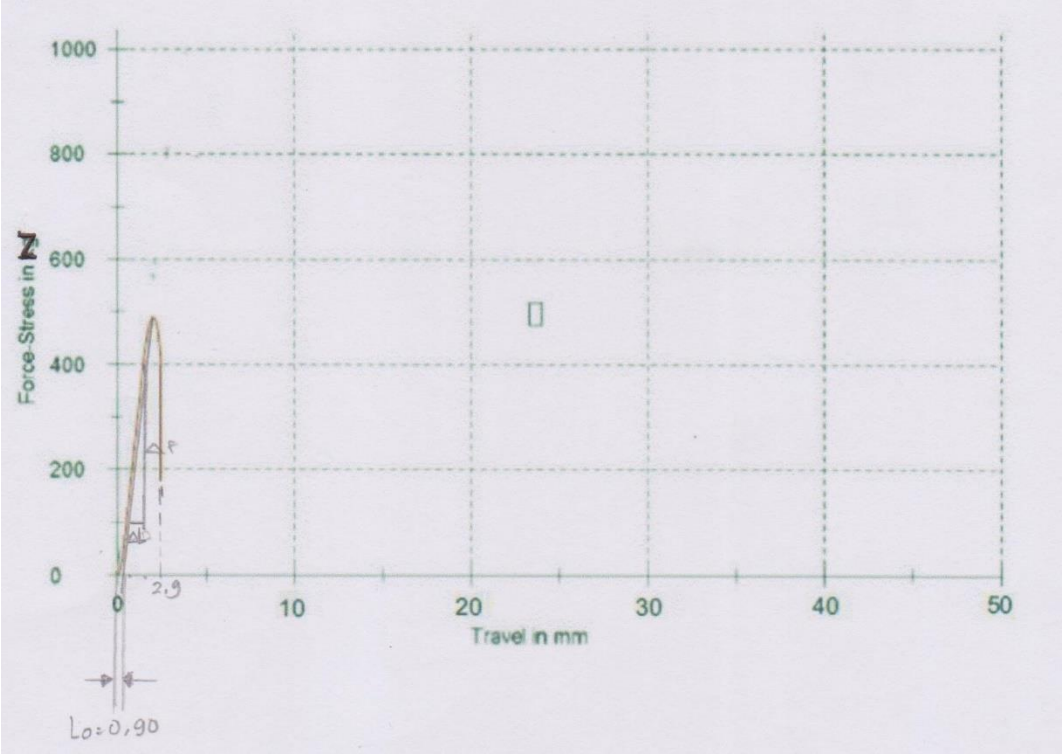
Parameter Table:

Headline	: KUAT TARIK
Custumer	: 374/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	2	48,674	2,90

Series graph :



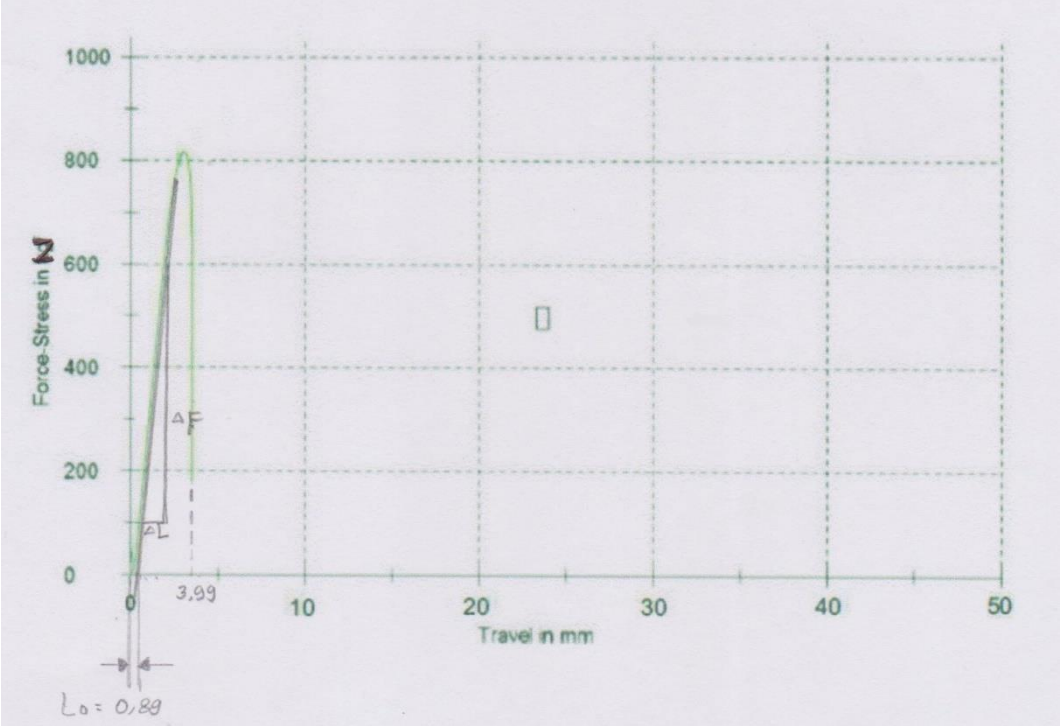
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 374/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	3	81,431	3,99



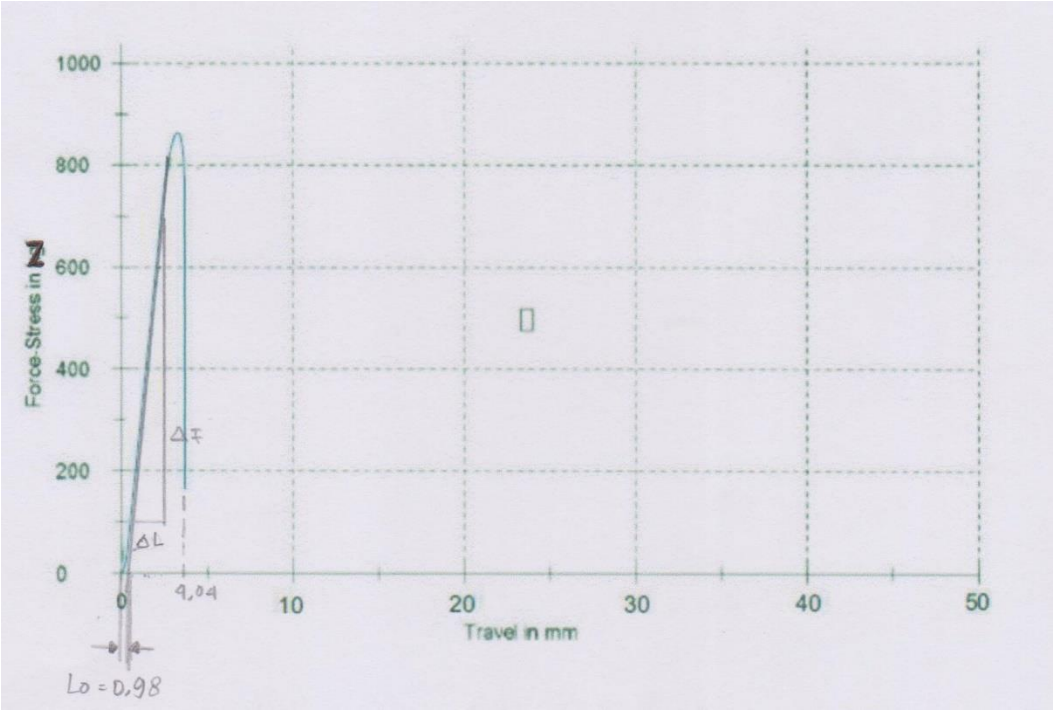
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 374/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	4	86,047	4,04



