

LAMPIRAN

Perhitungan pengujian tarik

Perhitungan pengujian tarik yaitu untuk mengetahui tegangan pada tiap specimen menggunakan rumus :

$$\sigma = \frac{P}{A_0}$$

Dimana :

σ = Tegangan (N/mm²)

P = Beban Tarik (N)

A₀ = Luas penampang specimen awal (mm²)

- 30 % karet silikon

Specimen 1

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{2269}{252} \\ &= 9,00 \text{ Kgf/mm}^2\end{aligned}$$

Specimen 2

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{2317}{252} \\ &= 9,19 \text{ Kgf/mm}^2\end{aligned}$$

Specimen 3

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{2727}{252} \\ &= 10,82 \text{ Kgf/mm}^2\end{aligned}$$

- 40 % karet silikon

Specimen 1

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{1585}{252} \\ &= 6,29 \text{ Kgf/mm}^2\end{aligned}$$

Specimen 2

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{2822}{252} \\ &= 11,20 \text{ Kgf/mm}^2\end{aligned}$$

Specimen 3

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{1558}{252} \\ &= 6,18 \text{ Kgf/mm}^2\end{aligned}$$

- 50 % karet silikon

Specimen 1

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{1746}{252} \\ &= 6,93 \text{ Kgf/mm}^2\end{aligned}$$

Specimen 2

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{2252}{252} \\ &= 8,94 \text{ Kgf/mm}^2\end{aligned}$$

Specimen 3

$$\begin{aligned}\sigma &= \frac{P}{A_0} \\ &= \frac{1949}{252} \\ &= 7,73 \text{ Kgf/mm}^2\end{aligned}$$

Analisa perhitungan jumlah rata-rata tegangan specimen 1,2, dan 3 terhadap presentase karet silikon sebagai penguat material komposit.

$$\text{Jumlah } (\sum^x) = X1 + X2 + X3$$

$$\text{Rata-rata } \bar{x} = \frac{\sum x}{N}$$

1. Hasil perhitungan nilai rata-rata karet silikon 30 % sebagai penguat.

$$\begin{aligned}\text{Jumlah } (\sum^x) &= X1 + X2 + X3 \\ &= 9,00 + 9,19 + 10,82 \\ &= 29,01\end{aligned}$$

$$\begin{aligned}\text{Rata-rata } \bar{x} &= \frac{\sum x}{N} \\ &= \frac{29,01}{3} \\ &= 9,06 \text{ Kgf/mm}^2\end{aligned}$$

2. Hasil perhitungan nilai rata-rata karet silikon 40 % sebagai penguat.

$$\begin{aligned}\text{Jumlah } (\sum^x) &= X1 + X2 + X3 \\ &= 6,29 + 11,20 + 6,18 \\ &= 23,67\end{aligned}$$

$$\text{Rata-rata } \bar{x} = \frac{\sum x}{N}$$

$$= \frac{23,67}{3}$$

$$= 7,89 \text{ Kgf/mm}^2$$

3. Hasil perhitungan nilai rata-rata karet silikon 50 % sebagai penguat.

$$\text{Jumlah } (\sum^x) = X1 + X2 + X3$$

$$= 6,93 + 8,94 + 7,73$$

$$= 23,6$$

$$\text{Rata-rata } \bar{x} = \frac{\sum^x}{N}$$

$$= \frac{23,6}{3}$$

$$= 7,86 \text{ Kgf/mm}^2$$

Dari hasil pengujian impact didapat nilai beta (β) yang digunakan untuk menghitung energy impact dan harga impact dari pengujian setiap specimen.

Berikut perhitungan dari setiap specimen uji impact.

Perhitungan hasil pengujian impact :

1. Perhitungan hasil pengujian impact specimen dengan penguat karet 30%

- a. Specimen 1

Energy impact :

$$E = W \times R (\cos \beta - \cos a)$$

$$= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 36^\circ - \cos 45^\circ)$$

$$= 17,02 \text{ kg.m} \times (0,798 - 0,707)$$

$$= 17,02 \text{ kg.m} \times 0,091$$

$$= 1,548 \text{ kg.m} \rightarrow 1,548 \text{ Joule}$$

Harga impact

$$HI = \frac{E}{A}$$

$$= \frac{1,736 \text{ Joule}}{80 \text{ mm}^2}$$

$$= 0,0217 \text{ Joule/mm}^2$$

b. Specimen 2

Energy impact :

$$\begin{aligned} E &= W \times R (\cos \beta - \cos a) \\ &= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 36^\circ - \cos 45^\circ) \\ &= 17,02 \text{ kg.m} \times (0,798 - 0,707) \\ &= 17,02 \text{ kg.m} \times 0,091 \\ &= 1,548 \text{ kg.m} \rightarrow 1,548 \text{ Joule} \end{aligned}$$

Harga impact

$$\begin{aligned} HI &= \frac{E}{A} \\ &= \frac{1,736 \text{ Joule}}{80 \text{ mm}^2} \\ &= 0,0217 \text{ Joule/mm}^2 \end{aligned}$$

c. Specimen 3

Energy impact :

$$\begin{aligned} E &= W \times R (\cos \beta - \cos a) \\ &= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 36^\circ - \cos 45^\circ) \\ &= 17,02 \text{ kg.m} \times (0,798 - 0,707) \\ &= 17,02 \text{ kg.m} \times 0,091 \\ &= 1,548 \text{ kg.m} \rightarrow 1,548 \text{ Joule} \end{aligned}$$

