

LAMPIRAN A

CONTOH PERHITUNGAN

Lampiran A. Contoh Perhitungan

1. Perhitungan Ukuran Butir Rata-rata Menggunakan Metode *Heyn*

Intercept (ASTM E 112)

Persamaan perhitungan ukuran butir rata-rata :

$$AVG = \frac{\text{Nilai } Known \text{ Distance}}{\text{Jumlah Butir dalam 1 garis}}$$

a. *Non-Heat Treatment*

$$\text{Garis 1} = \frac{321,23}{14} = 20,07$$

$$\text{Garis 2} = \frac{3297,95}{14} = 21,28$$

$$\text{Garis 3} = \frac{309,59}{9} = 34,29$$

$$\text{Garis 4} = \frac{308,90}{10} = 30,89$$

$$\text{Garis 5} = \frac{324,66}{12} = 27,05$$

$$AVG = \frac{20,07 + 21,28 + 34,29 + 30,89 + 27,05}{5} = 26,73 \mu\text{m}$$

b. Temperatur 300°C – 1 jam

$$\text{Garis 1} = \frac{302,63}{9} = 33,62$$

$$\text{Garis 2} = \frac{315,13}{9} = 35,01$$

$$\text{Garis 3} = \frac{302}{10} = 30,2$$

$$\text{Garis 4} = \frac{305,13}{12} = 25,12$$

$$\text{Garis 5} = \frac{314,51}{11} = 28,59$$

$$AVG = \frac{33,62 + 35,01 + 30,2 + 25,12 + 28,59}{5} = 30,50 \mu\text{m}$$

c. Temperatur 300°C – 3 jam

$$\text{Garis 1} = \frac{321,81}{10} = 32,18$$

$$\text{Garis 2} = \frac{312,77}{9} = 34,75$$

$$\text{Garis 3} = \frac{307,82}{9} = 34,20$$

$$\text{Garis 4} = \frac{312,68}{10} = 31,26$$

$$\text{Garis 5} = \frac{319,39}{9} = 35,48$$

$$\text{AVG} = \frac{32,18 + 34,75 + 34,20 + 31,26 + 35,48}{5} = 33,63 \mu\text{m}$$

d. Temperatur 300°C – 5 jam

$$\text{Garis 1} = \frac{306,23}{9} = 34,02$$

$$\text{Garis 2} = \frac{298,81}{6} = 49,80$$

$$\text{Garis 3} = \frac{307,47}{6} = 51,24$$

$$\text{Garis 4} = \frac{316,75}{7} = 45,25$$

$$\text{Garis 5} = \frac{316,75}{10} = 31,67$$

$$\text{AVG} = \frac{34,02 + 49,80 + 51,24 + 45,25 + 31,67}{5} = 43 \mu\text{m}$$

e. Temperatur 350°C – 1 jam

$$\text{Garis 1} = \frac{283,69}{1} = 283,70$$

$$\text{Garis 2} = \frac{281,47}{1} = 281,47$$

$$\text{Garis 3} = \frac{287,01}{1} = 287,01$$

$$\text{Garis 4} = \frac{282,03}{1} = 282,03$$

$$\text{Garis 5} = \frac{283,13}{1} = 283,13$$

$$\text{AVG} = \frac{283,70 + 281,47 + 287,01 + 282,03 + 283,13}{5} = 283,46 \mu\text{m}$$

f. Temperatur 350°C – 3 jam

$$\text{Garis 1} = \frac{286,08}{6} = 24,02$$

$$\text{Garis 2} = \frac{300,29}{7} = 21,71$$

$$\text{Garis 3} = \frac{300,88}{9} = 20,91$$

$$\text{Garis 4} = \frac{296,15}{7} = 22,22$$

$$\text{Garis 5} = \frac{292}{8} = 17,94$$

$$\text{AVG} = \frac{24,02 + 21,71 + 20,91 + 22,22 + 17,94}{5} = 21,36 \mu\text{m}$$

