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## LAMPIRAN



Foto Barium Karbonat



Proses karburizing



Proses holding time suhu 900 derajad

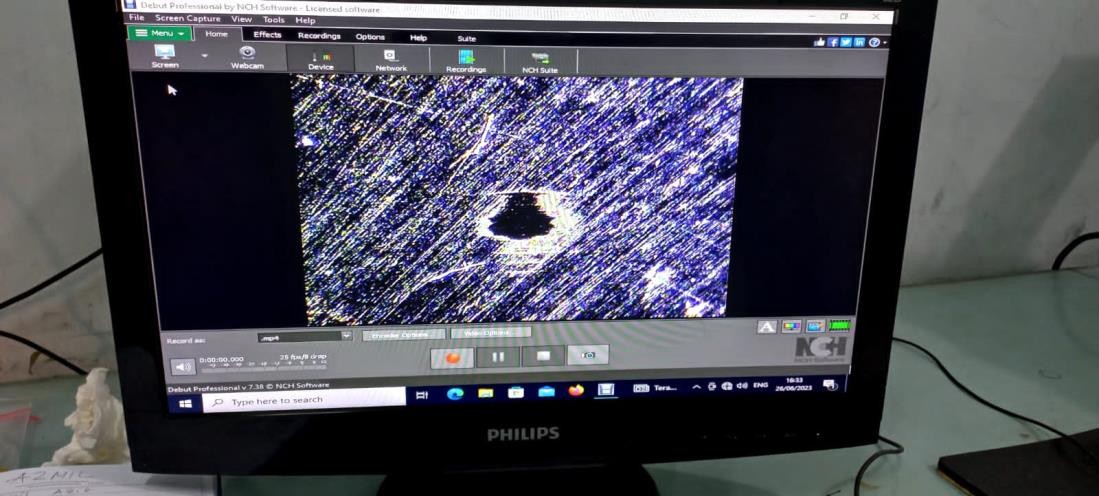


Proses Uji impek



Spesimen siap uji





Spesimen hasil uji keausan





Mesin uji kekarasan (brinel)





Gambar tulang setelah terbakar









Perhitungan

1. Menghitung nilai kekerasan
   1. Variasi raw material

VHN=

(1,854)P

𝑑2

Dimana:

P = Beban penekan ( Kgf )

D = Rata-rata diagonal jejak (mm)

Pengolahan data di bawah ini menggunakan baja st 41 dengan variasi perbandingan 650:350 gram