Harga impact

$$\begin{aligned} HI &= \frac{E}{A} \\ &= \frac{1,736 \text{ Joule}}{80 \text{ mm}^2} \\ &= 0,0217 \text{ Joule/mm}^2 \end{aligned}$$

2. Perhitungan hasil pengujian impact specimen dengan penguat karet 40%

a. Specimen 1

Energy impact :

$$\begin{aligned} E &= W \times R (\cos \beta - \cos a) \\ &= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 37^\circ - \cos 45^\circ) \\ &= 17,02 \text{ kg.m} \times (0,803 - 0,707) \\ &= 17,02 \text{ kg.m} \times 0,096 \\ &= 1,633 \text{ kg.m} \rightarrow 1,633 \text{ Joule} \end{aligned}$$

Harga impact

$$\begin{aligned} HI &= \frac{E}{A} \\ &= \frac{1,633 \text{ Joule}}{80 \text{ mm}^2} \\ &= 0,0193 \text{ Joule/mm}^2 \end{aligned}$$

b. Specimen 2

Energy impact :

$$\begin{aligned} E &= W \times R (\cos \beta - \cos a) \\ &= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 36^\circ - \cos 45^\circ) \\ &= 17,02 \text{ kg.m} \times (0,798 - 0,707) \\ &= 17,02 \text{ kg.m} \times 0,091 \\ &= 1,548 \text{ kg.m} \rightarrow 1,548 \text{ Joule} \end{aligned}$$

Harga impact

$$\begin{aligned} HI &= \frac{E}{A} \\ &= \frac{1,736 \text{ Joule}}{80 \text{ mm}^2} \\ &= 0,0217 \text{ Joule/mm}^2 \end{aligned}$$

c. Specimen 3

Energy impact :

$$E = W \times R (\cos \beta - \cos a)$$

$$\begin{aligned}
&= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 36^\circ - \cos 45^\circ) \\
&= 17,02 \text{ kg.m} \times (0,798 - 0,707) \\
&= 17,02 \text{ kg.m} \times 0,091 \\
&= 1,548 \text{ kg.m} \rightarrow 1,548 \text{ Joule}
\end{aligned}$$

Harga impact

$$\begin{aligned}
HI &= \frac{E}{A} \\
&= \frac{1,736 \text{ Joule}}{80 \text{ mm}^2} \\
&= 0,0217 \text{ Joule/mm}^2
\end{aligned}$$

3. Perhitungan hasil pengujian impact specimen dengan penguat karet 50%

a. Specimen 1

Energy impact :

$$\begin{aligned}
E &= W \times R (\cos \beta - \cos a) \\
&= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 38^\circ - \cos 45^\circ) \\
&= 17,02 \text{ kg.m} \times (0,788 - 0,707) \\
&= 17,02 \text{ kg.m} \times 0,081 \\
&= 1,378 \text{ kg.m} \rightarrow 1,378 \text{ Joule}
\end{aligned}$$

Harga impact

$$\begin{aligned}
HI &= \frac{E}{A} \\
&= \frac{1,378 \text{ Joule}}{80 \text{ mm}^2} \\
&= 0,0172 \text{ Joule/mm}^2
\end{aligned}$$

b. Specimen 2

Energy impact :

$$\begin{aligned}
E &= W \times R (\cos \beta - \cos a) \\
&= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 37^\circ - \cos 45^\circ) \\
&= 17,02 \text{ kg.m} \times (0,803 - 0,707)
\end{aligned}$$

$$= 17,02 \text{ kg.m} \times 0,096$$

$$= 1,633 \text{ kg.m} \rightarrow 1,633 \text{ Joule}$$

Harga impact

$$HI = \frac{E}{A}$$

$$= \frac{1,633 \text{ Joule}}{80 \text{ mm}^2}$$

$$= 0,0193 \text{ Joule/mm}^2$$

c. Specimen 3

Energy impact :

$$E = W \times R (\cos \beta - \cos a)$$

$$= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 37^\circ - \cos 45^\circ)$$

$$= 17,02 \text{ kg.m} \times (0,803 - 0,707)$$

$$= 17,02 \text{ kg.m} \times 0,096$$

$$= 1,633 \text{ kg.m} \rightarrow 1,633 \text{ Joule}$$

Harga impact

$$HI = \frac{E}{A}$$

$$= \frac{1,633 \text{ Joule}}{80 \text{ mm}^2}$$

$$= 0,0193 \text{ Joule/mm}^2$$

$$HI = \frac{E}{A}$$

$$= \frac{1,633 \text{ Joule}}{80 \text{ mm}^2}$$

$$= 0,0193 \text{ Joule/mm}^2$$

d. Specimen 3

Energy impact :

$$\begin{aligned} E &= W \times R (\cos \beta - \cos a) \\ &= 26,32 \text{ kg} \times 0,647 \text{ m} (\cos 37^\circ - \cos 45^\circ) \\ &= 17,02 \text{ kg.m} \times (0,803 - 0,707) \\ &= 17,02 \text{ kg.m} \times 0,096 \\ &= 1,633 \text{ kg.m} \rightarrow 1,633 \text{ Joule} \end{aligned}$$

