PENGUJIAN TARIK SERVO PULSER PEMBEBANAN 2 TON

Perhitungan pengujian tarik komposit hybrid serat alam rami acak dan fiberglass woven roving 200 gr dengan lapisan 1 alam (serat rami) 2 sintetis (fiber) metode *Hand Lay-up.*

1. SpesimenVr 1 (RF)
   a. Luas penampang specimen Vr 1 (RF)

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

      Lebar spesimen (l) = 13,15 mm

      Ditanyakan A (Luas penampang spesimen) ?

      A = t x l

      = 1,19 x 13,15

      = 15,648 mm^2

   b. Tegangan spesimenVr 1 (RF)

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

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

      F = 1901,2 N

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

      $\sigma = \frac{1901,2}{15,648}$

$$\sigma = 121{,}498 \text{ N/mm}^2$$

c. Regangan spesimenVr 1 (RF)

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

$$\varepsilon = \frac{2}{168} \text{x } 100$$

$$\varepsilon = 1{,}19\ \%$$

d. Modulus elastisitas spesimenVr 1 (RF)

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

$$E = \frac{121{,}498}{1{,}19\ \%}$$

$$E = 10{,}21 \text{ GPa}$$

2. SpesimenVr 2 (RF)

a. Luas penampang specimen Vr 2 (RF)

Diketa hui : Tebal spesimen (t) = 1,20 mm

Lebar spesimen (l) = 13,45 mm

Ditanyakan A (Luas penampang spesimen) ?

$$A = t \text{ x } l$$

$$= 1{,}20 \text{ x } 13{,}45$$

$$= 16{,}14 \text{ mm}^2$$

b. Tegangan spesimenVr 2 (RF)

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

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

F = 1685,6 N

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

$\sigma = \frac{1685,6}{16,14}$

σ = 104,436 N/mm^2

c. Regangan spesimenVr 2

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

$\varepsilon = \frac{3}{168}$x 100

ε = 1,78 %

d. Modulus elastisitas spesimenVr 2

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

$E = \frac{104,436}{1,78\ \%}$

E = 5867,191 N/mm^2 = 5,867 GPa

3. SpesimenVr 3 (RF)

a. Luas penampang specimen Vr 3(RF)

Diketahui : Tebal spesimen (t) = 1,20 mm

Lebar spesimen (l) = 14,15 mm

Ditanyakan A (Luas penampang spesimen) ?

A = t x l

= 1,20 x 14,15

= 16,98 mm^2

b. Tegangan spesimenVr 3 (RF)

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

$F = \frac{11,6}{100}$ x 2000 kg x 9,8 m/s^2

F = 2273,6 N

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

$\sigma = \frac{2273,6}{16,98}$

σ = 133,90 N/mm^2

c. Regangan spesimenVr 3 (RF)

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

$\varepsilon = \frac{2}{168}$x 100

ε = 1,19 %

d. Modulus elastisitas spesimenVr 3

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

$E = \frac{133,90}{1,19\ \%}$

E = 11252,101 N/mm^2 = 11,25 GPa

4. SpesimenVr 4 (RF)

a. Luas penampang specimen Vr 4 (RF)

Diketahui : Tebal spesimen (t) = 1,09 mm

Lebar spesimen (l) = 14,45 mm

Ditanyakan A (Luas penampang spesimen) ?

$A = t \times l$

$= 1{,}09 \times 14{,}45$

$= 15{,}75\ mm^2$

b. Tegangan spesimenVr 4 (RF)

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

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

$F = 2293{,}2\ N$

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

$\sigma = \frac{2293{,}2}{15{,}75}$

$\sigma = 145{,}6\ N/mm^2$

c. Regangan spesimenVr 4 (RF)

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

$\varepsilon = \frac{2}{168} \times 100$

$\varepsilon = 1{,}19\ \%$

d. Modulus elastisitas spesimenVr 4

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

$E = \frac{145,6}{1,19\ \%}$

$E = 12235,294\ N/mm^2 = 12,24\ GPa$

5. SpesimenVr 5 (RF)

a. Luas penampang specimen Vr 5 (RF)

Diketahui : Tebal spesimen (t) = 1,07 mm

Lebar spesimen (l) = 15,51 mm

Ditanyakan A (Luas penampang spesimen) ?

