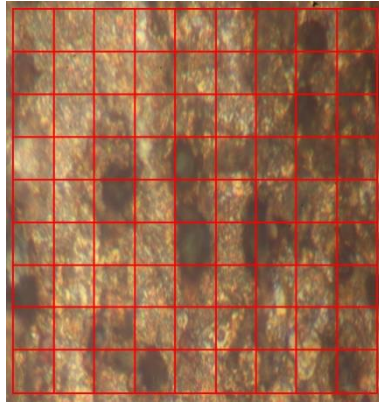


## LAMPIRAN

### Perhitungan Presentase Perlit dan Ferit Struktur Mikro

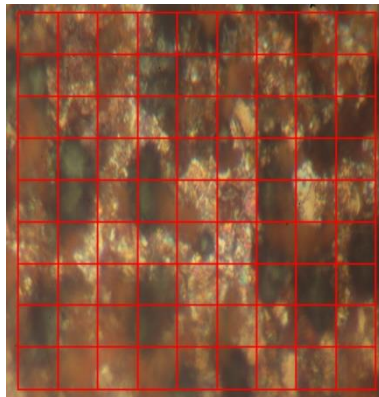
1. Suhu 100°C
  - a. Media Pendingin Air
    - Base Metal



$$\begin{aligned}\text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{29}{100} \times 100 \% = 29 \%\end{aligned}$$

$$\begin{aligned}\text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 29 = 71 \%\end{aligned}$$

- HAZ



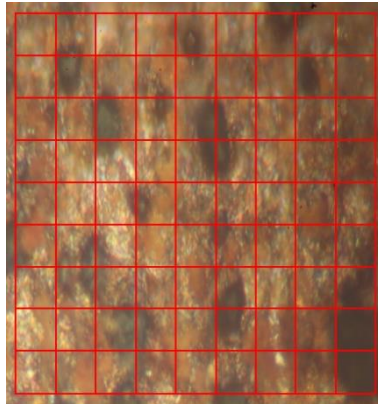
$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{30}{100} \times 100 \% = 30 \%$$

$$\text{Presentase Ferit} = 100 \% - \text{Presentase Perlit} = \%$$

$$= 100 \% - 30 = 70 \%$$

- Welding Metal



$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

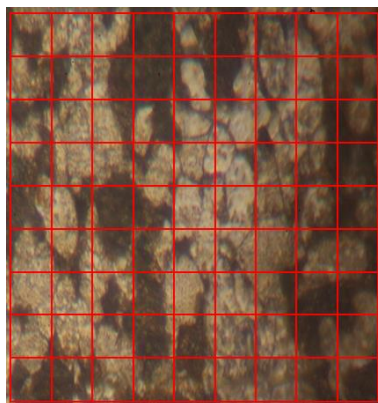
$$= \frac{29}{100} \times 100 \% = 29 \%$$

$$\text{Presentase Ferit} = 100 \% - \text{Presentase Perlit} = \%$$

$$= 100 \% - 29 = 71 \%$$

b. Media Pendingin Oli

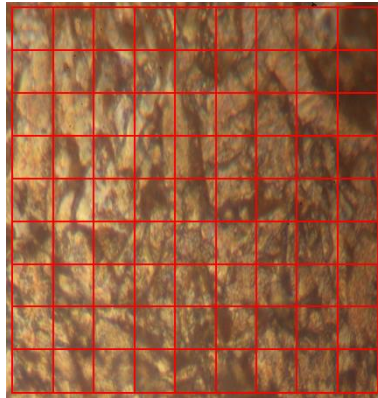
- Base Metal



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{24}{100} \times 100 \% = 24 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 24 = 76 \% \end{aligned}$$

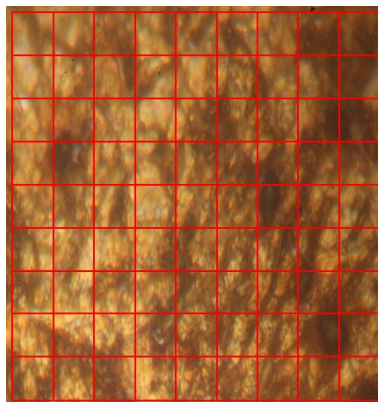
- HAZ



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{32}{100} \times 100 \% = 32 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 32 = 68 \% \end{aligned}$$