Harga impact

$$\begin{aligned} HI &= \frac{E}{A} \\ &= \frac{1,633 \text{ Joule}}{80 \text{ mm}^2} \\ &= 0,0193 \text{ Joule/mm}^2 \end{aligned}$$




DATA PENGUJIAN IMPAK

Nama : **I Made Agung Dwipayana**
NIM/ : **1811926**
Jurusan : **Teknik Mesin S1**
Hari / Tanggal : **Kamis / 11 Desember 2019**
Specimen : **Komposit Serat Karbon, Karet , Rami dan Kenaf**

Variasi Prosentase Karet	Jumlah Sample	l (mm)	b (mm)	t (mm)	h (mm)	Luas (mm ²)	α (°)	β (°)	Energi (Joule)	HI (Joule/mm)
30 %	1	55	10	10	8	80	45	36	1,7354	0,0217
	2	55	10	10	8	80	45	36	1,7354	0,0217
	3	55	10	10	8	80	45	36	1,7354	0,0217
40 %	1	55	10	10	8	80	45	37	1,5586	0,0195
	2	55	10	10	8	80	45	36	1,7354	0,0217
	3	55	10	10	8	80	45	36	1,7354	0,0217
50 %	1	55	10	10	8	80	45	38	1,3777	0,0172
	2	55	10	10	8	80	45	37	1,5586	0,0195
	3	55	10	10	8	80	45	37	1,5586	0,0195

Malang, 11 Desember 2019
Kepala Laboratorium Uji Material


Ir. Teguh Rahardjo, MT
NIP. 195706011992021001




INSTITUT TEKNOLOGI NASIONAL MALANG
FAKULTAS TEKNOLOGI INDUSTRI JURUSAN TEKNIK MESIN
LABORATORIUM PENGUJIAN MATERIAL
Jl. Raya Karanglo Km. 2 Telp. (0341) 417636 Ext. 511 Malang

Nama : **I Made Agung Dwipayana**
NIM/ : **1811926**
Jurusan : **Teknik Mesin S1**
Hari / Tanggal : **Kamis / 11 Desember 2019**
Specimen : **Komposit Serat Karbon, Karet , Rami dan Kenaf**

