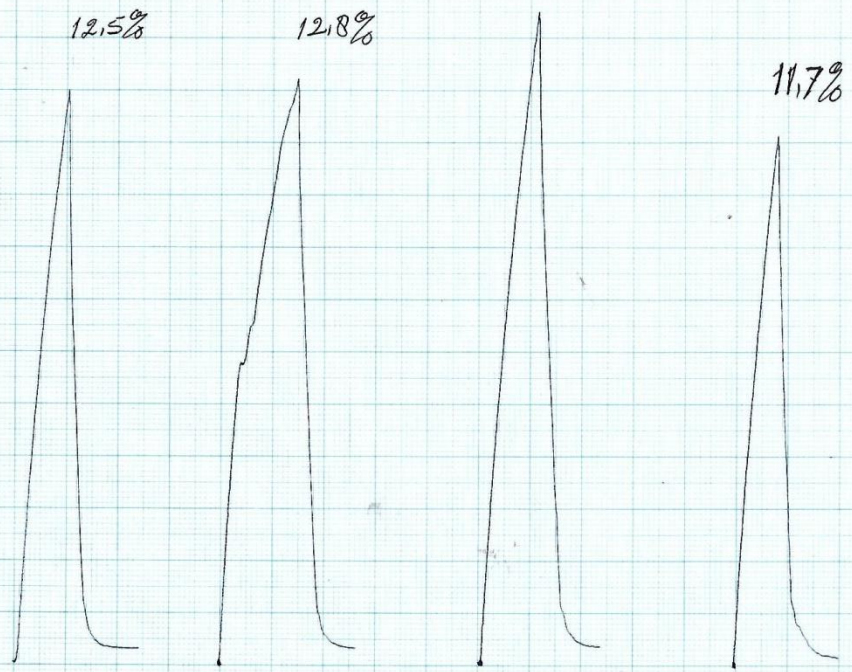
LAMPIRAN

VI-1

Beban yang diterapkan
2 ton

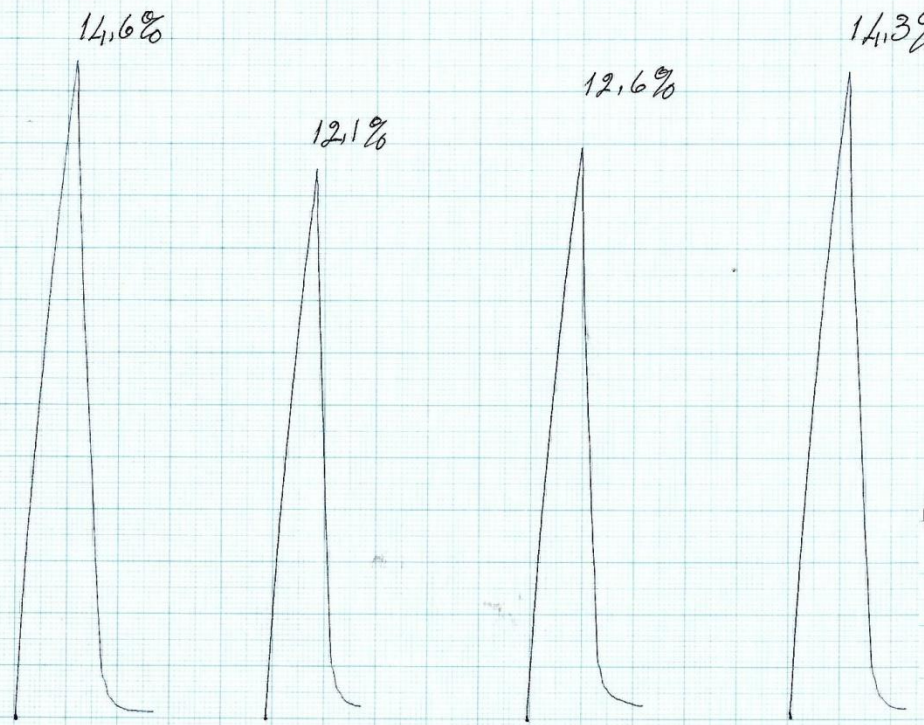


Yogyakarta, 26/07-2

Suwahjo

VI-2

Beban pengerjaan
2 Ton



Yogyakarta, 26/07-2

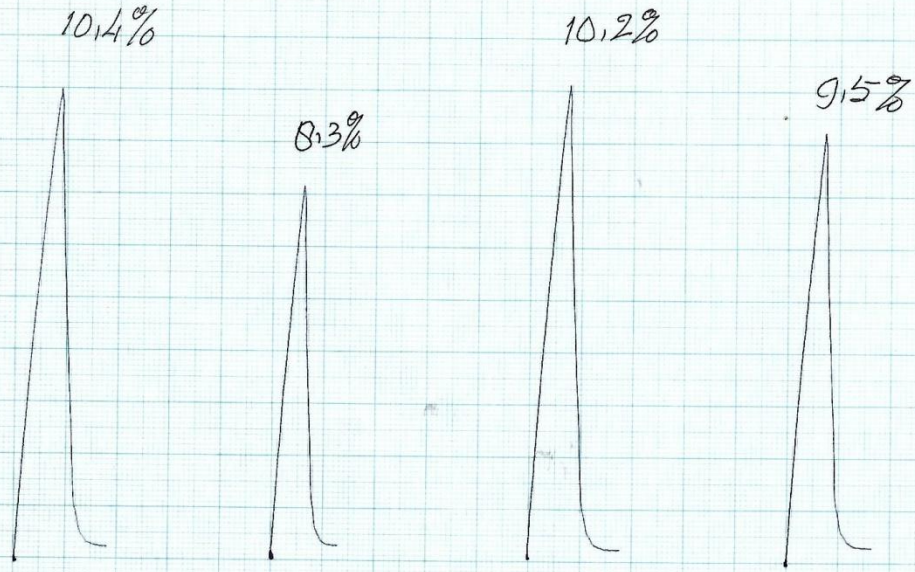
Suwahjo

PM

Beban yg diterapkan
2 ton

Yogyakarta, 26/07-2

Sutrajo



Pengujian Tarik

Perhitungan pengujian tarik koposit metode *Vaccum Infusion* dengan aliran masuk resin dari samping (VI-1)

1. Spesimen A1

    a. Luas penampang spesimen A1

    Diketahui : Tebal spesimen (t) = 1,15 mm

    Lebar spesimen (l) = 13,02 mm

Ditanyakan A (Luas penampang spesimen) ?

$$A = t \times l$$

$$= 1{,}15 \times 13{,}02$$

$$= 14{,}97 \text{ mm}^2$$

b. Tegangan spesimen A1

$$\sigma = \frac{F}{A}$$

$$F = \frac{12{,}5}{100} \times 2000 \text{ kg} \times 9{,}8 \text{ m/s}^2$$

$$F = 2450 \text{ N}$$

Maka $\sigma = \frac{F}{A}$

$$\sigma = \frac{2450}{14{,}97}$$

$$\sigma = 163{,}63 \text{ N/mm}^2$$

c. Regangan spesimen A1

$$\varepsilon = \frac{\Delta L}{L}$$

$$\varepsilon = \frac{0{,}86}{164{,}73} \times 100$$

$$\varepsilon = 0{,}52\ \%$$

d. Modulus elastisitas spesimen A1

$$E = \frac{\sigma}{\varepsilon}$$

$E = \frac{163,63}{0,52\ \%}$

$E = 31342,35\ N/mm^2 = 31,34\ GPa$

2. Spesimen A2

   a. Luas penampang spesimen A2

      Diketahui : Tebal spesimen (t) = 1,19 mm

      Lebar spesimen (l) = 13,12 mm

      Ditanyakan A (Luas penampang spesimen) ?

      $A = t \times l$

      $= 1,19 \times 13,12$

      $= 15,61\ mm^2$

   b. Tegangan spesimen A2

      $\sigma = \frac{F}{A}$

      $F = \frac{12,8}{100} \times 2000\ kg \times 9,8\ m/s^2$

      $F = 2508,8\ N$

      Maka $\sigma = \frac{F}{A}$

      $\sigma = \frac{2508,8}{15,61}$

      $\sigma = 160,69\ N/mm^2$

c. Regangan spesimen A2