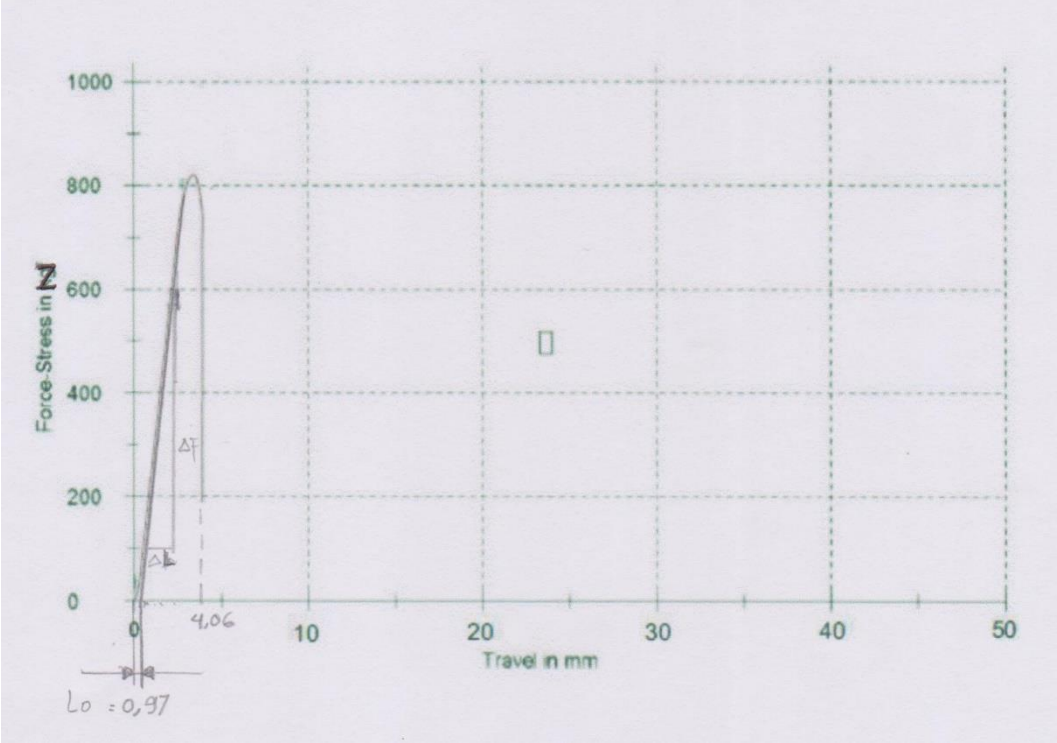
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 374/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	5	82,445	4,06



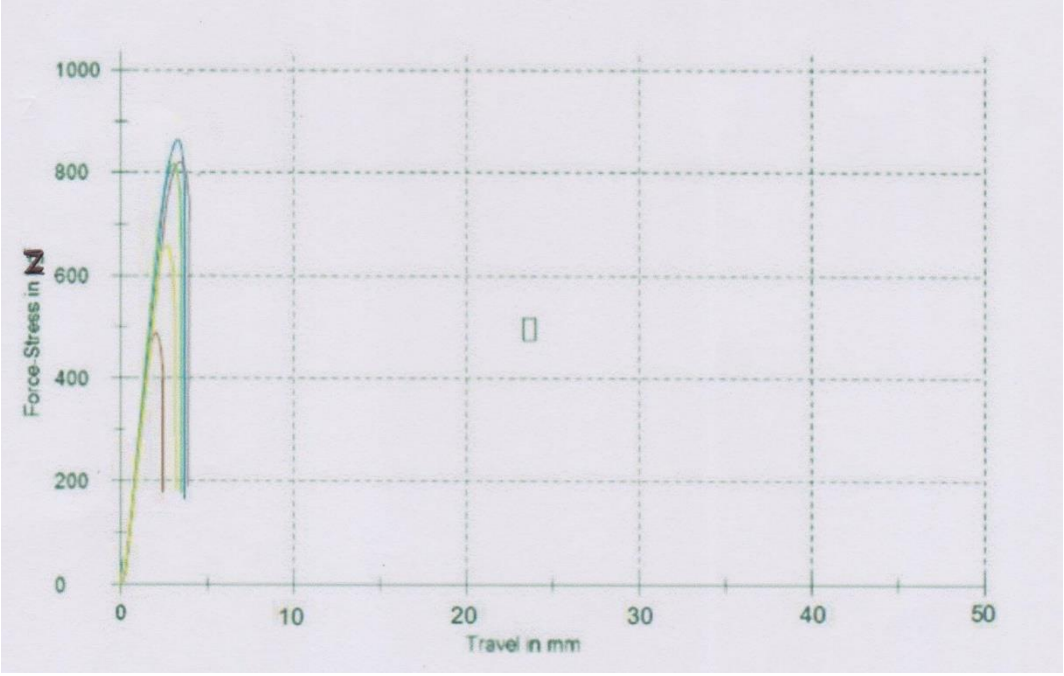
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 374/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	1	66,102	3,69
	2	48,674	2,90
	3	81,431	3,99
	4	86,047	4,04
	5	82,445	4,06