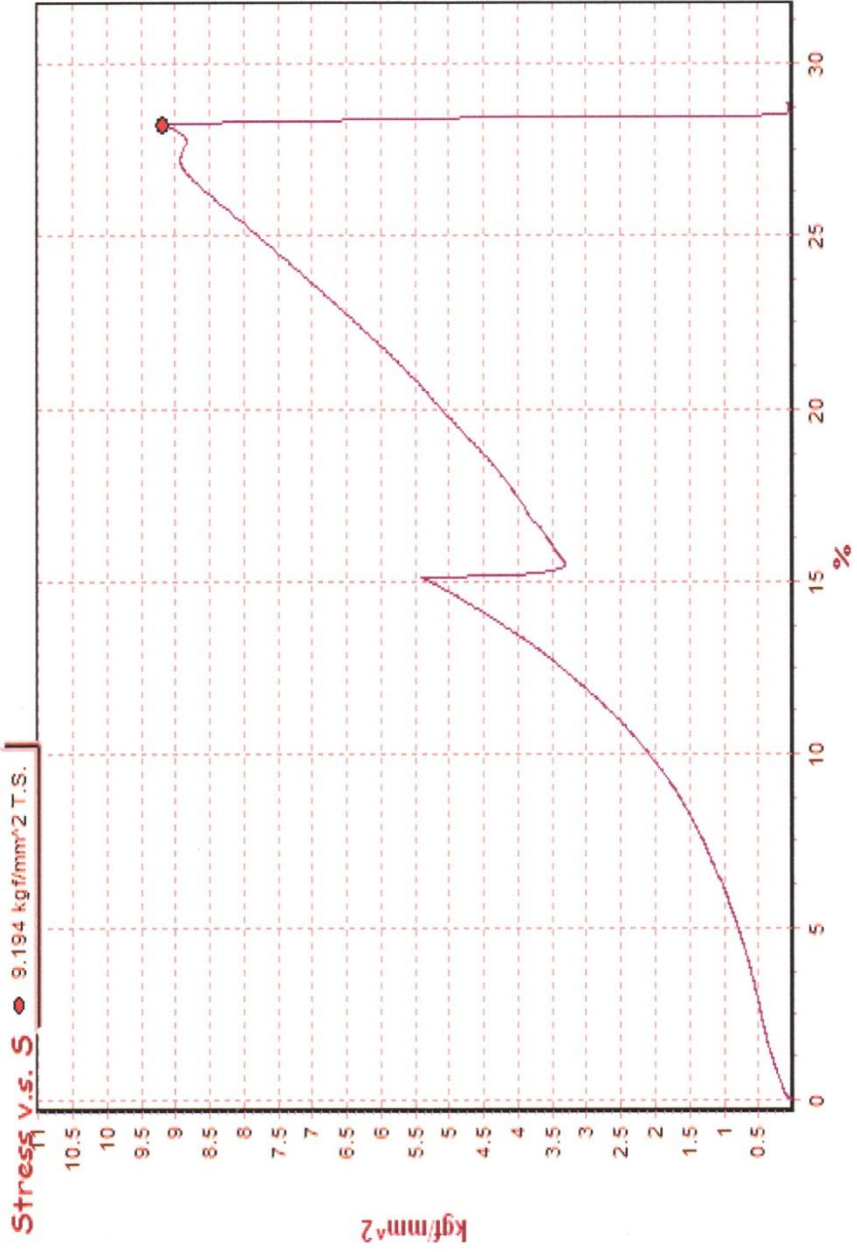
TEST REPORT PENGUJIAN TARIK

No	Variasi Prosentase Karet	Jumlah Speciment	Area Mm ²	Max Force Kgf	0.2 % Y.S Kgf/mm ²	Tensile Straing Kgf/mm ²	Elongition (%)
1	30 %	1	252	2269	4.27	9.00	24
		2	252	2317	4.64	9.19	28
		3	252	2727	7.37	10.82	31
2	40 %	1	252	1585	3.07	6.29	25
		2	252	2822	4.85	11.20	19
		3	252	1558	2.55	6.18	11
3	50 %	1	252	1746	2.97	6.93	11
		2	252	2253	3.76	8.94	39
		3	252	1949	3.30	7.73	20