$A = t \times l$

$= 1,07 \times 15,51$

$= 16,596\ mm^2$

b. Tegangan spesimenVr 5 (RF)

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

$F = \frac{12,7}{100} \times 2000\ kg \times 9,8\ m/s^2$

$F = 2489,2\ N$

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

$\sigma = \frac{2489,2}{16,596}$

$\sigma = 149,988\ N/mm^2$

c. Regangan spesimenVr 5 (RF)

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

$$\varepsilon = \frac{4}{168} \text{x } 100$$

$$\varepsilon = 2{,}38\ \%$$

d. Modulus elastisitas spesimenVr 5

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

$$E = \frac{149{,}988}{2{,}38\ \%}$$

$$E = 6302{,}017\ \text{N/mm}^2 = 6{,}30\ \text{GPa}$$

Pengujian tarik

Perhitungan pengujian tarik pada komposit serat sitentis berlapis 2 serat fiberglass Woven Rooving 200 gr mengunakan metode *Hnad lay-up.*

Gambar

1. SpesimenV1 (FF)

   a. Luas penampang specimen V1 (FF)

   Diketahui : Tebal spesimen (t) = 0.20 mm

   Lebar spesimen (l) = 13.39 mm

   Ditanyakan A (Luas penampang spesimen) ?

   A = t x l

   = 0.20 x 13.39

   = 2.678 mm^2

   b. Tegangan spesimenV1 (FF)

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

   F = $\frac{4.7}{100}$ x 2000 kg x 9,8 m/s^2

   F = 921.2 N

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

   $\sigma = \frac{921.2}{2.678}$

   σ = 343.988 N/mm^2

   c. Regangan spesimenV1 (FF)

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

$\varepsilon = \frac{3}{165}$x 100

ε = 1.81 %

d. Modulus elastisitas spesimenV1 (FF)

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

$E = \frac{343.988}{1.81\ \%}$

E = 19004.862 N/mm^2 = 19 GPa

2. SpesimenV2 (FF)

a. Luas penampang specimen V2 (FF)

Diketahui : Tebal spesimen (t) = 0.16 mm

Lebar spesimen (l) = 14.16 mm

Ditanyakan A (Luas penampang spesimen) ?

A = t x l

= 0.16 x 14.16

= 2.266 mm^2

b. Tegangan spesimenV2 (FF)

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

F = $\frac{5.6}{100}$ x 2000 kg x 9,8 m/s^2

F = 1097.6 N

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

$\sigma = \frac{1097.6}{2.266}$

$\sigma = 484.378\ N/mm^2$

c. Regangan spesimenV2 (FF)

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

$\varepsilon = \frac{3}{168}$x 100

$\varepsilon = 1.78\ \%$

d. Modulus elastisitas spesimenV2 (FF)

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

$E = \frac{484.378}{1.78\ \%}$

$E = 27212.247\ N/mm^2 = 27{,}21\ GPa$

3. Spesimen V3 (FF)

a. Luas penampang specimen V3 (FF)

Diketahui : Tebal spesimen (t) = 0.20 mm

Lebar spesimen (l) = 13,45 mm

Ditanyakan A (Luas penampang spesimen) ?

$A = t \times l$

$= 0.20 \times 13.45$

$= 2.69\ mm^2$

b. Tegangan spesimenV3 (FF)

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

F = $\frac{4.6}{100}$ x 2000 kg x 9,8 m/s^2

F = 901.6 N

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

$\sigma = \frac{901,6}{2.69}$

σ = 335.167 N/mm^2

c. Regangan specimen V3 (FF)

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

$\varepsilon = \frac{3}{167}$x 100 %

ε = 1,80 %

d. Modulus elastisitas spesimenV3 (FF)

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

E = $\frac{335.167}{1,80\ \%}$

E = 18620,389 N/mm^2 = 18,62 GPa

4. SpesimenV4 (FF)

a. Luas penampang specimen V4 (FF)

Diketahui : Tebal spesimen (t) = 0,20 mm

Lebar spesimen (l) = 14,31 mm

Ditanyakan A (Luas penampang spesimen) ?

$$A = t \times l$$

$$= 0.20 \times 14{,}31$$

$$= 2{,}862 \text{ mm}^2$$

b. Tegangan spesimenV4 (FF)