$\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{0,85}{165,09}$ x 100

ε = 0,515 %

d. Modulus elastisitas spesimen A2

$E = \frac{\sigma}{\varepsilon}$

$E = \frac{160,09}{0,515\ \%}$

E = 31209,52 N/mm^2 = 31,2 GPa

3. Spesimen A3

a. Luas penampang spesimen A1

Diketahui : Tebal spesimen (t) = 1,17 mm

Lebar spesimen (l) = 13,22 mm

Ditanyakan A (Luas penampang spesimen) ?

A = t x l

= 1,17 x 13,22

= 15,46 mm^2

b. Tegangan spesimen A3

$\sigma = \frac{F}{A}$

F = $\frac{14,4}{100}$ x 2000 kg x 9,8 m/s^2

F = 2822,4 N

Maka $\sigma = \frac{F}{A}$

$\sigma = \frac{2822,4}{15,46}$

σ = 182,47 N/mm^2

c. Regangan spesimen A3

$\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{0,67}{165,23}$ x 100

ε = 0,4 %

d. Modulus elastisitas spesimen A3

E = $\frac{\sigma}{\varepsilon}$

E = $\frac{182,47}{0,4\ \%}$

E = 45000,29 N/mm^2 = 45 GPa

4. Spesimen A4

a. Luas penampang spesimen A4

Diketahui : Tebal spesimen (t) = 1,16 mm

Lebar spesimen (l) = 12,58 mm

Ditanyakan A (Luas penampang spesimen) ?

$$A = t \times l$$

$$= 1{,}16 \times 12{,}58$$

$$= 14{,}59 \text{ mm}^2$$

b. Tegangan spesimen A4

$$\sigma = \frac{F}{A}$$

$$F = \frac{11{,}7}{100} \times 2000 \text{ kg} \times 9{,}8 \text{ m/s}^2$$

$$F = 2293{,}2 \text{ N}$$

Maka $$\sigma = \frac{F}{A}$$

$$\sigma = \frac{2293{,}2}{14{,}59}$$

$$\sigma = 157{,}15 \text{ N/mm}^2$$

c. Regangan spesimen A4

$$\varepsilon = \frac{\Delta L}{L}$$

$$\varepsilon = \frac{0{,}81}{164{,}95} \times 100$$

$$\varepsilon = 0{,}49\ \%$$

d. Modulus elastisitas spesimen A4

$$E = \frac{\sigma}{\varepsilon}$$

$$E = \frac{157{,}15}{0{,}49\ \%}$$

$$E = 32001{,}52 \text{ N/mm}^2 = 32{,}01 \text{ GPa}$$

5. Nilai tegangan rata-rata keempat spesimen

$$\sigma_{\text{(rata-rata)}} = \frac{\sigma 1 + \sigma 2 + \sigma 3 + \sigma 4}{4}$$