Malang, 11 Desember 2019
Kepala Laboratorium Pengujian Material

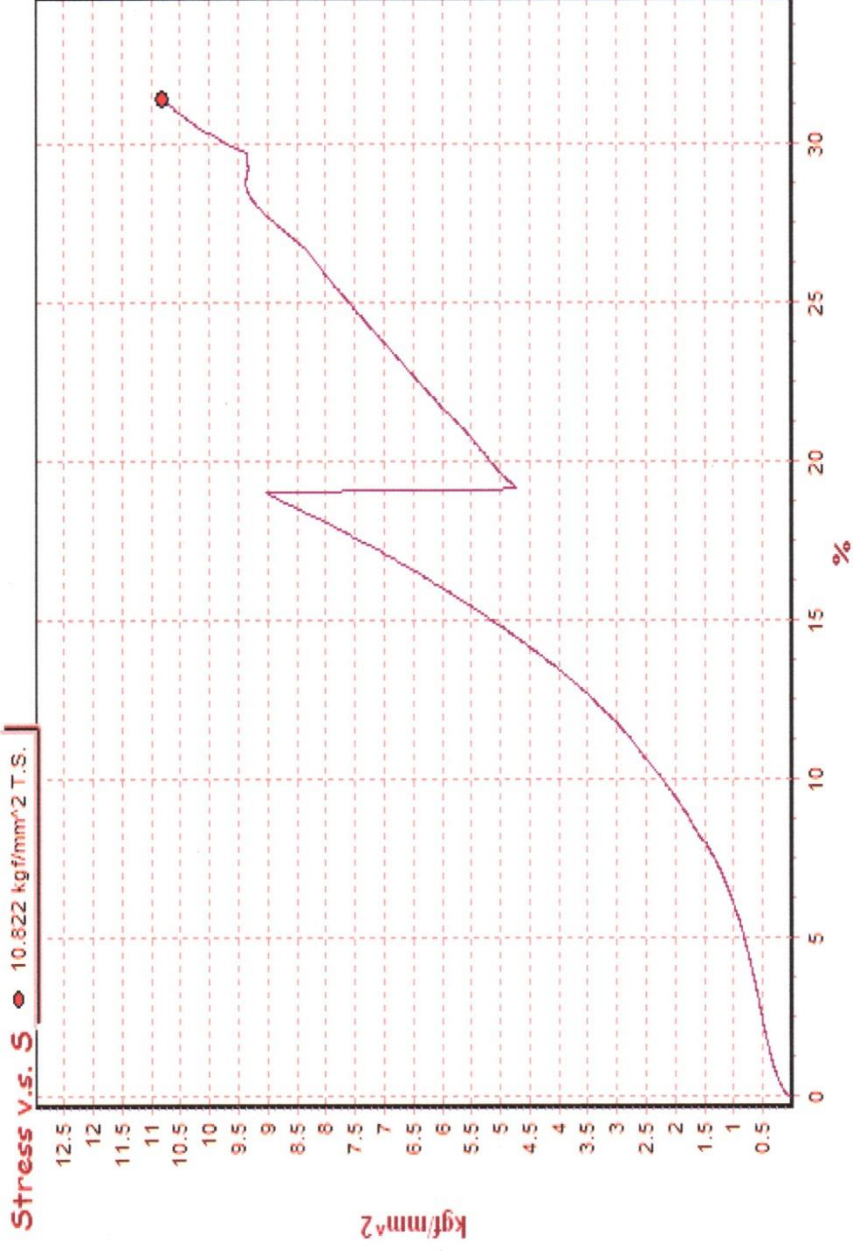

Ir. Teguh Rahardjo, MT