g. Temperatur 350°C – 5 jam

$$\text{Garis 1} = \frac{288,40}{7} = 41,2$$

$$\text{Garis 2} = \frac{298,7}{7} = 42,57$$

$$\text{Garis 3} = \frac{301,60}{6} = 50,26$$

$$\text{Garis 4} = \frac{293,20}{7} = 41,88$$

$$\text{Garis 5} = \frac{284,21}{7} = 40,60$$

$$\text{AVG} = \frac{41,2 + 42,57 + 50,26 + 41,88 + 40,60}{5} = 43,30 \mu\text{m}$$

h. Temperatur 400°C – 1 jam

$$\text{Garis 1} = \frac{283,54}{7} = 40,50$$

$$\text{Garis 2} = \frac{302,28}{6} = 50,38$$

$$\text{Garis 3} = \frac{292,60}{7} = 41,8$$

$$\text{Garis 4} = \frac{295,63}{7} = 42,23$$

$$\text{Garis 5} = \frac{297,44}{6} = 49,57$$

$$\text{AVG} = \frac{40,50 + 50,38 + 41,8 + 42,23 + 49,57}{5} = 44,90 \mu\text{m}$$

i. Temperatur 400°C – 3 jam

$$\text{Garis 1} = \frac{297,62}{6} = 49,60$$

$$\text{Garis 2} = \frac{282,45}{7} = 40,35$$

$$\text{Garis 3} = \frac{295,37}{6} = 49,22$$

$$\text{Garis 4} = \frac{302,67}{7} = 43,25$$

$$\text{Garis 5} = \frac{281,90}{6} = 47$$

$$\text{AVG} = \frac{49,60 + 40,35 + 49,22 + 43,25 + 47}{5} = 45,90 \mu\text{m}$$

j. Temperatur 400°C – 5 jam

$$\text{Garis 1} = \frac{320,36}{2} = 160$$

$$\text{Garis 2} = \frac{301,05}{2} = 150,52$$

$$\text{Garis 3} = \frac{299,84}{2} = 149,92$$

$$\text{Garis 4} = \frac{302,26}{2} = 151,13$$

$$\text{Garis 5} = \frac{322,77}{2} = 161,38$$

$$\text{AVG} = \frac{160 + 150,52 + 149,92 + 151,13 + 161,38}{5} = 154,59 \mu\text{m}$$

2. Perhitungan Rata-rata Kekerasan

$$\text{AVG} = \frac{\text{Nilai kekerasan masing-masing titik}}{\text{Jumlah titik yang di uji}}$$

a. Non-Heat Treatment

Titik 1 = 245,16 VHN

Titik 2 = 315,56 VHN

Titik 3 = 296,65 VHN

Titik 4 = 318,41 VHN

Titik 5 = 316,98 VHN

$$\text{AVG} = \frac{245,16+315,56+296,65+318,41+316,98}{5} = 298,55 \text{ VHN}$$

b. Temperatur 300°C – 1 jam

Titik 1 = 515,71 VHN

Titik 2 = 527,03 VHN

Titik 3 = 506,61 VHN

Titik 4 = 510,95 VHN

Titik 5 = 526,07 VHN

$$\text{AVG} = \frac{515,71+527,03+506,61+510,95+526,07}{5} = 517,27 \text{ VHN}$$

c. Temperatur 300°C – 3 jam

Titik 1 = 404,36 VHN

Titik 2 = 382,69 VHN

Titik 3 = 398,67 VHN

Titik 4 = 415,28 VHN

Titik 5 = 400,28 VHN

$$\text{AVG} = \frac{404,36+382,69+398,67+415,28+400,28}{5} = 400,25 \text{ VHN}$$

d. Temperatur 300°C – 5 jam

Titik 1 = 378,94 VHN

Titik 2 = 380,81 VHN

Titik 3 = 375,24 VHN

Titik 4 = 394,28 VHN

Titik 5 = 386,50 VHN

$$\text{AVG} = \frac{378,94+380,81+375,24+394,28+386,50}{5} = 383,15 \text{ VHN}$$