$$= \frac{163{,}63 + 160{,}69 + 182{,}47 + 157{,}15}{4}$$

$$= 179{,}69 \text{ MPa}$$

6. Nilai rata-rata regangan keempat spesimen

$$\varepsilon_{\text{(rata-rata)}} = \frac{\varepsilon 1 + \varepsilon 2 + \varepsilon 3 + \varepsilon 4}{4}$$

$$= \frac{0{,}52 + 0{,}51 + 0{,}40 + 0{,}49}{4}$$

$$= 0{,}48\ \%$$

7. Nilai rata-rata modulus elastisitas dari keempat spesimen

$$E_{\text{(rata-rata)}} = \frac{E1 + E2 + E3 + E4}{4}$$

$$= \frac{31{,}34 + 31{,}21 + 45{,}00 + 32{,}00}{4}$$

$$= 34{,}89 \text{ GPa}$$

Perhitungan pengujian tarik koposit metode *Vaccum Infusion* dengan aliran masuk resin dari tengah (VI-2)

1. Spesimen B1
    a. Luas penampang spesimen B1

        Diketahui : Tebal spesimen (t) = 0,94 mm

        Lebar spesimen (l) = 12,98 mm

        Ditanyakan A (Luas penampang spesimen) ?

$$A = t \times l$$

$$= 0{,}94 \times 12{,}98$$

$$= 12{,}2 \text{ mm}^2$$

b. Tegangan spesimen B1

$$\sigma = \frac{F}{A}$$

$$F = \frac{14{,}6}{100} \times 2000 \text{ kg} \times 9{,}8 \text{ m/s}^2$$

$$F = 2861{,}6 \text{ N}$$

Maka $$\sigma = \frac{F}{A}$$

$$\sigma = \frac{2861{,}6}{12{,}2}$$

$$\sigma = 234{,}5 \text{ N/mm}^2$$

c. Regangan spesimen B1

$$\varepsilon = \frac{\Delta L}{L}$$

$$\varepsilon = \frac{1{,}03}{164{,}6} \times 100$$

$$\varepsilon = 0{,}62\ \%$$

d. Modulus elastisitas spesimen B1

$$E = \frac{\sigma}{\varepsilon}$$

$$E = \frac{234{,}5}{0{,}62\ \%}$$

$$E = 37525{,}49 \text{ N/mm}^2 = 37{,}52 \text{ GPa}$$

2. Spesimen B2

   a. Luas penampang spesimen B2

      Diketahui : Tebal spesimen (t) = 0,95 mm

      Lebar spesimen (l) = 13,14 mm

      Ditanyakan A (Luas penampang spesimen) ?

      $A = t \times l$

      $= 0{,}95 \times 13{,}14$

      $= 12{,}48\ mm^2$

   b. Tegangan spesimen B2

      $\sigma = \frac{F}{A}$

      $F = \frac{12{,}1}{100} \times 2000\ kg \times 9{,}8\ m/s^2$

      $F = 2371{,}6\ N$

      Maka $\sigma = \frac{F}{A}$

      $\sigma = \frac{2371{,}6}{12{,}48}$

      $\sigma = 189{,}99\ N/mm^2$

   c. Regangan spesimen B2

      $\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{1,07}{165,39}$ x 100

ε = 0,64 %

d. Modulus elastisitas spesimen B2

$E = \frac{\sigma}{\varepsilon}$

$E = \frac{165,39}{0,64\ \%}$

E = 28366,21 N/mm^2 = 28,36 GPa

3. Spesimen B3

a. Luas penampang spesimen B3

Diketahui : Tebal spesimen (t) = 0,95 mm

Lebar spesimen (l) = 13,08 mm

Ditanyakan A (Luas penampang spesimen) ?

A = t x l

= 0,95 x 13,08

= 12,42 mm^2

b. Tegangan spesimen B3

$\sigma = \frac{F}{A}$

$F = \frac{12,6}{100}$ x 2000 kg x 9,8 m/s^2

F = 2469,6 N

Maka $\sigma = \frac{F}{A}$

$\sigma = \frac{2469,6}{12,42}$

$\sigma = 198,74\ N/mm^2$

c. Regangan spesimen B3

$\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{1,12}{165,52} \times 100$

$\varepsilon = 0,67\ \%$

d. Modulus elastisitas spesimen B3

$E = \frac{\sigma}{\varepsilon}$

$E = \frac{198,74}{0,67\ \%}$

$E = 29371,61\ N/mm^2 = 29,37\ GPa$

4. Spesimen B4

a. Luas penampang spesimen B4

Diketahui : Tebal spesimen (t) = 1,06 mm

Lebar spesimen (l) = 12,98 mm

Ditanyakan A (Luas penampang spesimen) ?