NIP. 195706011992021001

20% B



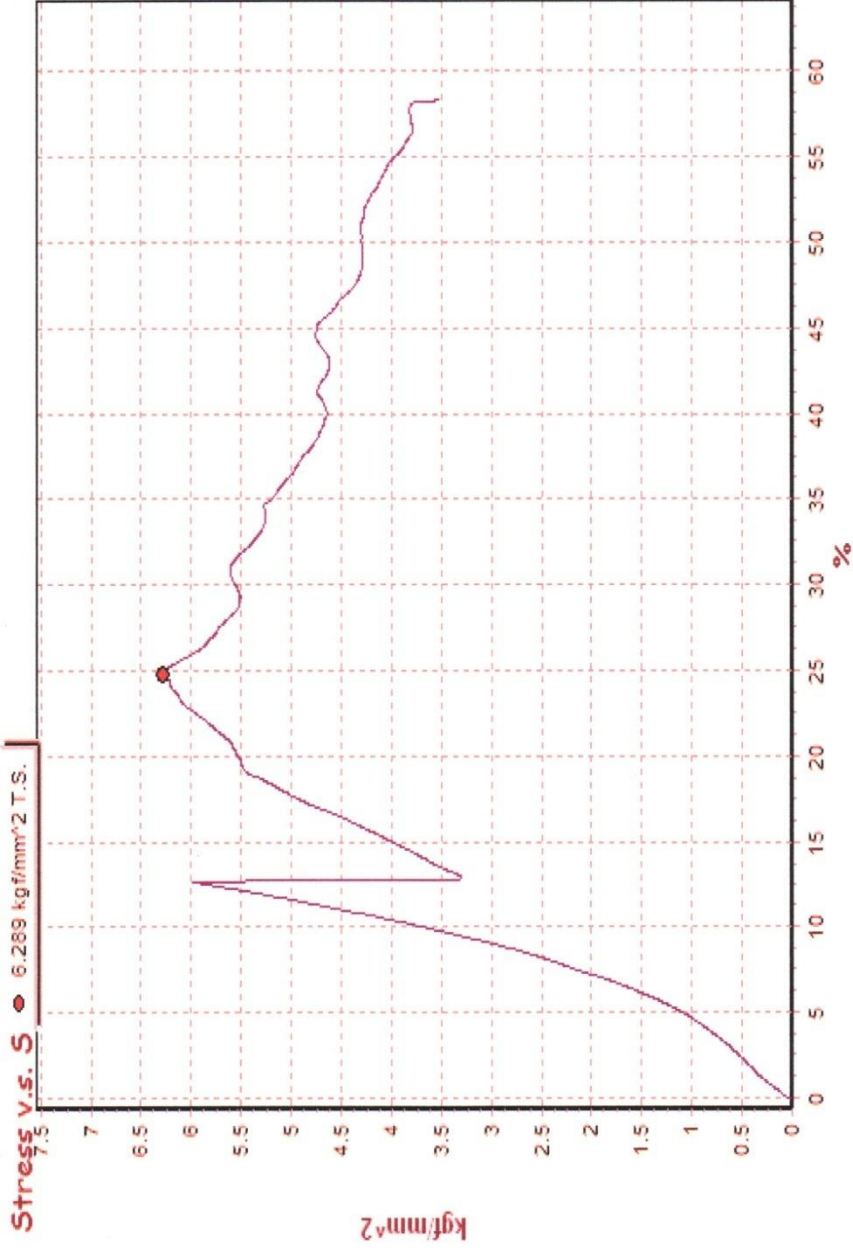
301-003

30% c



301-004

40% A



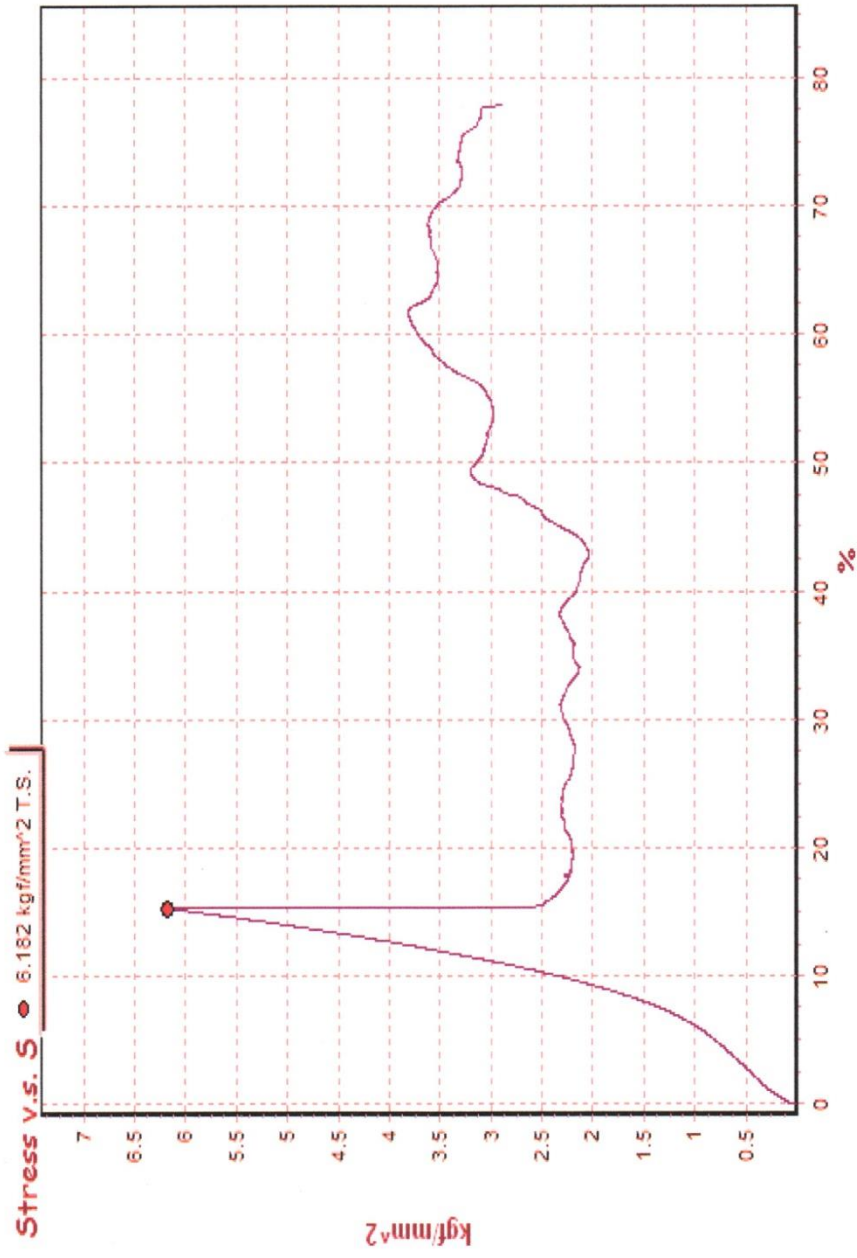