* + 1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,682

= 74,16

0,4624

= 160,4 VHN

* + 1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,682

= 74,16

0,4624

= 160,4 VHN

* + 1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,692

= 74,16

0,4761

= 155,8 VHN

* 1. Variasi 500 : 500 gram

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,4252

= 74,16

0,180625

= 410,6 VHN

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,402

=74,16

0,16

= 463,5 VHN

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,4152

= 74,16

0,172225

= 430,6 VHN

* 1. Variasi 650 : 350 gram

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,362

= 74,16

0,1296

= 572,2 VHN

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,372

= 74,16

0,1369

= 541,7 VHN

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,3552

= 74,16

0,126025

= 588,5 VHN

* 1. Variasi 750 : 250 gram

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,342

= 74,16

0,1156

= 641,5 VHN

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,3352

= 74,16

0,112225

= 660,8 VHN

1. VHN=

(1,854)P

𝑑2

= 1,854 𝑥 40

0,3452

= 74,16

0,119025

= 623,1 VHN

1. Menghitung nilai keausan
   1. Variasi raw 1 material

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,903

=

8𝑥13,6𝑥6,36𝑥15

= 23,66355

10.379,52

= 0,00228 𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,903

=

8𝑥13,6𝑥6,36𝑥15

= 23,66355

10.379,52

= 0,00228 𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥2,003

=

8𝑥13,6𝑥6,36𝑥15

= 27,6

10.379,52

= 0,00266 𝑚𝑚3/𝑘𝑔

* 1. Variasi raw 2 material

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,853

=

8𝑥13,6𝑥6,36𝑥15

= 21,8441063

10.379,52

= 0,00210 𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,903

=

8𝑥13,6𝑥6,36𝑥15

= 23,66355

10.379,52

= 0,00228 𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,853

=

8𝑥13,6𝑥6,36𝑥15

= 21,8441063

10.379,52

= 0,00210 𝑚𝑚3/𝑘𝑔

* 1. Variasi raw 3 material

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,903

=

8𝑥13,6𝑥6,36𝑥15

= 23,66355

10.379,52

= 0,00228 𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,803

=

8𝑥13,6𝑥6,36𝑥15

= 20,1204

10.379,52

= 0,00194𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,853

=

8𝑥13,6𝑥6,36𝑥15

= 21,8441063

10.379,52

= 0,00210 𝑚𝑚3/𝑘𝑔

* 1. Variasi 500:500 gram 1

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,853

=

8𝑥13,6𝑥6,36𝑥15

= 2,11873125

10.379,52

= 0,00021 𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,753

=

8𝑥13,6𝑥6,36𝑥15

= 1,45546875

10.379,52

= 0,00014 𝑚𝑚3/𝑘𝑔

* 1. Variasi 500:500 gram 2

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/𝑘𝑔

* 1. Variasi 500:500 gram 3

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,593

=

8𝑥13,6𝑥6,36𝑥15

= 0,70855755

10.379,52

= 0,00007𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/𝑘𝑔

* 1. Variasi 650 : 350 gram 1

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,673

=

8𝑥13,6𝑥6,36𝑥15

= 1,03763235

10.379,52

= 0,00010𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/kg

* 1. Variasi 650:350 gram 2

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,673

=

8𝑥13,6𝑥6,36𝑥15

= 1,03763235

10.379,52

= 0,00010𝑚𝑚3/kg

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/kg

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/kg

* 1. Variasi 650:350 gram 3

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/kg

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,993

=

8𝑥13,6𝑥6,36𝑥15

= 3,34753155

10.379,52

= 0,00032𝑚𝑚3/kg

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/kg

* 1. Variasi 750:250 gram 1

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,073

=

8𝑥13,6𝑥6,36𝑥15

= 4,22639835

10.379,52

= 0,00040𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,803

=

8𝑥13,6𝑥6,36𝑥15

= 1,7664

10.379,52

= 0,00017𝑚𝑚3/𝑘𝑔

* 1. Variasi 750:250 gram 2

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,073

=

8𝑥13,6𝑥6,36𝑥15

= 4,22639835

10.379,52

= 0,00040𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥1,073

=

8𝑥13,6𝑥6,36𝑥15

= 4,22639835

10.379,52

= 0,00040𝑚𝑚3/𝑘𝑔

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/𝑘𝑔

* 1. Variasi 750:250 gram 3

1) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/𝑘𝑔

2) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,993

=

8𝑥13,6𝑥6,36𝑥15

= 3,34753155

10.379,52

= 0,00032𝑚𝑚3/kg

3) 𝑤 = 𝐵.𝑏3

8 𝑟.𝑝𝑜.𝑙𝑜

3,45 𝑥0,933

=

8𝑥13,6𝑥6,36𝑥15

= 2,77503165

10.379,52

= 0,00027𝑚𝑚3/kg

1. Menghitung energi dan nilai impak
   1. Menghitung energy impak
2. Raw material

∆E = W . L ( cos β – cos α )

= 200 . 0,8 (cos 46º-cos 151º)

= 160 (0,694658+0,875619)

= 160 x 1,570277

= 251,24432 joule

1. Variasi 500:500 gram

∆E = W . L ( cos β – cos α )

= 200 . 0,8 (cos 106º-cos 151º)

= 160 (-0,275637+0,875619)

= 160 x 0,599982

= 95,99712 joule

1. Variasi 650:350 gram

∆E = W . L ( cos β – cos α )

= 200 . 0,8 (cos 115º-cos 151º)

= 160 (-0,422618+0,875619)

= 160 x 0,453001

= 72,48016 joule

1. Variasi 750:250 gram

∆E = W . L ( cos β – cos α )

= 200 . 0,8 (cos 129º-cos 151º)

= 160 (-0,629320+0,875619)

= 160 x 0,246299

= 39,40784 joule

* 1. Menghitung nilai impak

1. Raw Material

# IS =𝐸

𝐴

=147,0

84,91

=1,731 joule/mm2

1. Variasi 500:500

# IS =𝐸

𝐴

=95,8

81,7

=1,713 joule/mm2

1. Variasi 650:350

# IS =𝐸

𝐴

=72,3

85,0

=0,85 joule/mm2

1. Variasi 750:250

# IS =𝐸

𝐴

=39,2 = 0,43 joule/mm2

89,9