e. Temperatur 350°C – 1 jam

Titik 1 = 410,58 VHN

Titik 2 = 444 VHN

Titik 3 = 448,76 VHN

Titik 4 = 473,75 VHN

Titik 5 = 416,96 VHN

$$\text{AVG} = \frac{410,58+444+448,76+473,75+416,96}{5} = 438,81 \text{ VHN}$$

f. Temperatur 350°C – 3 jam

Titik 1 = 420,33 VHN

Titik 2 = 321,31 VHN

Titik 3 = 339,82 VHN

Titik 4 = 418,32 VHN

Titik 5 = 436,66 VHN

$$\text{AVG} = \frac{420,33+321,31+339,82+418,32+436,66}{5} = 387,29 \text{ VHN}$$

g. Temperatur 350°C – 5 jam

Titik 1 = 398,98 VHN

Titik 2 = 335,95 VHN

Titik 3 = 377,95 VHN

Titik 4 = 396,52 VHN

Titik 5 = 332,16 VHN

$$AVG = \frac{398,98+335,95+377,64+396,52+332,16}{5} = 368,25 \text{ VHN}$$

h. Temperatur 400°C – 1 jam

Titik 1 = 465,60 VHN

Titik 2 = 481,57 VHN

Titik 3 = 468,73 VHN

Titik 4 = 475,09 VHN

Titik 5 = 462,50 VHN

$$AVG = \frac{465,60+481,57+468,73+475,09+462,50}{5} = 470,7 \text{ VHN}$$

i. Temperatur 400°C – 3 jam

Titik 1 = 444,54 VHN

Titik 2 = 456,40 VHN

Titik 3 = 441,65 VHN

Titik 4 = 498,38 VHN

Titik 5 = 435,95 VHN

$$AVG = \frac{444,54+456,40+441,65+498,38+435,95}{5} = 455,38 \text{ VHN}$$

j. Temperatur 400°C – 5 jam

Titik 1 = 391,67 VHN

Titik 2 = 401,46 VHN

Titik 3 = 409,05 VHN

Titik 4 = 416,85 VHN

Titik 5 = 403,97 VHN

$$AVG = \frac{391,67+401,46+409,05+416,85+403,97}{5} = 404,60 \text{ VHN}$$

LAMPIRAN B
DATA HASIL PENELITIAN

Lampiran B. Data Hasil Penelitian

1. Tabel Data Hasil Penelitian

Tabel B.1 Komposisi Spesimen.

Unsur %										
Ti	Fe	C	O	N	H	Co	Cu	Cr	Nb	Ni
44,6	0,014	0,041	0,03	0,006	0,001	0,074	0,01	<0,01	<0,01	55,2

Tabel B.2 Rata-rata Ukuran Butir.

Spesimen	Ukuran Butir Rata-rata
	(μm)
NT	26,73
301	30,50
303	33,63
305	43
351	283,46
353	40,56
355	43,30
401	44,90
403	45,90
405	154,60

Tabel B.3 Hasil Uji Tarik.