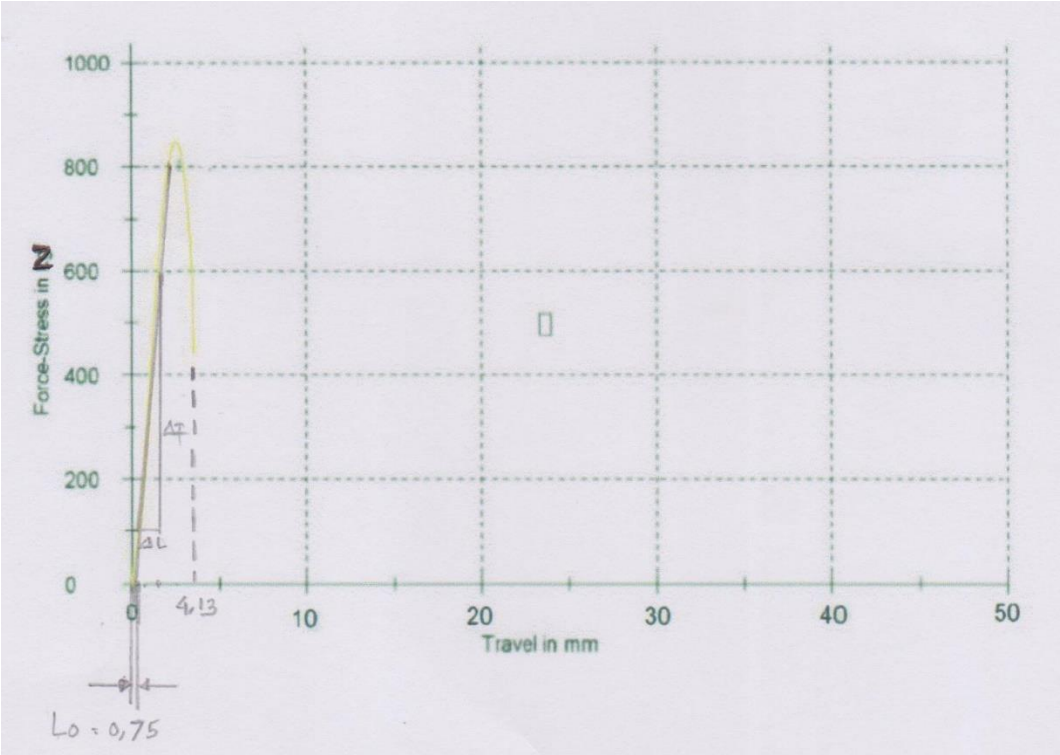
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 375/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	1	84,238	4,13



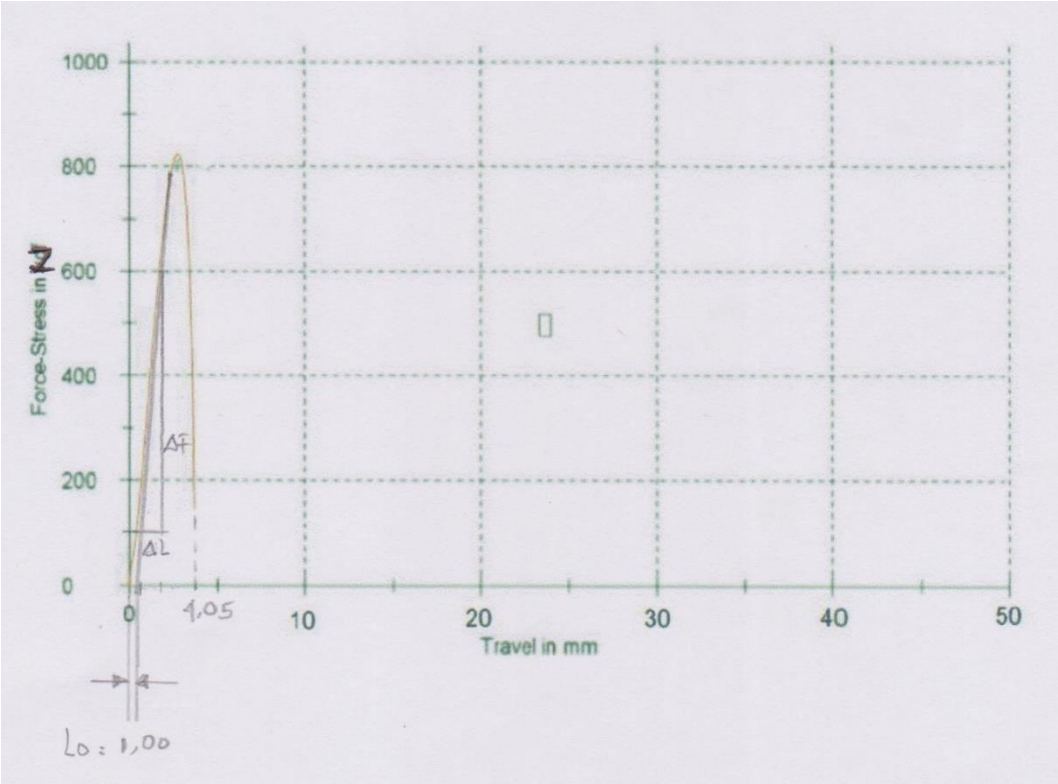
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 375/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	2	83,928	4,05



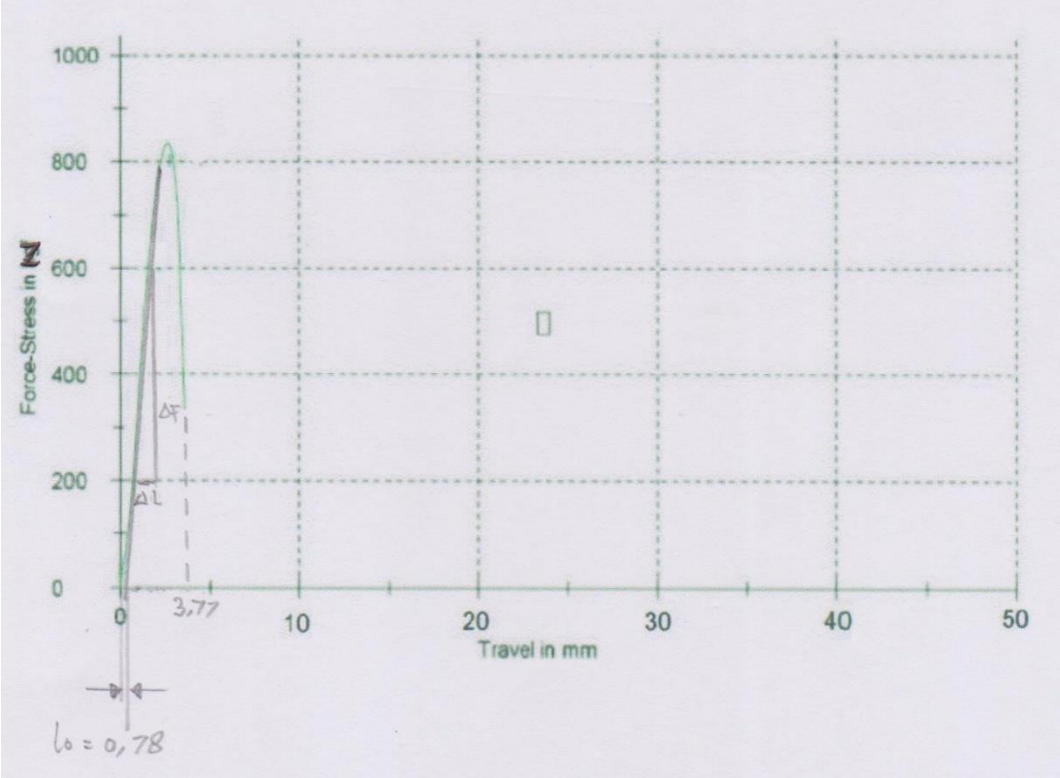
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 375/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	3	84,119	3,77