A = t x l

= 1.06 x 12,98

= 13,75 mm^2

b. Tegangan spesimen B4

$\sigma = \frac{F}{A}$

F = $\frac{14,3}{100}$ x 2000 kg x 9,8 m/s^2

F = 2802,8 N

Maka $\sigma = \frac{F}{A}$

$\sigma = \frac{2802,8}{13,75}$

σ = 203,71 N/mm^2

c. Regangan spesimen B4

$\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{1,29}{165,34}$ x 100

ε = 0,78 %

d. Modulus elastisitas spesimen B4

E = $\frac{\sigma}{\varepsilon}$

E = $\frac{203,71}{0,78\ \%}$

E = 26109,57 N/mm^2 = 26,11 GPa

5. Nilai tegangan rata-rata keempat spesimen

$$\sigma_{(\text{rata-rata})} = \frac{\sigma 1 + \sigma 2 + \sigma 3 + \sigma 4}{4}$$

$$= \frac{234{,}53 + 189{,}99 + 198{,}74 + 203{,}71}{4}$$

$$= 206{,}74 \text{ MPa}$$

6. Nilai rata-rata regangan keempat spesimen

$$\varepsilon_{(\text{rata-rata})} = \frac{\varepsilon 1 + \varepsilon 2 + \varepsilon 3 + \varepsilon 4}{4}$$

$$= \frac{0{,}62 + 0{,}64 + 0{,}67 + 0{,}78}{4}$$

$$= 0{,}68 \%$$

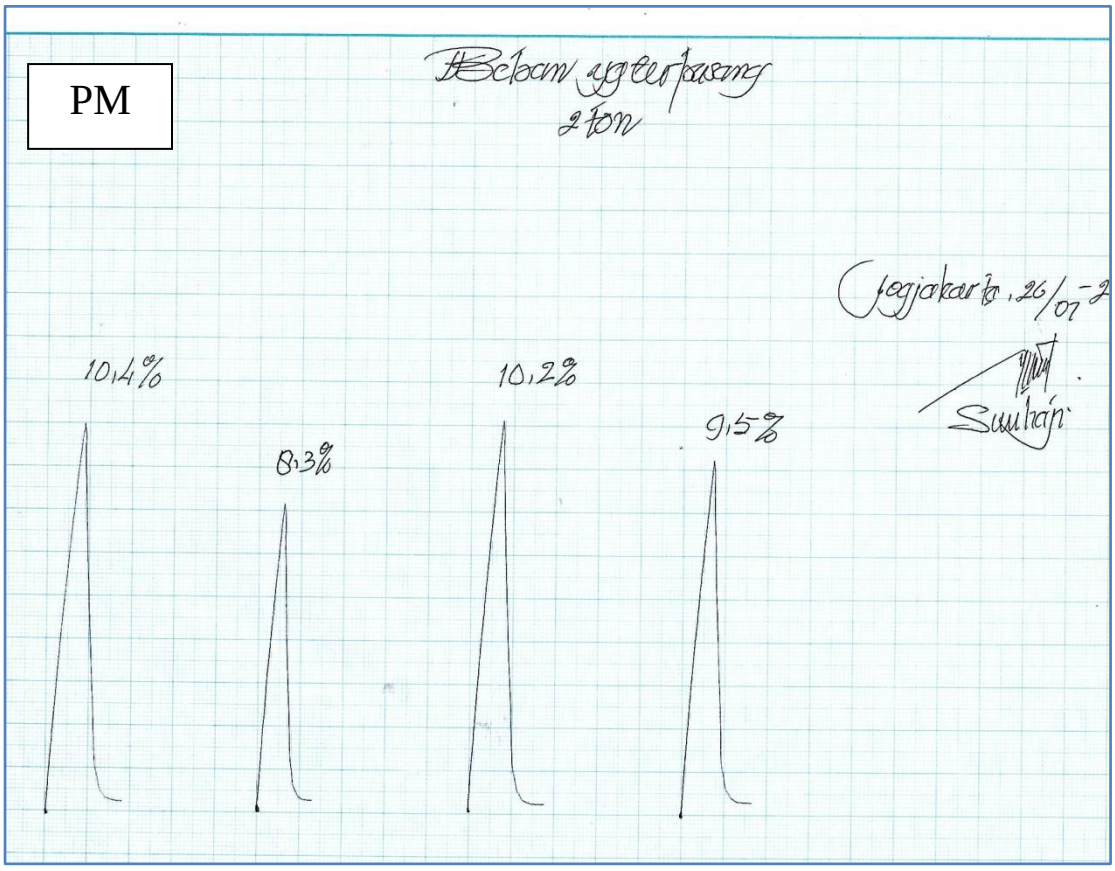
7. Nilai rata-rata modulus elastisitas dari keempat spesimen

$$E_{(\text{rata-rata})} = \frac{E1 + E2 + E3 + E4}{4}$$

$$= \frac{37{,}53 + 29{,}37 + 29{,}37 + 26{,}11}{4}$$

$$= 30{,}59 \text{ GPa}$$

Perhitungan pengujian tarik koposit metode *Press Mold*



1. Spesimen C1

    a. Luas penampang spesimen C1

    Diketahui : Tebal spesimen (t) = 1,23 mm

    Lebar spesimen (l) = 13,03 mm

Ditanyakan A (Luas penampang spesimen) ?