301-006

407.8



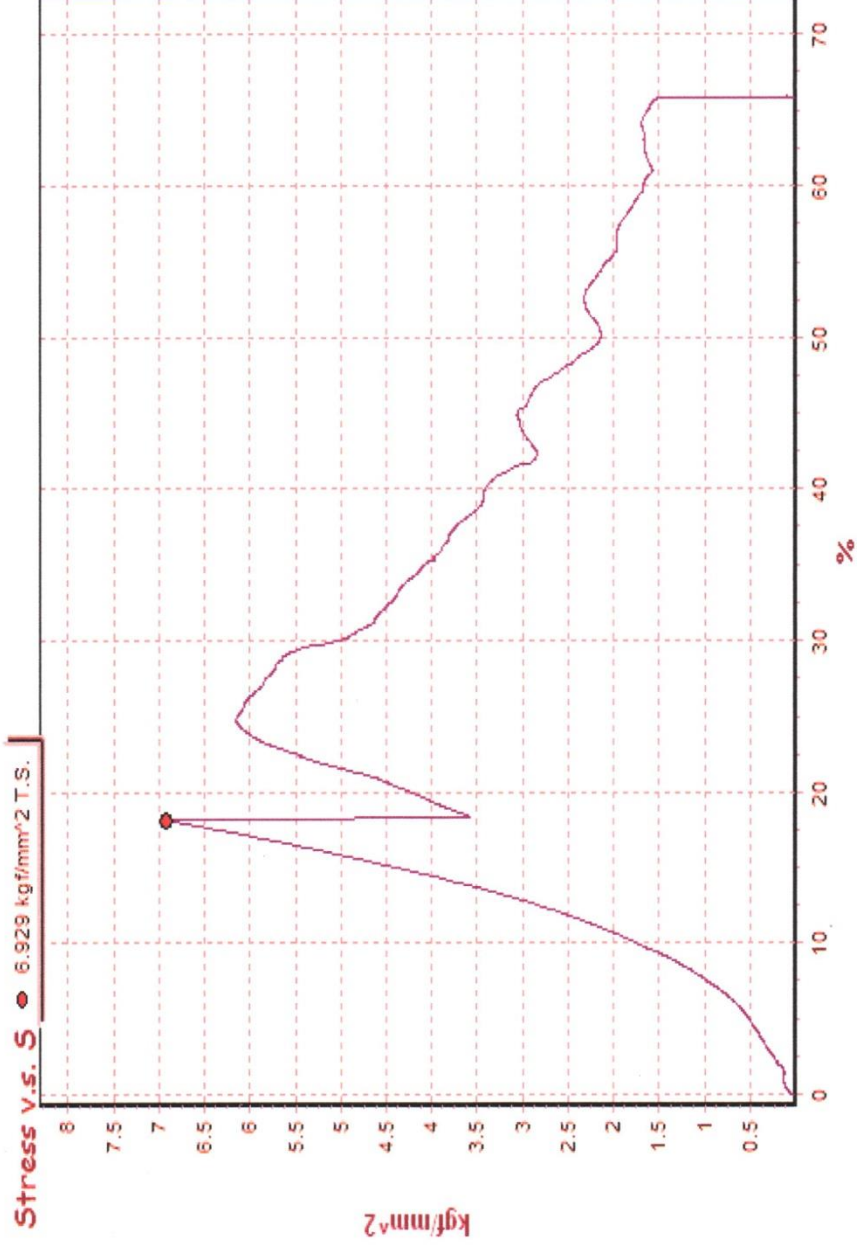
301-007

409 C



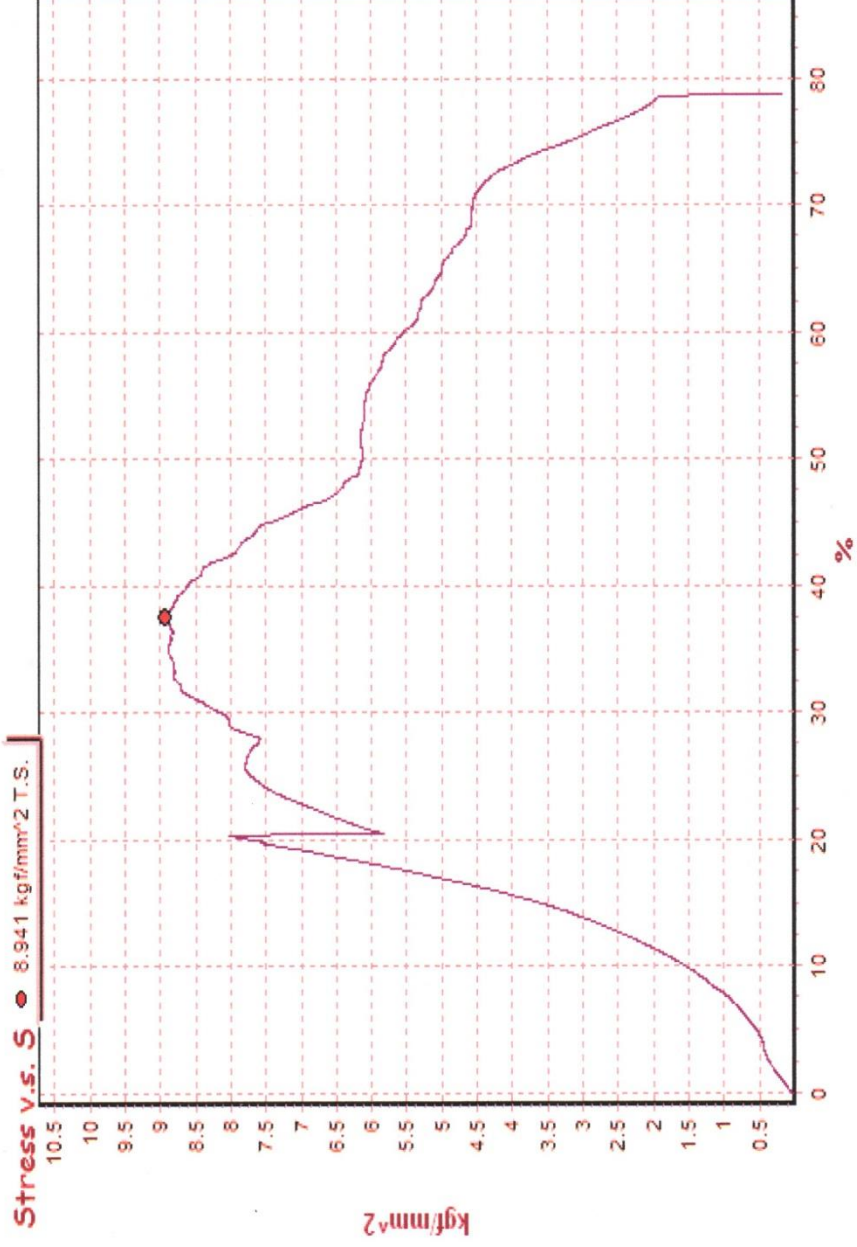
301-005

50% / A