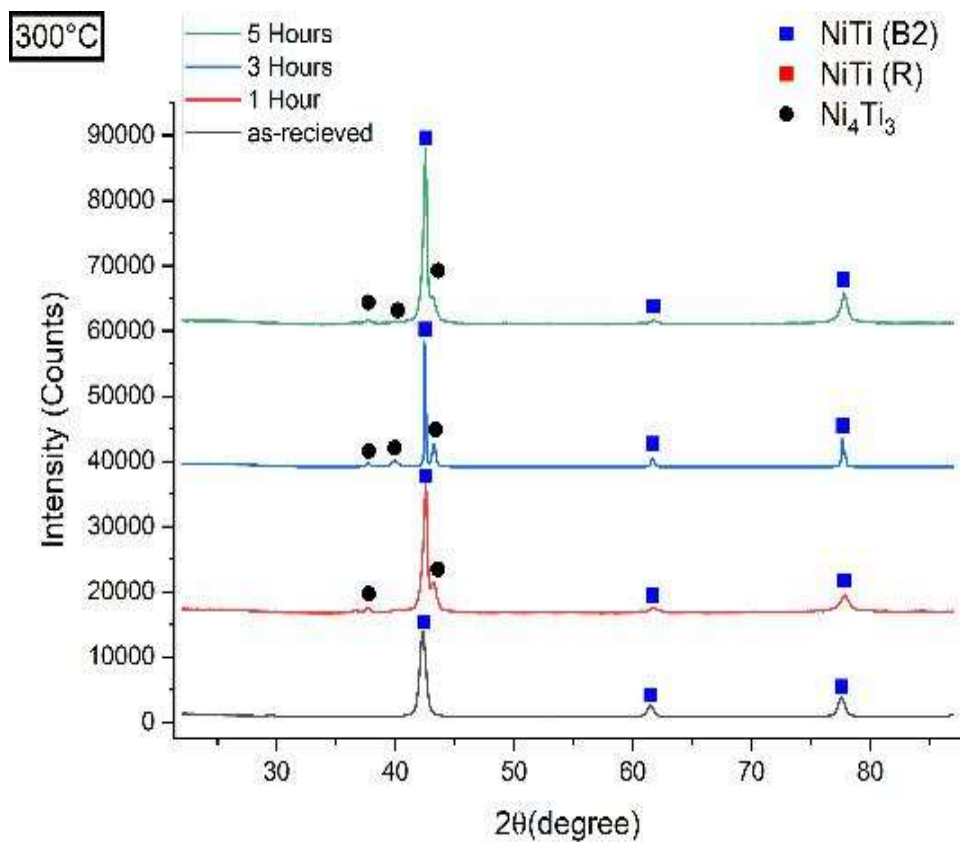
Spesimen	Kekuatan		
	<i>Yield Strength</i> (MPa)	<i>Tensile Strength</i> (MPa)	<i>Elongation (%)</i>
NT	413	628	10.50
301	408	411	1.50
303	261	295	0.92
305	402	426	1.71
351	361	378	1.49
353	351	355	1.85
355	366	373	2.23
401	384	398	2.54
403	406	406	2.41
405	320	350	1.65

Tabel B.4 Rata-rata Nilai Kekerasan.

Spesimen	Nilai Kekerasan Rata-rata (HV)
NT	299
301	518
303	400
305	383
351	439
353	388
355	369
401	471
403	455
405	405