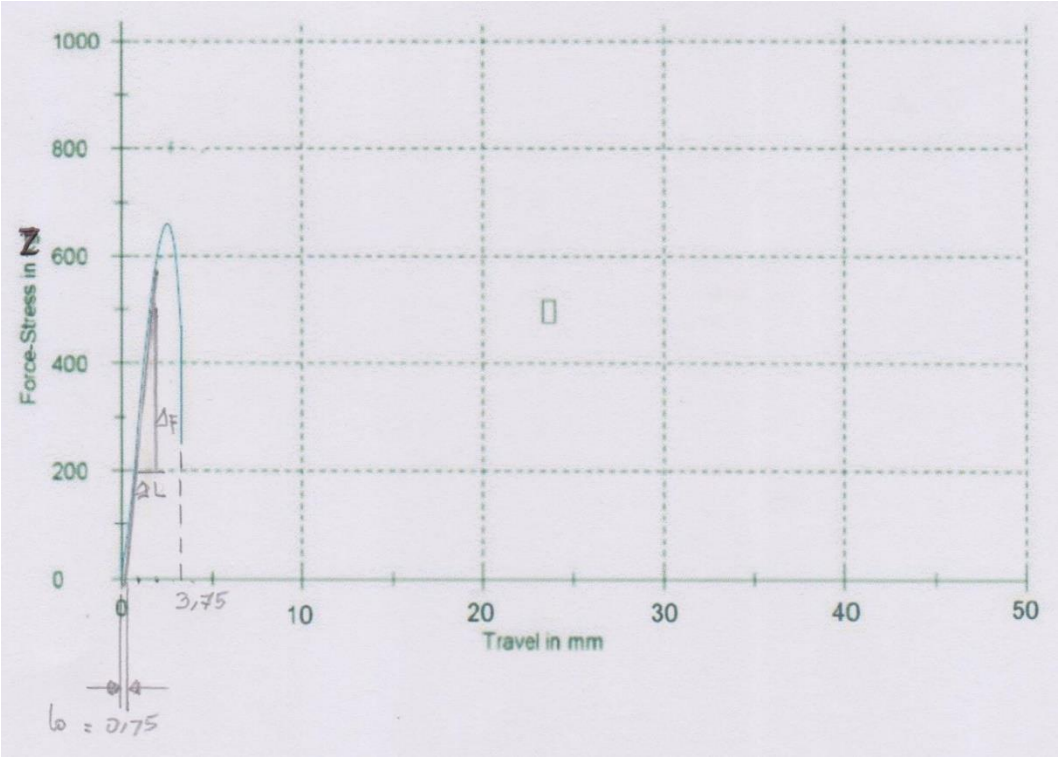
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 375/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	4	66,655	3,75



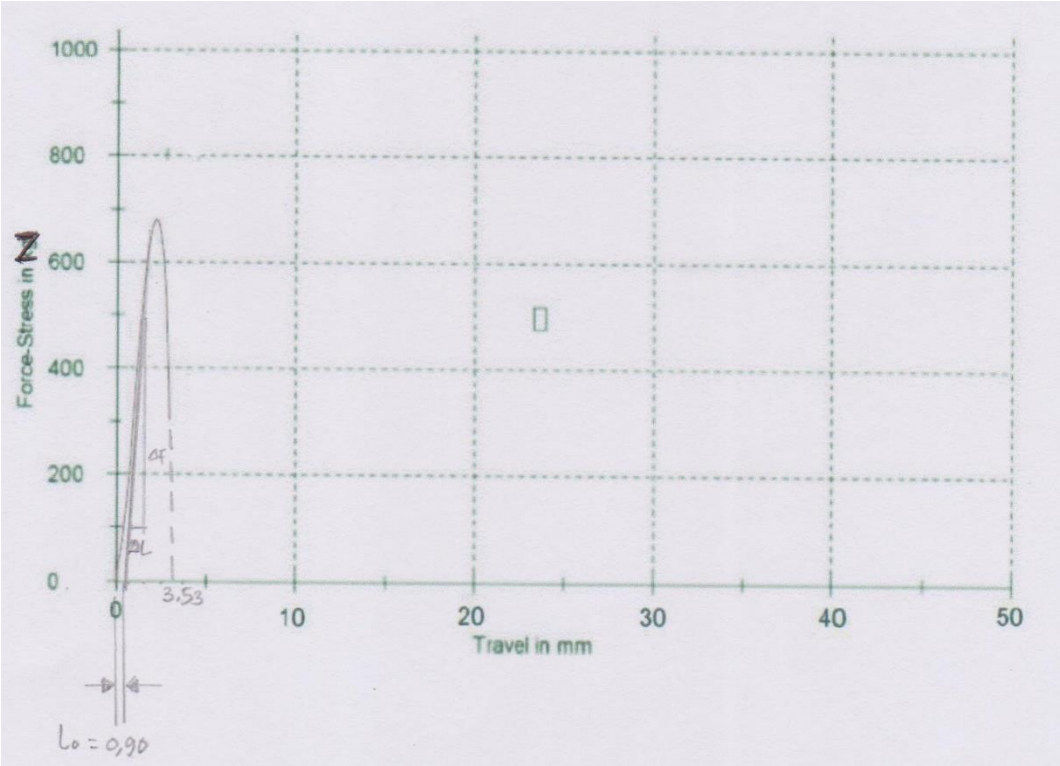
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 375/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	5	68,156	3,53