$$A = t \times l$$

$$= 1{,}32 \times 13{,}03$$

$$= 16{,}02 \text{ mm}^2$$

b. Tegangan spesimen C1

$$\sigma = \frac{F}{A}$$

$$F = \frac{10{,}4}{100} \times 2000 \text{ kg} \times 9{,}8 \text{ m/s}^2$$

$$F = 2038{,}4 \text{ N}$$

Maka $\sigma = \frac{F}{A}$

$$\sigma = \frac{2038{,}4}{16{,}02}$$

$$\sigma = 127{,}19 \text{ N/mm}^2$$

c. Regangan spesimen C1

$$\varepsilon = \frac{\Delta L}{L}$$

$$\varepsilon = \frac{0{,}42}{164{,}9} \times 100$$

$$\varepsilon = 0{,}25\ \%$$

d. Modulus elastisitas spesimen C1

$$E = \frac{\sigma}{\varepsilon}$$

$E = \frac{127,19}{0,25\ \%}$

$E = 49935,71\ N/mm^2 = 49,93\ GPa$

2. Spesimen C2

   a. Luas penampang spesimen C2

      Diketahui : Tebal spesimen (t) = 1,14 mm

      Lebar spesimen (l) = 12,98 mm

      Ditanyakan A (Luas penampang spesimen) ?

      $A = t \times l$

      $= 1,14 \times 12,98$

      $= 14,79\ mm^2$

   b. Tegangan spesimen C2

      $\sigma = \frac{F}{A}$

      $F = \frac{8,3}{100} \times 2000\ kg \times 9,8\ m/s^2$

      $F = 1626,8\ N$

      Maka $\sigma = \frac{F}{A}$

      $\sigma = \frac{1626,8}{14,79}$

      $\sigma = 109,94\ N/mm^2$

c. Regangan spesimen C2

$\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{0,34}{165,77}$ x 100

ε = 0,20 %

d. Modulus elastisitas spesimen C2

$E = \frac{\sigma}{\varepsilon}$

$E = \frac{109,94}{0,20\ \%}$

E = 53602,08 N/mm^2 = 53,6 GPa

3. Spesimen C3

a. Luas penampang spesimen C3

Diketahui : Tebal spesimen (t) = 1,18 mm

Lebar spesimen (l) = 13,13 mm

Ditanyakan A (Luas penampang spesimen) ?

A = t x l

= 1,18 x 13,13

= 15,49 mm^2

b. Tegangan spesimen C3

$\sigma = \frac{F}{A}$

F = $\frac{10,2}{100}$ x 2000 kg x 9,8 m/s^2

F = 1999,2 N

Maka $\sigma = \frac{F}{A}$

$\sigma = \frac{1999,2}{15,49}$

σ = 129,04 N/mm^2

c. Regangan spesimen C3

$\varepsilon = \frac{\Delta L}{L}$

$\varepsilon = \frac{0,71}{165,41}$ x 100

ε = 0,42%

d. Modulus elastisitas spesimen C3

E = $\frac{\sigma}{\varepsilon}$

E = $\frac{129,04}{0,42\ \%}$

E = 30061,66 N/mm^2 = 30,06 GPa

4. Spesimen C4

a. Luas penampang spesimen C4

Diketahui : Tebal spesimen (t) = 1,11 mm

Lebar spesimen (l) = 12,86 mm

Ditanyakan A (Luas penampang spesimen) ?

$$A = t \times l$$

$$= 1.11 \times 12{,}86$$

$$= 14{,}27 \ mm^2$$

b. Tegangan spesimen C4

$$\sigma = \frac{F}{A}$$

$$F = \frac{9{,}5}{100} \text{ x } 2000 \text{ kg x } 9{,}8 \text{ m/s}^2$$

$$F = 1862 \text{ N}$$

Maka $$\sigma = \frac{F}{A}$$

$$\sigma = \frac{1862}{14{,}27}$$

$$\sigma = 130{,}44 \text{ N/mm}^2$$

c. Regangan spesimen B4

$$\varepsilon = \frac{\Delta L}{L}$$

$$\varepsilon = \frac{0{,}63}{165{,}77} \text{ x } 100$$

$$\varepsilon = 0{,}38 \ \%$$

d. Modulus elastisitas spesimen C4

$$E = \frac{\sigma}{\varepsilon}$$

$$E = \frac{130{,}44}{0{,}38 \ \%}$$

$$E = 34322{,}67 \text{ N/mm}^2 = 34{,}32 \text{ GPa}$$

5. Nilai tegangan rata-rata keempat spesimen

$$\sigma_{\text{(rata-rata)}} = \frac{\sigma 1 + \sigma 2 + \sigma 3 + \sigma 4}{4}$$

$$= \frac{127{,}19 + 109{,}94 + 129{,}04 + 130{,}44}{4}$$

$$= 124{,}15 \text{ MPa}$$

6. Nilai rata-rata regangan keempat spesimen

$$\varepsilon_{\text{(rata-rata)}} = \frac{\varepsilon 1 + \varepsilon 2 + \varepsilon 3 + \varepsilon 4}{4}$$

$$= \frac{0{,}25 + 0{,}20 + 0{,}42 + 0{,}38}{4}$$

$$= 0{,}31\ \%$$

7. Nilai rata-rata modulus elastisitas dari keempat spesimen

$$E_{\text{(rata-rata)}} = \frac{E1 + E2 + E3 + E4}{4}$$

$$= \frac{49{,}94 + 53{,}60 + 30{,}06 + 34{,}32}{4}$$

$$= 41{,}98 \text{ GPa}$$

Pengujian Densitas

Perhitungan densitas secara aktual

Perhitungan pengujian densitas koposit metode *Vaccum Infusion* dengan aliran masuk resin dari samping (VI-1)

1. Spesimen A1

   Diketahui : Panjang (p) : 30,20 mm

   Lebar (l) : 29,43 mm

   Tebal (t) : 1,26 mm

   Massa (m) : 1,57 gr

   Ditanya ρ (Densitas spesimen) ?