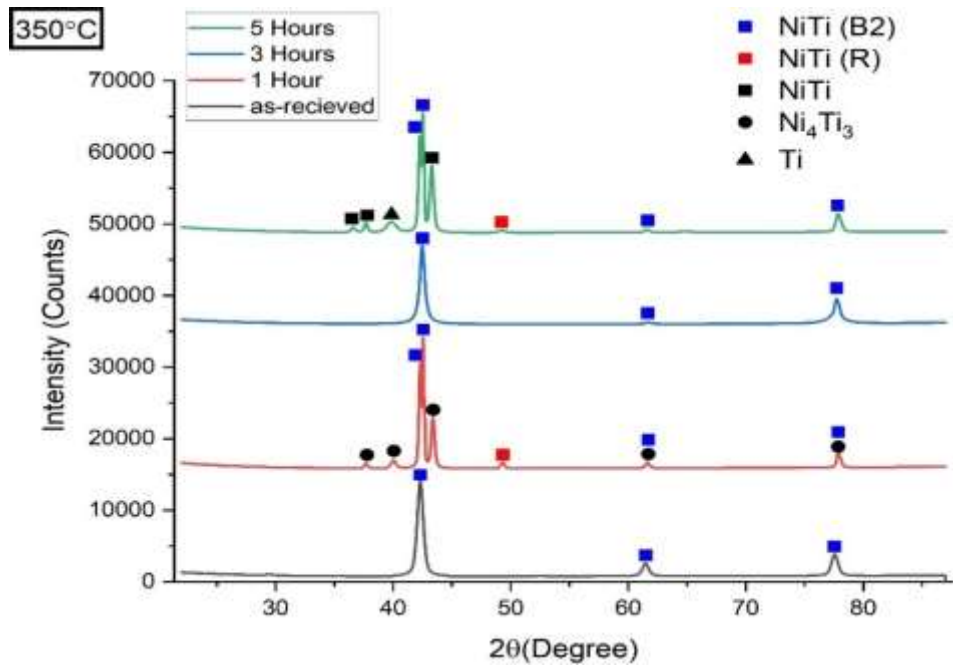
2. Gambar Pola Uji XRD

a. Pola Uji XRD Spesimen Temperatur 300°C



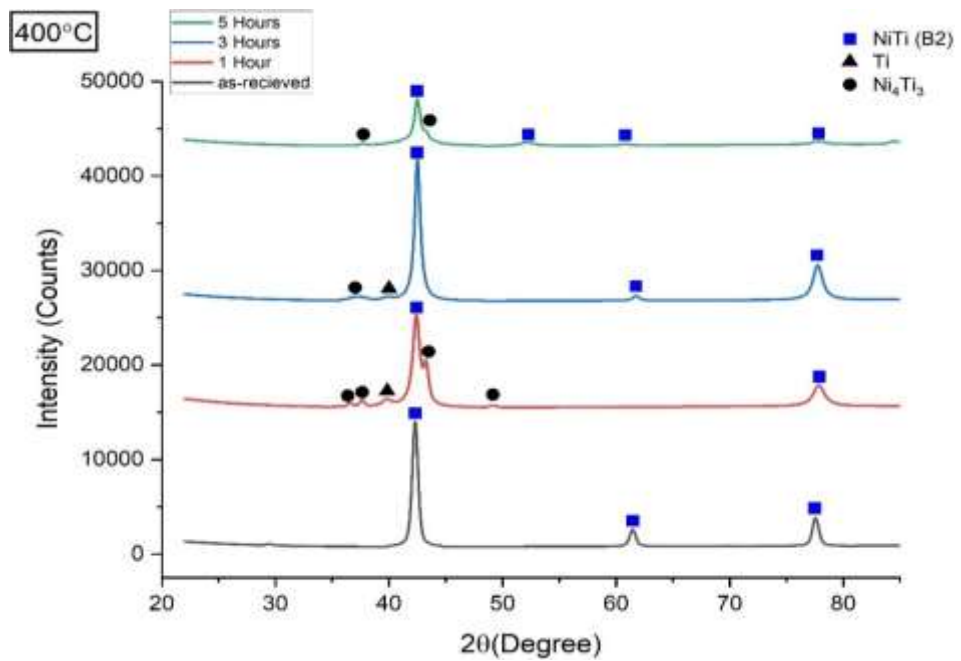
Gambar B.1 Hasil Uji XRD Spesimen Temperatur 300°C.

b. Pola Uji XRD Spesimen Temperatur 350°



Gambar B.2 Hasil Uji XRD Spesimen Temperatur 350°C.

c. Pola Uji XRD Spesimen Temperatur 400°C



Gambar B.3 Hasil Uji XRD Spesimen Temperatur 400°C.

LAMPIRAN C

GAMBAR ALAT DAN BAHAN

C.1 Gambar Alat dan Bahan



Gambar C.1 Silika Ampul.



Gambar C.2 Muffle Furnace.