- Welding Metal



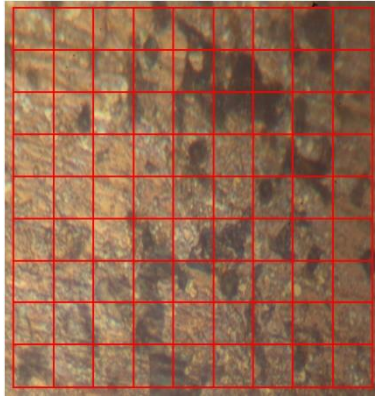
$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{24}{100} \times 100 \% = 24 \%$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 24 = 76 \% \end{aligned}$$

c. Media Pendingin Suhu Ruangan

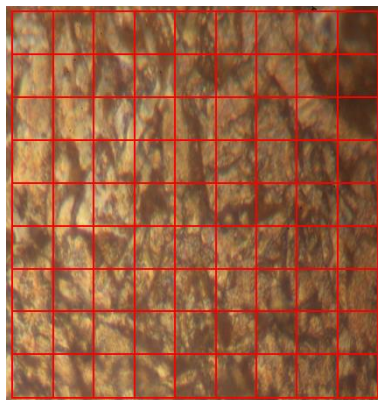
- Base Metal



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{25}{100} \times 100 \% = 25 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 25 = 75 \% \end{aligned}$$

- HAZ

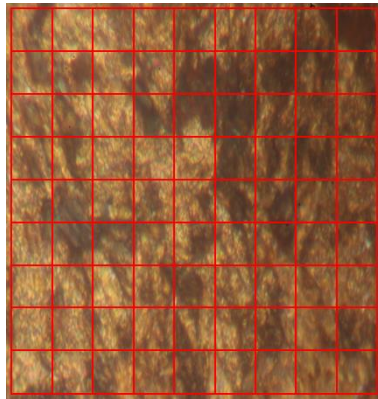


$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{32}{100} \times 100 \% = 32 \%$$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 32 = 68 %

- Welding Metal



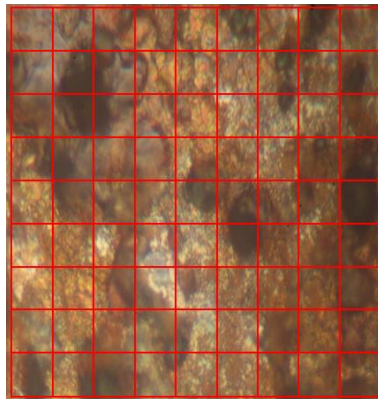
Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 $= \frac{23}{100} \times 100 \% = 23 \%$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 23 = 77%

2. Suhu 200°C

a. Media Pendingin Air

- Base Metal



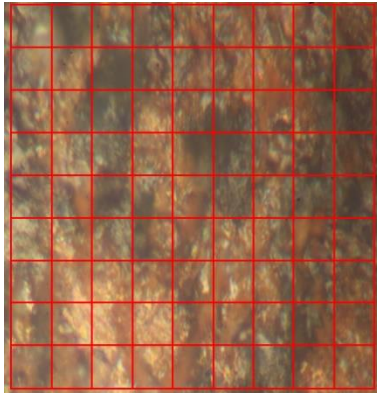
$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{16}{100} \times 100 \% = 16 \%$$

$$\text{Presentase Ferit} = 100 \% - \text{Presentase Perlit} = \%$$

$$= 100 \% - 16 = 84\%$$

- HAZ



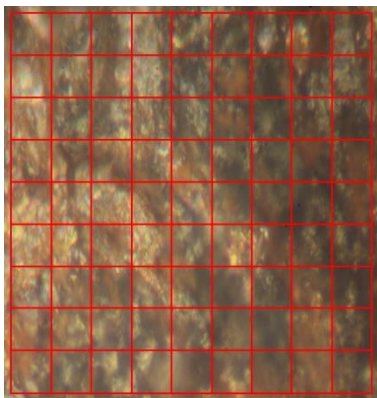
$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{13}{100} \times 100 \% = 13 \%$$

$$\text{Presentase Ferit} = 100 \% - \text{Presentase Perlit} = \%$$

$$= 100 \% - 13 = 87 \%$$

- Welding Metal



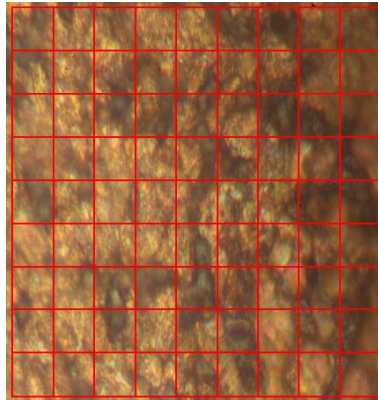
$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{28}{100} \times 100 \% = 28 \%$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 28 = 72 \% \end{aligned}$$

b. Media Pendingin Oli

- Base Metal

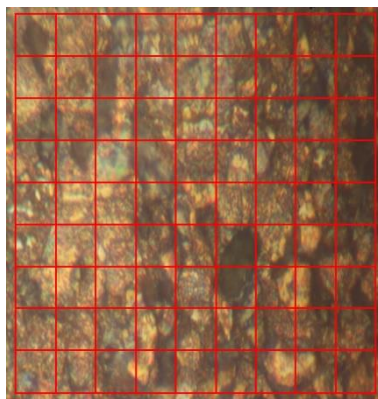


$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{39}{100} \times 100 \% = 39 \%$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 39 = 61 \% \end{aligned}$$