   Jawab $\rho = \frac{m}{v}$

   $v = p \times l \times t$

   $= 30{,}20 \times 29{,}43 \times 1{,}26$

   $= 1119{,}87\ mm^3$

   $\rho = \frac{m}{v}$

   $= \frac{1{,}57}{1119{,}87}$

   $= 0{,}00140\ gr/mm^3 = 1{,}4\ gr/cm^3$

2. Spesimen A2

   Diketahui : Panjang (p) : 29,60 mm

   Lebar (l) : 29,26 mm

Tebal (t) : 1,16 mm

Massa (m) : 1,59 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

v = p x l x t

= 29,60 x 29,26 x 1,16

= 1004,67 mm^3

$\rho = \frac{m}{v}$

$= \frac{1,59}{1004,67}$

= 0,00158 gr/mm^3 = 1,58 gr/cm^3

3. Spesimen A3

Diketahui : Panjang (p) : 29,52 mm

Lebar (l) : 29,10 mm

Tebal (t) : 1,23 mm

Massa (m) : 1,52 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

v = p x l x t

= 29.52 x 29,10 x 1,23

= 1056,61 mm^3

$$\rho = \frac{m}{v}$$

$$= \frac{1,52}{1056,61}$$

$= 0,00144$ gr/mm^3 $= 1,44$ gr/cm^3

4. Spesimen A4

Diketahui : Panjang (p) : 30,72 mm

Lebar (l) : 29,16 mm

Tebal (t) : 1,19 mm

Massa (m) : 1,65 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

v = p x l x t

= 30,72 x 29,16 x 1,19

= 1066 mm^3

$$\rho = \frac{m}{v}$$

$$= \frac{1,57}{1066}$$

$= 0,00155$ gr/mm^3 $= 1,55$ gr/cm^3

5. Nilai massa jenis (densitas) rata-rata

$$\rho_{\text{(rata-rata)}} = \frac{\rho 1 + \rho 2 + \rho 3 + \rho 4}{4}$$

$$= \frac{1,40 + 1,58 + 1,44 + 1.55}{4}$$

$= 1,49$ gr/cm^3

Perhitungan pengujian densitas koposit metode *Vaccum Infusion* dengan aliran masuk resin dari tengah (VI-2)

1. Spesimen B1

   Diketahui : Panjang (p) : 31,07 mm

   Lebar (l) : 29,44 mm

   Tebal (t) : 1,06 mm

   Massa (m) : 1,42 gr

   Ditanya ρ (Densitas spesimen) ?

   Jawab $\rho = \frac{m}{v}$

   v = p x l x t

   = 31,07 x 29,44 x 1,06

   = 969,58 mm^3

   $\rho = \frac{m}{v}$

   $= \frac{1,42}{969,58}$

   = 0,00146 gr/mm^3 = 1,46 gr/cm^3

2. Spesimen B2

   Diketahui : Panjang (p) : 31,02 mm

   Lebar (l) : 30,07 mm

   Tebal (t) : 1,04 mm

   Massa (m) : 1,44 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

$v = p \times l \times t$

$= 30{,}02 \times 30{,}07 \times 1{,}04$

$= 970{,}08\ mm^3$

$\rho = \frac{m}{v}$

$= \frac{1{,}44}{970{,}08}$

$= 0{,}00148\ gr/mm^3 = 1{,}48\ gr/cm^3$

3. Spesimen B3

Diketahui : Panjang (p) : 31,34 mm

Lebar (l) : 29,31 mm

Tebal (t) : 1,07 mm

Massa (m) : 1,41 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

$v = p \times l \times t$

$= 31{,}34 \times 29{,}31 \times 1{,}07$

$= 982{,}88\ mm^3$

$\rho = \frac{m}{v}$

$= \frac{1{,}41}{982{,}88}$

$= 0{,}00143 \text{ gr/mm}^3 = 1{,}43 \text{ gr/cm}^3$

4. Spesimen B4

Diketahui : Panjang (p) : 31,23 mm

Lebar (l) : 31,13 mm

Tebal (t) : 1,10 mm

Massa (m) : 1,56 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

$v = p \times l \times t$

$= 31{,}23 \times 31{,}13 \times 1{,}10$

$= 1068{,}72 \text{ mm}^3$

$\rho = \frac{m}{v}$

$= \frac{1{,}56}{1068{,}72}$

$= 0{,}00146 \text{ gr/mm}^3 = 1{,}46 \text{ gr/cm}^3$

5. Nilai massa jenis (densitas) rata-rata

$\rho_{\text{(rata-rata)}} = \frac{\rho 1 + \rho 2 + \rho 3 + \rho 4}{4}$

$= \frac{1{,}46 + 1{,}48 + 1{,}43 + 1.46}{4}$

$= 1{,}46 \text{ gr/cm}^3$

Perhitungan pengujian densitas koposit metode *Press Mold* (PM)

1. Spesimen C1

   Diketahui : Panjang (p) : 31,42 mm

   Lebar (l) : 29,91 mm

   Tebal (t) : 1,44 mm

   Massa (m) : 1,93 gr

   Ditanya ρ (Densitas spesimen) ?