Gambar C.3 *Wire Cut.*



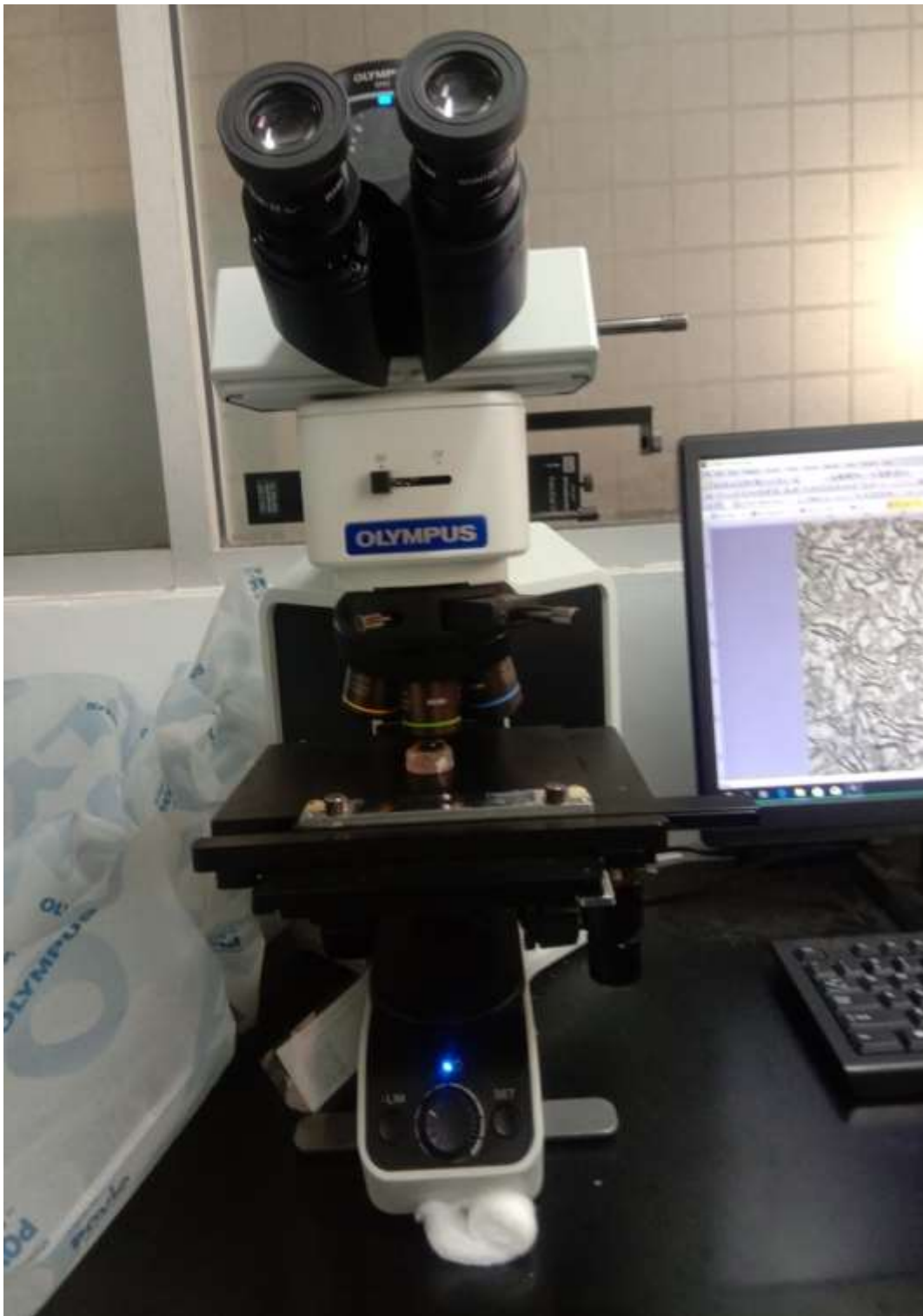
Gambar C.4 Ember.



Gambar C.5 Mesin Uji Tarik.



Gambar C.6 Amplas.



Gambar C.7 Mikroskop Optik.



Gambar C.8 *Vickers Hardness.*



Gambar C.9 Mesin *Grinding & Polishing*.



Gambar C.10 *Dryer*.



Gambar C.11 Tang Krusibel.



Gambar C.12 Alat Uji X-Ray Diffraction.



Gambar C.13 Gelas Beaker 500 ml.



Gambar C.14 Etanol 96%.



Gambar C.15 HNO₃.



Gambar C.16 HF.



Gambar C.19 Sarung Tangan Latex.