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

$F = \frac{5,7}{100} \times 2000 \text{ kg} \times 9{,}8 \text{ m/s}^2$

$F = 1117{,}2 \text{ N}$

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

$\sigma = \frac{1117,2}{2,862}$

$\sigma = 390{,}356 \text{ N/mm}^2$

c. Regangan spesimenV4 (FF)

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

$\varepsilon = \frac{3}{165} \times 100$

$\varepsilon = 1.81\ \%$

d. Modulus elastisitas spesimenV4 (FF)

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

$E = \frac{390,356}{1.81\ \%}$

$E = 21566{,}630 \text{ N/mm}^2 = 21{,}57 \text{ GPa}$

5. SpesimenV5 (FF)

a. Luas penampang specimen V5 (FF)

Diketahui : Tebal spesimen (t) = 0,20 mm

Lebar spesimen (l) = 14,40 mm

Ditanyakan A (Luas penampang spesimen) ?

$A = t \times l$

$= 0{,}20 \times 14{,}40$

$= 2{,}88\ mm^2$

b. Tegangan spesimenV5 (FF)

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

$F = \frac{6{,}5}{100} \times 2000\ kg \times 9{,}8\ m/s^2$

$F = 1274\ N$

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

$\sigma = \frac{1274}{2{,}88}$

$\sigma = 442{,}361\ N/mm^2$

c. Regangan spesimenV5 (FF)

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

$\varepsilon = \frac{4}{168} \times 100$

$\varepsilon = 2{,}38\%$

d. Modulus elastisitas spesimenV5 (FF)

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

$E = \frac{442,361}{2,38\ \%}$

$E = 18586,610\ N/mm^2 = 18,59\ GPa$

6. Spesimen V6 (FF)

   a. Luas penampang specimen V6 (FF)

      Diketahui : Tebal spesimen (t) = 0,20 mm

      Lebar spesimen (l) = 15,20 mm

      Ditanyakan A (Luas penampang spesimen) ?

      $A = t \times l$

      $= 0,20 \times 15,20$

      $= 3,04\ mm^2$

   b. Tegangan spesimenV6 (FF)

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

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

      $F = 1411,2\ N$

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

      $\sigma = \frac{1411,2}{3,04}$

      $\sigma = 464,211\ N/mm^2$

   c. Regangan specimen V6 (FF)

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

$\varepsilon = \frac{4}{167}$x 100 %

ε = 2,48 %

d. Modulus elastisitas spesimenV6 (FF)

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

$E = \frac{464,211}{2,48\ \%}$

E = 18718,185 N/mm^2 = 18,72 GPa

PENGUJIAN IMPAK

a. Energy yang diserap specimen 1 (E)

$I_1 = 147^o$

$\propto = 155°$

$\beta = 155° - 147° = 8°$

$$E = W \times r \times (cos\ \beta - cos\ \alpha)$$

$$= 137,34 \times 0,65 \times (cos8° - cos155°)$$

$= 169,309\ Joule$

b. Energy yang diserap specimen 2 (E)

$I_2 = 149^o$

$\propto = 155°$

$\beta = 155° - 149° = 6°$

$$E = W \times r \times (cos\ \beta - cos\ \alpha)$$

$$= 137{,}34 \times 0{,}65 \times (cos6° - cos155°)$$

$$= 169{,}689\ Joule$$

c. Energy yang diserap specimen 3 (E)

$I_3 = 148{,}5^o$

$\propto = 155°$

$\beta = 155° - 148{,}5° = 6{,}5°$

$$E = W \times r \times (cos\ \beta - cos\ \alpha)$$

$$= 137{,}34 \times 0{,}65 \times (cos6{,}5° - cos155°)$$

$$= 169{,}604\ Joule$$

d. Energy yang diserap specimen 4 (E)

$I_1 = 147^o$

$\propto = 155°$

$\beta = 155° - 147° = 8°$

$$E = W \times r \times (cos\,\beta - cos\,\alpha)$$

$$= 137{,}34 \times 0{,}65 \times (cos 8° - cos 155°)$$

$$= 169{,}309\ Joule$$

e. Energy yang diserap specimen 5 (E)

$I_1 = 148^o$

$\propto = 155°$

$\beta = 155° - 148° = 7°$

$$E = W \times r \times (cos\,\beta - cos\,\alpha)$$

$$= 137{,}34 \times 0{,}65 \times (cos 7° - cos 155°)$$

$$= 169{,}512\ Joule$$