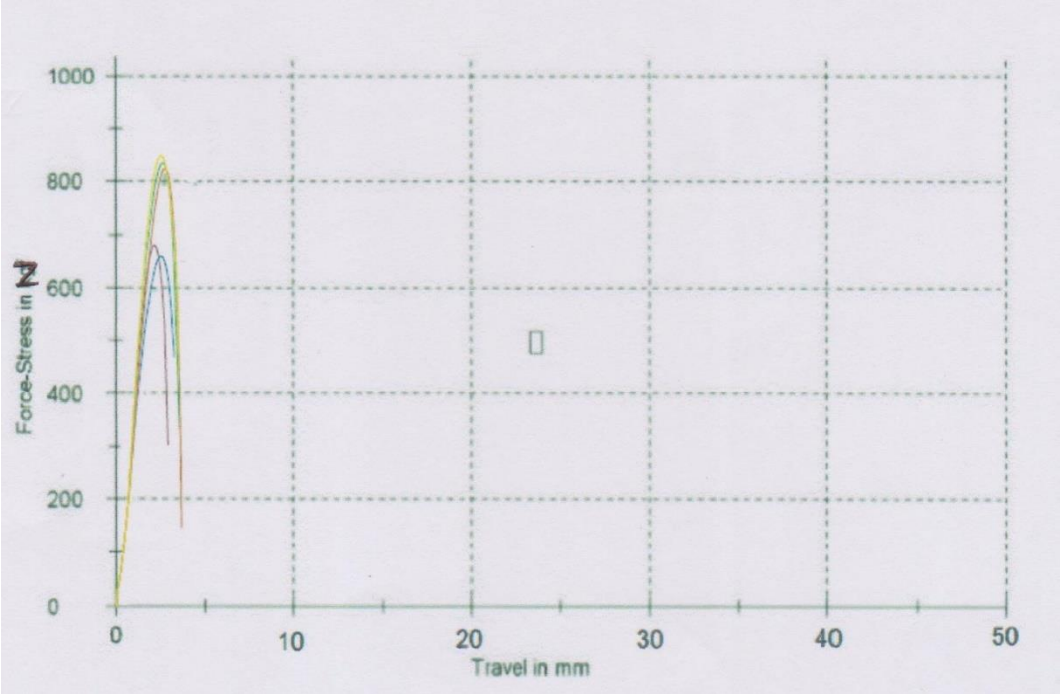
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 375/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	1	84,238	4,13
	2	83,928	4,05
	3	84,119	3,77
	4	66,655	3,75
	5	68,156	3,53



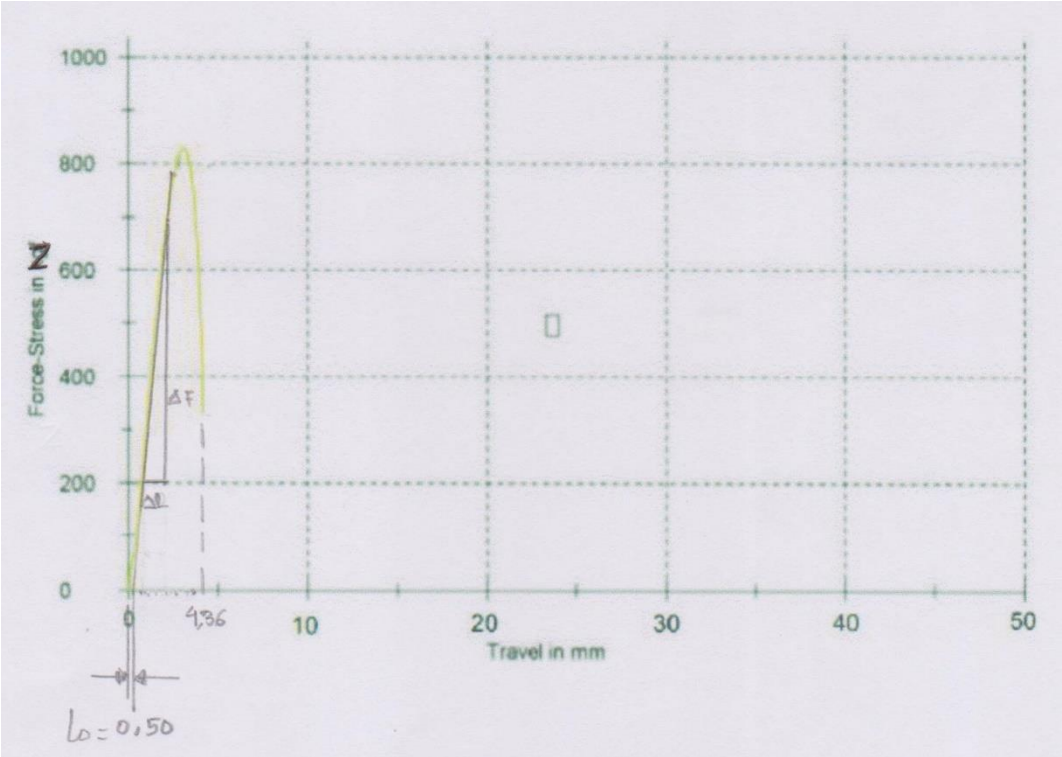
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 376/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	1	83,669	4,36



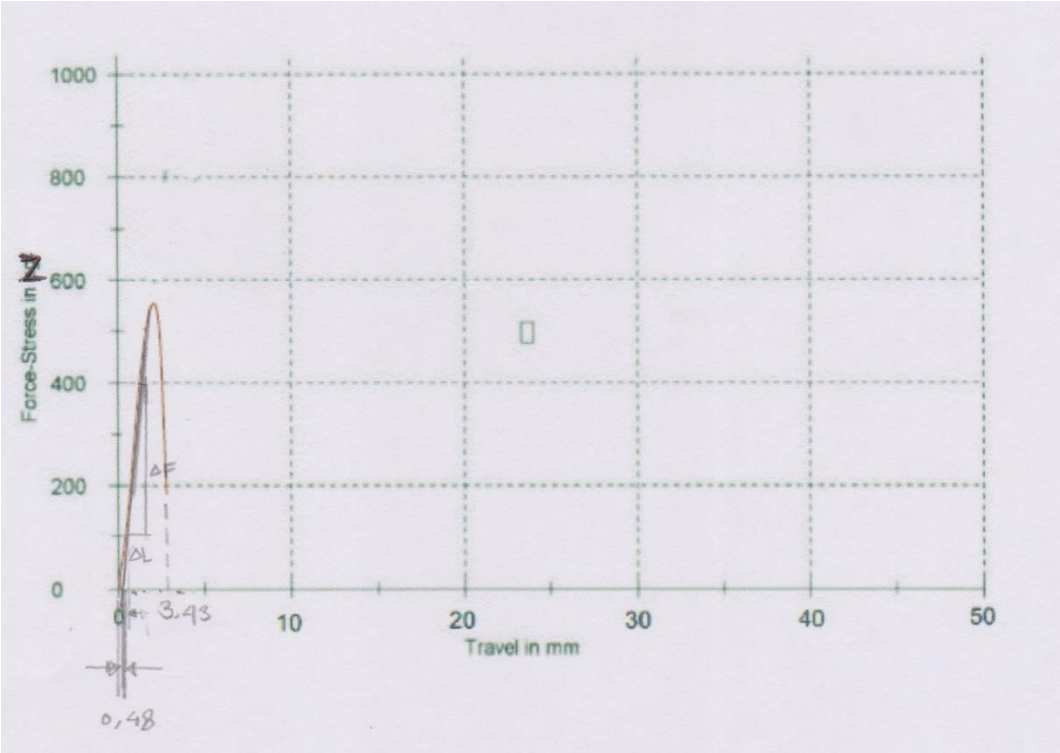
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 376/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	2	56,690	3,43