   Jawab $\rho = \frac{m}{v}$

   v = p x l x t

   = 31,42 x 29,91 x 1,44

   = 1353,27 mm^3

   $\rho = \frac{m}{v}$

   $= \frac{1,93}{1353,27}$

   = 0,00143 gr/mm^3 = 1,43 gr/cm^3

2. Spesimen C2

   Diketahui : Panjang (p) : 31,13 mm

   Lebar (l) : 30,08 mm

   Tebal (t) : 1,37 mm

   Massa (m) : 1,78 gr

   Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

v = p x l x t

= 31,13 x 30,08 x 1,37

= 1282,85 mm^3

$\rho = \frac{m}{v}$

$= \frac{1,78}{1282,85}$

= 0,00139 gr/mm^3 = 1,39 gr/cm^3

3. Spesimen C3

Diketahui : Panjang (p) : 30,15 mm

Lebar (l) : 29,90 mm

Tebal (t) : 1,26 mm

Massa (m) : 1,71 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

v = p x l x t

= 30,6 x 29,90 x 1,26

= 1135,87 mm^3

$\rho = \frac{m}{v}$

$= \frac{1,71}{1135,87}$

= 0,00151 gr/mm^3 = 1,51 gr/cm^3

4. Spesimen C4

Diketahui : Panjang (p) : 30,96 mm

Lebar (l) : 29,41 mm

Tebal (t) : 1,39 mm

Massa (m) : 1,87 gr

Ditanya ρ (Densitas spesimen) ?

Jawab $\rho = \frac{m}{v}$

$v = p \times l \times t$

$= 30{,}96 \times 29{,}41 \times 1{,}39$

$= 1265{,}64\ mm^3$

$\rho = \frac{m}{v}$

$= \frac{1{,}87}{1265{,}64}$

$= 0{,}00148\ gr/mm^3 = 1{,}48\ gr/cm^3$

5. Nilai massa jenis (densitas) rata-rata

$\rho_{(rata\text{-}rata)} = \frac{\rho 1 + \rho 2 + \rho 3 + \rho 4}{4}$

$= \frac{1{,}43 + 1{,}39 + 1{,}51 + 1.48}{4}$

$= 1{,}45\ gr/cm^3$

Perhitungan densitas secara teoritis

1. Perhitungan pengujian densitas koposit metode *Vaccum Infusion* dengan aliran masuk resin dari samping (VI-1)

   Diketahui $\rho m = 1{,}215$ gr/mm^3

   $\rho f = 2{,}54$ gr/mm^3

   $WF = 0{,}76$ gr

   Ditanya ρ_t (massa jenis teoritis) ?

   $\rho_t = \rho s \,.\, fs + \rho m \,.\, fm$

   WC = Rata-rata massa komposit variasi A

   $$= \frac{mA1 + mA2 + mA3 + mA4}{4}$$

   $$= \frac{1{,}57 + 1{,}59 + 1{,}52 + 1{,}65}{4}$$

   $$= 1{,}58 \text{ gr}$$

   Mencari fraksi massa serat dan fraksi massa matriks

   $$wf = \frac{WF}{WC}$$

   $$= \frac{0{,}76}{1{,}58}$$

   $$= 0{,}48$$

   $wf + wm = 1$

$0{,}48 + wm = 1$

$wm = 0{,}52$

$\rho_t = \rho s \,.\, fs + \rho m \,.\, fm$

$= 2{,}54 \,.\, 0{,}48 + 1{,}215 \,.\, 0{,}52$

$= 1{,}85 \text{ gr/mm}^3$

2. Perhitungan pengujian densitas koposit metode *Vaccum Infusion* dengan aliran masuk resin dari tengah (VI-2)

Diketahui $\rho m = 1{,}215$ gr/mm^3

$\rho f = 2{,}54$ gr/mm^3

$WF = 0{,}76$ gr

Ditanya ρ_t (massa jenis teoritis) ?

$\rho_t = \rho s \,.\, fs + \rho m \,.\, fm$

WC = Rata-rata massa komposit variasi B

$$= \frac{mB1 + mB2 + mB3 + mB4}{4}$$

$$= \frac{1{,}42 + 1{,}44 + 1{,}41 + 1{,}56}{4}$$

$= 1{,}46$ gr

Mencari fraksi massa serat dan fraksi massa matriks

$$wf = \frac{WF}{WC}$$

$= \frac{0,76}{1,46}$

$= 0,52$

$wf + wm = 1$

$0,52 + wm = 1$

$wm = 0,48$

$\rho_t = \rho s \,.\, fs + \rho m \,.\, fm$

$= 2,54 \,.\, 0,52 + 1,215 \,.\, 0,48$

$= 1,91$ gr/mm^3

3. Perhitungan pengujian densitas koposit metode *Press mold* (PM)

Diketahui $\rho m = 1,215$ gr/mm^3

$\rho f = 2,54$ gr/mm^3

$WF = 0,76$ gr

Ditanya ρ_t (massa jenis teoritis) ?