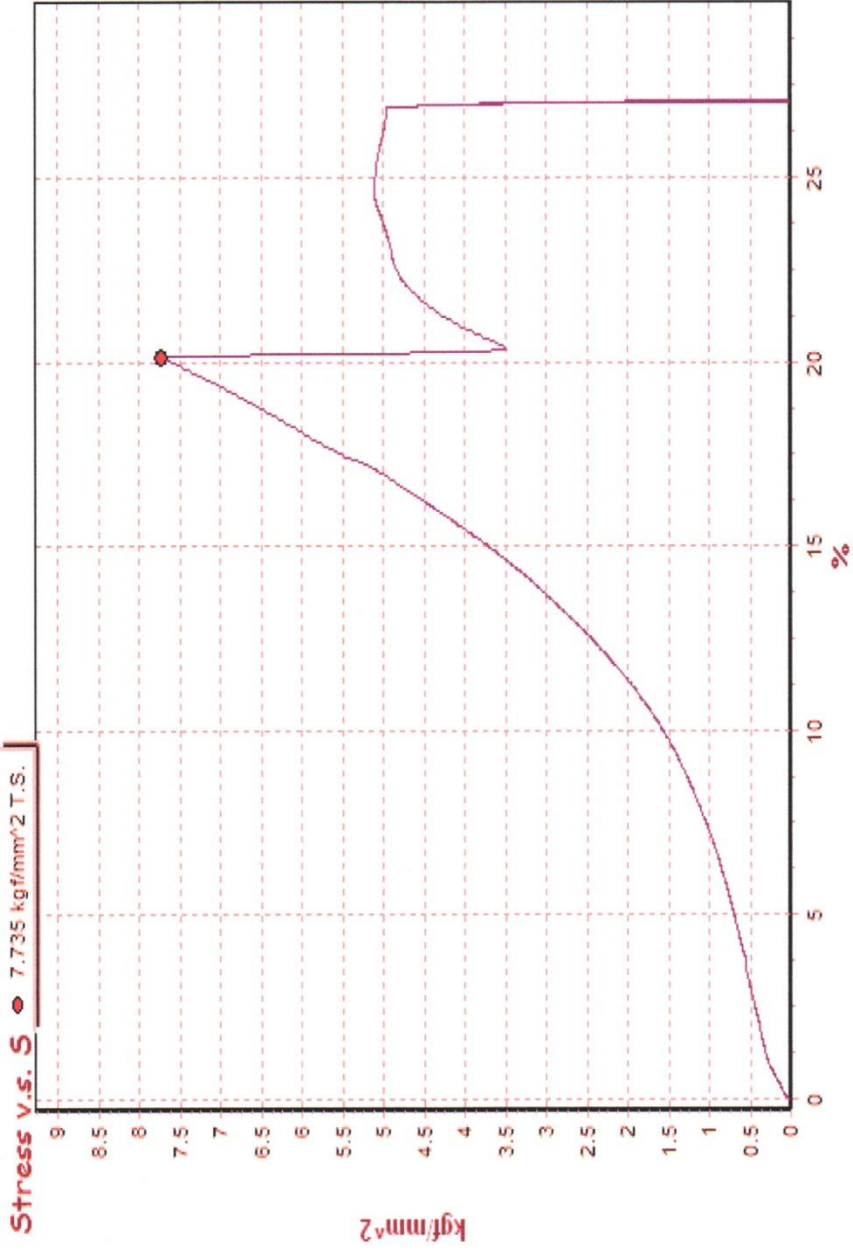
301-009

S26/B



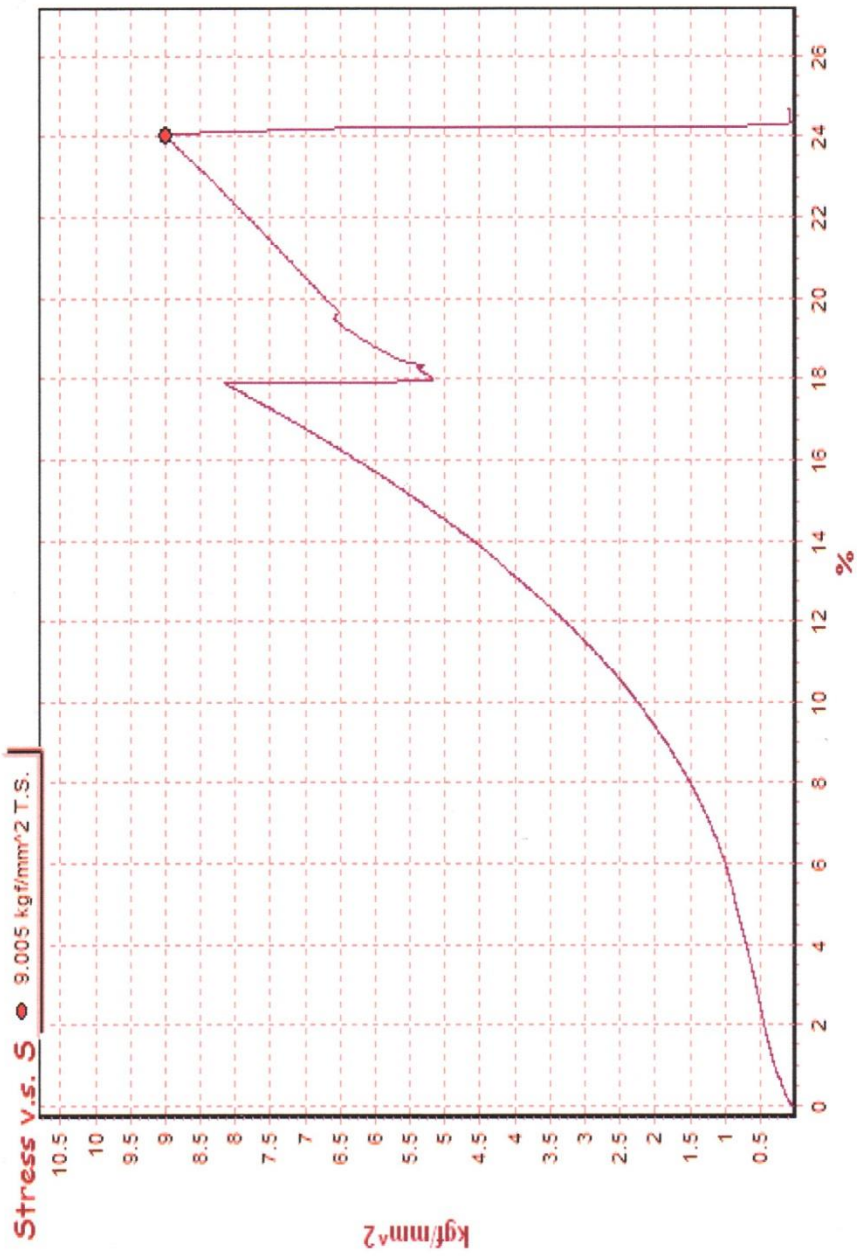
301-010

σ_0/c



301-011

302/A



301-002