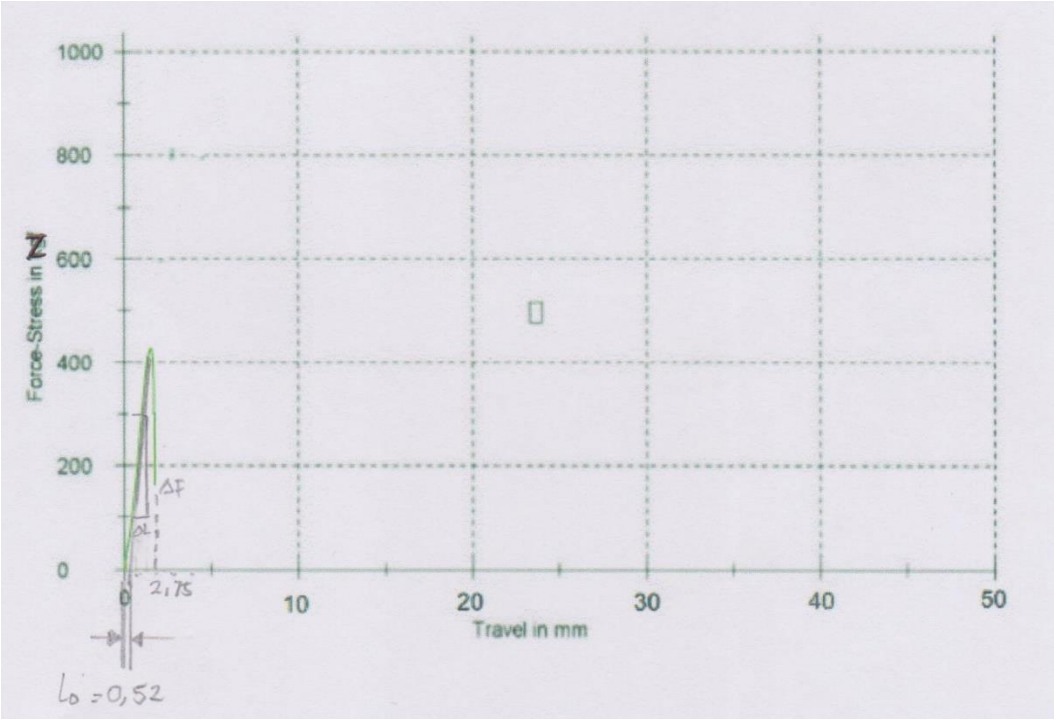
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 376/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	3	43,380	2,75



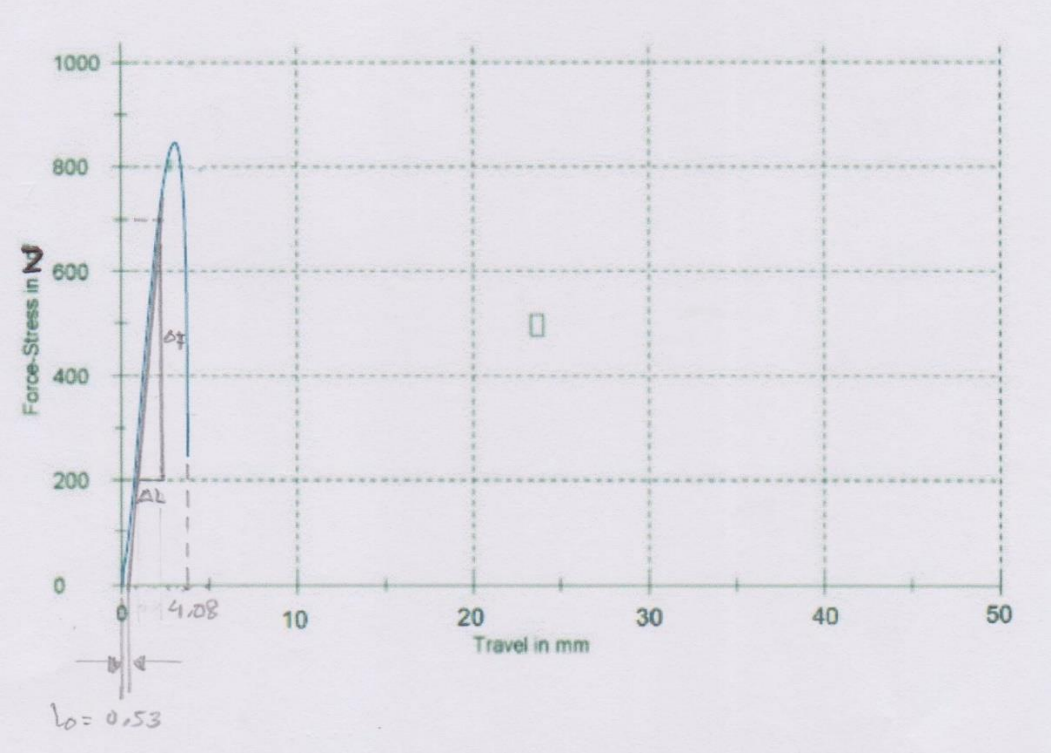
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 376/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	4	84,637	4,08



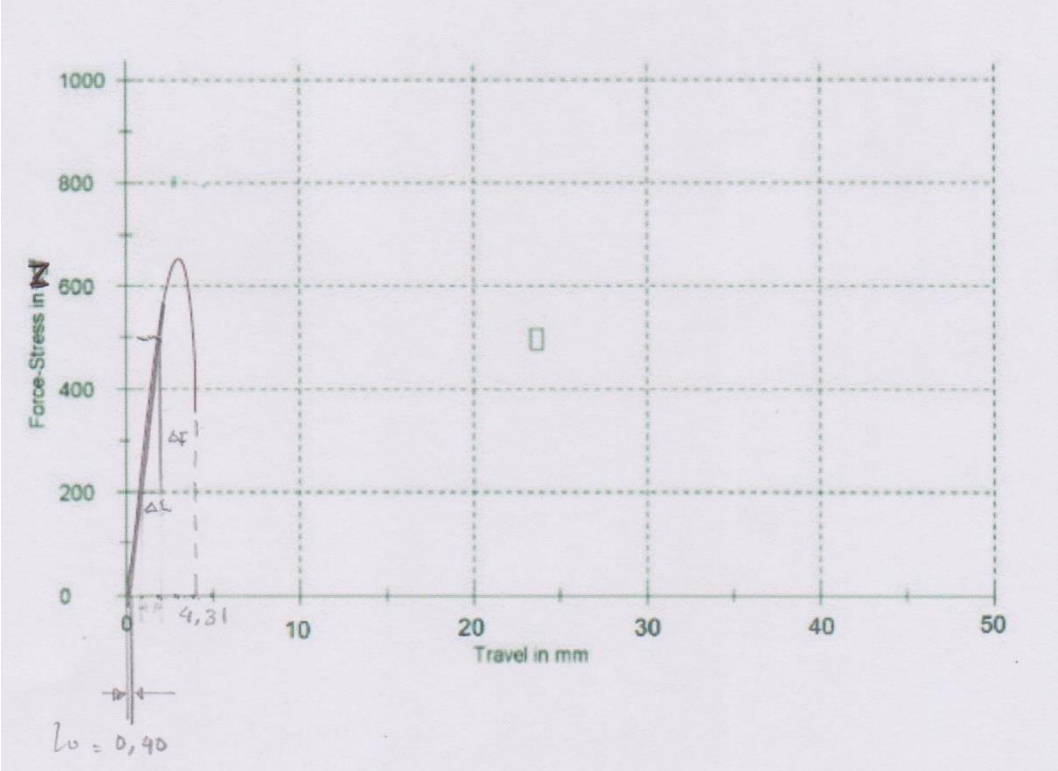
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 376/II/18
Tester	: L Triyono
Material	: serbuk kayu jati matriks epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	5	85,574	4,31