$\rho_t = \rho s \,.\, fs + \rho m \,.\, fm$

WC = Rata-rata massa komposit variasi A

$= \frac{mB1 + mB2 + mB3 + mB4}{4}$

$= \frac{1,93 + 1,78 + 1,71 + 1,87}{4}$

$= 1,82$ gr

Mencari fraksi massa serat dan fraksi massa matriks

$wf = \frac{WF}{WC}$

$= \frac{0,76}{1,82}$

$= 0,42$

$wf + wm = 1$

$0,52 + wm = 1$

$wm = 0,58$

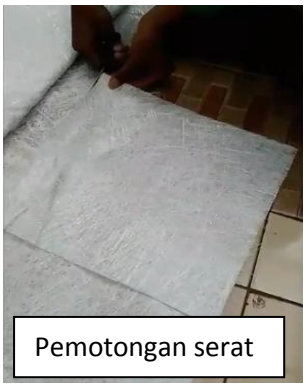
$\rho_t = \rho s \, . \, fs + \rho m \, . \, fm$

$= 2,54 \, . \, 0,42 + 1,215 \, . \, 0,58$

$= 1,77 \text{ gr/mm}^3$

Foto proses penelitian

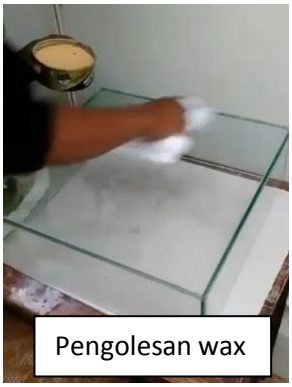
Pembuatan material komposit menggunakan metode *Vacuum Infusion*



Pemotongan serat

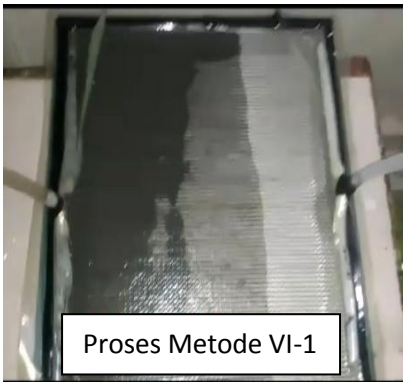
Penimbangan serat

Penimbangan resin

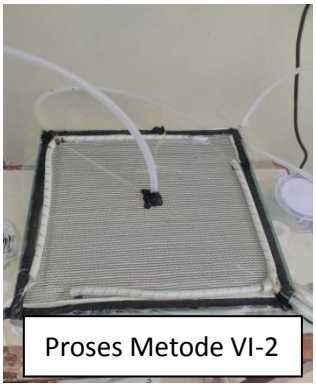


Pengolesan wax

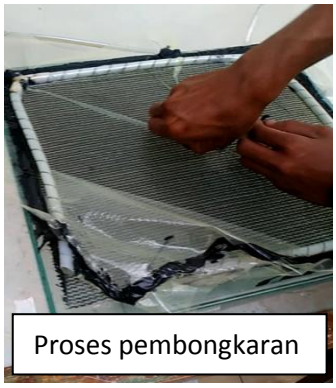
Perangkaian cetakan



Proses Metode VI-1



Proses Metode VI-2



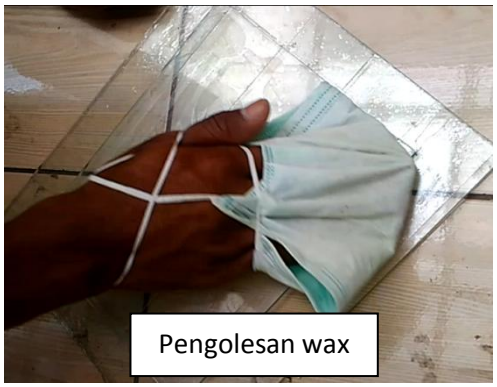
Proses pembongkaran

Pembuatan material komposit menggunakan metode *Press Mold*

Pemotongan serat

Penimbangan serat

Penimbangan resin



Pengolesan wax

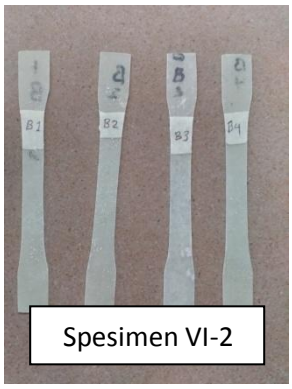
Penuangan resin

Proses pengepresan

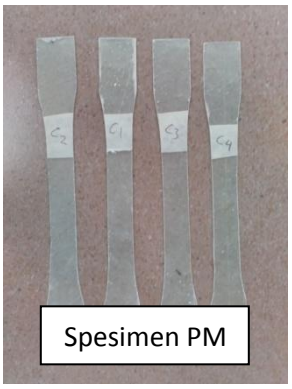
Proses pembongkaran

Proses pengujian

Spesimen VI-1



Spesimen VI-2



Spesimen PM

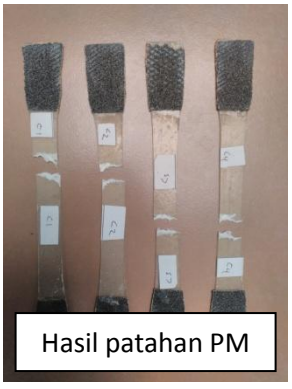
Proses pengujian

Data hasil pengujian tarik

Data hasil pengujian tarik

Hasil patahan VI-1

Hasil patahan VI-2



Hasil patahan PM