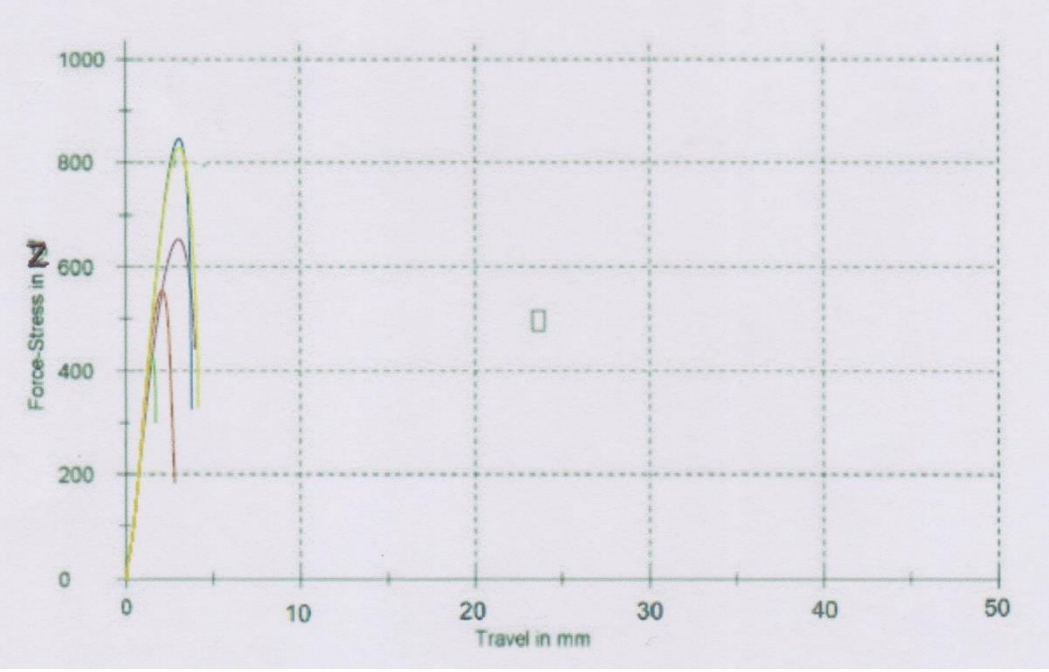
KUAT TARIK

Parameter Table:

Headline	: KUAT TARIK
Custumer	: 376/II/18
Tester	: L Triyono
Material	: Serbuk Kayu Jati Matriks Epoxy
Test standar	: ASTM D 638

RESULT :

Legends	No	Fmax Lm (Kgf)	Measurement travel end (mm)
	1	83,669	4,36
	2	56,690	3,43
	3	43,380	2,75
	4	84,637	4,08
	5	85,574	4,31



Lampiran 2

Hasil perhitungan data uji tarik

Pada data hasil pengujian yang didapatkan nilai beban yang diberikan masih dalam bentuk satuan kgf, sehingga perlu diubah dahulu ke N dengan cara mengkalikannya dengan 9,804.

Besar kuat tarik rata-rata spesimen A1:

$\sigma = \frac{F}{A}$ (MPa)

$\sigma = \frac{715{,}33\ (N)}{6\ (mm)\ x\ 4\ (mm)}$

$\sigma = 29{,}81$ (MPa)

Besar kuat tarik rata-rata spesimen A2:

$\sigma = \frac{F}{A}$ (MPa)

$\sigma = \frac{759{,}25\ (N)}{6\ (mm)\ x\ 4\ (mm)}$

$\sigma = 31{,}64$ (MPa)

Besar kuat tarik rata-rata spesimen A3:

$\sigma = \frac{F}{A}$ (MPa)

$\sigma = \frac{829{,}93\ (N)}{6\ (mm)\ x\ 4\ (mm)}$

$\sigma = 34{,}58$ (MPa)

Besar regangan rata-rata spesimen A1:

$\varepsilon = \frac{L - L_0}{Lc} = \frac{\Delta L}{Lc}\ x\ 100\%$

$\varepsilon = \frac{2{,}79\ mm}{25\ mm}\ x\ 100\ \%$

$\varepsilon = 11{,}18\%$

Besar regangan rata-rata spesimen A2:

$\varepsilon = \frac{L - L_0}{Lc} = \frac{\Delta L}{Lc}\ x\ 100\%$

$\varepsilon = \frac{3{,}01\ mm}{25\ mm}\ x\ 100\ \%$

$\varepsilon = 12{,}05\%$

Besar regangan rata-rata spesimen A3:

$$\varepsilon = \frac{L-L_0}{Lc} = \frac{\Delta L}{Lc}\ x\ 100\%$$

$$\varepsilon = \frac{3{,}77\ mm}{25\ mm}\ x\ 100\ \%$$

$\varepsilon = 15{,}07\%$

Besar modulus elastisitas rata-rata spesimen A1

$$E = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{\Delta F/A}{\Delta L/Lc}\ \text{(MPa)}$$

$$E = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{450/6.4}{1{,}5/25}$$

$E = 319{,}44$ (MPa)

Besar modulus elastisitas rata-rata spesimen A2

$$E = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{\Delta F/A}{\Delta L/Lc}\ \text{(MPa)}$$

$$E = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{340/6.4}{0{,}97/25}$$

$E = 365{,}20$ (MPa)

Besar modulus elastisitas rata-rata spesimen A3

$$E = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{\Delta F/A}{\Delta L/Lc}\ \text{(MPa)}$$

$$E = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{433/6.4}{1{,}16/25}$$

$E = 393{,}52$ (MPa)

Untuk keseluruhan hasil perhitungan ditunjukan pada tabel dibawah ini:

Tabel hasil perhitungan uji tatrik

spesimen	NO	LEBAR	TEBAL	L STANDAR ASTM D 638-02 TYPE IV	L0 (mm)	L (mm)	ΔL (mm)	Nilai Pembebanan (kgf)	P (N)	σ (Mpa)	ε (%)	E (Mpa)
A1	1	6	4	25	0,90	3,69	2,79	66,10	648,26	27,01	11,16	416,67
	2	6	4	25	0,89	2,9	2,01	48,68	477,39	19,89	8,04	260,42
	3	6	4	25	0,98	3,99	3,01	81,43	798,59	33,27	12,04	347,22
	4	6	4	25	0,97	4,04	3,07	86,05	843,86	35,16	12,28	312,50
	5	6	4	25	0,97	4,06	3,09	82,45	808,54	33,69	12,36	260,42
Minimun		6	4	25	0,89	2,9	2,01	48,68	477,39	19,89	8,04	260,42
Maximum		6	4	25	0,98	4,06	3,09	86,05	843,86	35,16	12,36	416,67
Rata-Rata		6	4	25	0,94	3,74	2,79	72,94	715,33	29,81	11,18	319,44
standar deviasi					0,04	0,49	0,45	15,57	152,69	6,36	1,82	65,65
A2	1	6	4	25	0,75	4,13	3,38	84,24	826,12	34,42	13,52	416,67
	2	6	4	25	1,00	4,05	3,05	83,93	823,08	34,30	12,20	312,50
	3	6	4	25	0,78	3,77	2,99	84,12	824,96	34,37	11,96	312,50
	4	6	4	25	0,75	3,76	3,01	66,66	653,69	27,24	12,04	367,65
	5	6	4	25	0,90	3,53	2,63	68,16	668,41	27,85	10,52	416,67
Minimun		6	4	25	0,75	3,53	2,63	66,66	653,69	27,24	10,52	312,50
Maximum		6	4	25	1,00	4,13	3,38	84,24	826,12	34,42	13,52	416,67
Rata-Rata		6	4	25	0,84	3,85	3,01	77,42	759,25	31,64	12,05	365,20
standar deviasi					0,11	0,24	0,27	9,16	89,81	3,74	1,06	52,10
A3	1	6	4	25	0,5	4,36	3,86	83,67	820,54	34,19	15,44	520,83

	4	6	4	25	0,53	4,06	3,53	84,64	830,04	34,58	14,12	347,22
	5	6	4	25	0,40	4,31	3,91	85,57	839,22	34,97	15,64	312,50
Minimun		6	4	25	0,40	4,06	3,53	83,67	820,54	34,19	14,12	312,50
Maximum		6	4	25	0,53	4,36	3,91	85,57	839,22	34,97	15,64	520,83
Rata-Rata		6	4	25	0,48	4,24	3,77	84,63	829,93	34,58	15,07	393,52
standar deviasi					0,07	0,16	0,21	0,95	9,34	0,39	0,83	111,62

Catatan: nilai regangan dan modulus elastisitas didapatkan dengan metode *offset*, metode ini dilakukan dengan cara menarik garis lurus yang sejajar dengan garis miring pada daerah proposional (elastis) seperti ditunjukan pada grafik lampiran hasil uji tarik.

LAMPIRAN 3

Lampiran 3

Hasil data uji kekerasan

Spesimen 1	A1	A1
Diameter injakan 1	44	39
Diameter injakan 2	40	39
Diameter injakan 3	30	38
Diameter injakan 4	39	39
Diameter injakan 5	40	39
Rata-rata diameter injakan	38,6	38,8
Rata-rata diameter injakan (mm) pada mikroskop perbesaran 100x	1,02	1,02
Rata-rata	1,02	
Spesimen 2	A2	A2
Diameter injakan 1	39	39
Diameter injakan 2	39	38
Diameter injakan 3	39	40
Diameter injakan 4	40	39
Diameter injakan 5	39	40
Rata-rata diameter injakan	39,2	39,2
Rata-rata diameter injakan (mm) pada mikroskop perbesaran 100x	1,03	1,03
Rata-rata	1,03	
Spesimen 3	A3	A3
Diameter injakan 1	40	40
Diameter injakan 2	42	44
Diameter injakan 3	41	41
Diameter injakan 4	40	41
Diameter injakan 5	41	41
Rata-rata diameter injakan	40,8	41,4
Rata-rata diameter injakan (mm) pada mikroskop perbesaran 100x	1,07	1,09
Rata-rata	1,08	

Berdasarkan tabel diatas maka nilai kekerasan rata-rata komposit serbuk kayu jati/epoxy dapat dihitung, perhitungan nilai kekerasan rata-ratanya sebagai berikut:

Nilai kekerasan rata-rata spesimen A1:

$$HB = \frac{2F}{\pi D(D-\sqrt{D^2-d^2})} \qquad (\text{kg/mm}^2)$$

$$HB = \frac{2.15{,}625}{\pi.2{,}5(2{,}5-\sqrt{2{,}5^2-1{,}02^2})}$$

$$HB = 18{,}35\ (\text{kg/mm}^2)$$

Nilai kekerasan rata-rata spesimen A2:

$$HB = \frac{2F}{\pi D(D-\sqrt{D^2-d^2})} \qquad (\text{kg/mm}^2)$$

$$HB = \frac{2.15{,}625}{\pi.2{,}5(2{,}5-\sqrt{2{,}5^2-1{,}03^2})}$$

$$HB = 17{,}86\ (\text{kg/mm}^2)$$

$$HB = \frac{2F}{\pi D(D-\sqrt{D^2-d^2})} \qquad (\text{kg/mm}^2)$$

$$HB = \frac{2.15{,}625}{\pi.2{,}5(2{,}5-\sqrt{2{,}5^2-1{,}08^2})}$$

$$HB = 16{,}17\ (\text{kg/mm}^2)$$

Untuk keseluruhan hasil perhitungan dapat dilihat pada tabel dibawah ini:

No	Diameter injakan (mm)	Gaya tekan (F) (kg)	Penetrator diameter (D
1	1,02	15,625	2,5
2	1,02	15,625	2,5
Rata-rata	1,02	15,625	2,5
Standar deviasi			
1	1,03	15,625	2,5
2	1,03	15,625	2,5
Rata-rata	1,03	15,625	2,5
Standar deviasi			
1	1,07	15,625	2,5
2	1,09	15,625	2,5
Rata-rata	1,08	15,625	2,5
Standar deviasi			