- HAZ

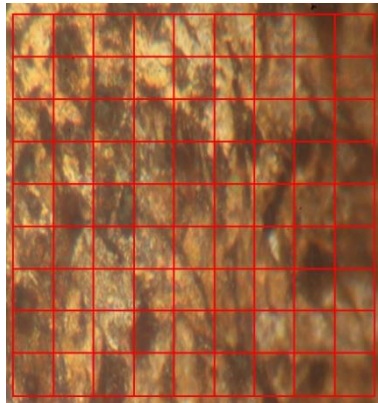


$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{26}{100} \times 100 \% = 26 \%$$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 26 = 74 %

- Welding Metal

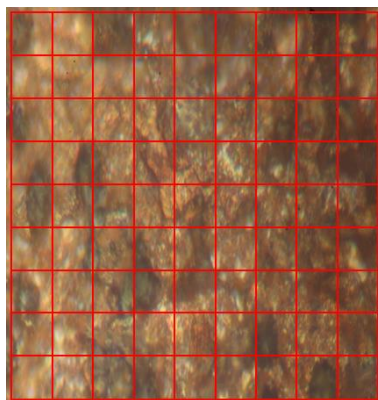


Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 =  $\frac{23}{100} \times 100 \% = 23 \%$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 23 = 77 %

d. Media Pendingin Suhu Ruangan

- Base Metal



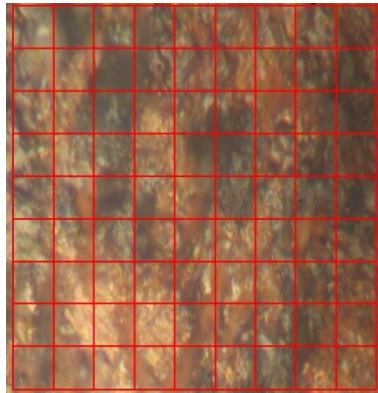
Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$



$$= \frac{30}{100} \times 100 \% = 30 \%$$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 30 = 70 %

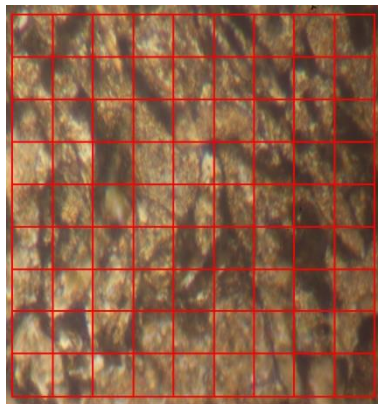
- HAZ



Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 $= \frac{23}{100} \times 100 \% = 23 \%$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 23 = 77 %

- Welding Metal



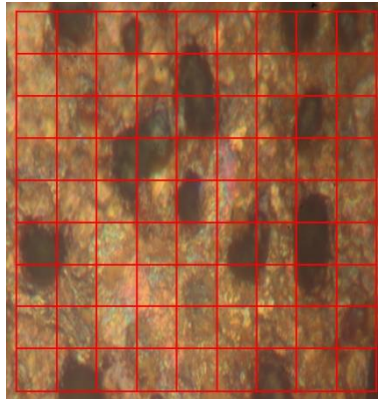
Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 $= \frac{21}{100} \times 100 \% = 21 \%$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 21 = 79 \% \end{aligned}$$

### 3. Suhu 300°C

#### a. Media Pendingin Air

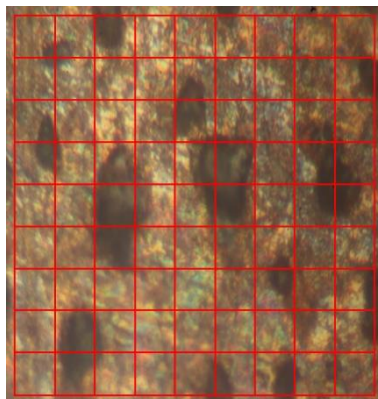
- Base Metal



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{18}{100} \times 100 \% = 18 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 18 = 82 \% \end{aligned}$$

- HAZ

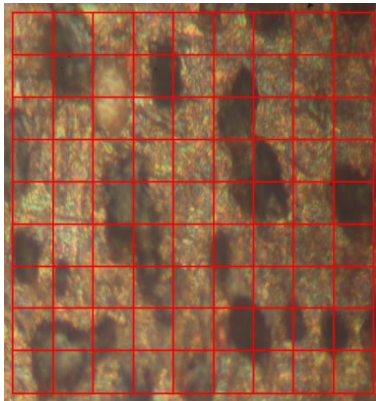


$$\text{Presentase Perlit} = \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$$

$$= \frac{18}{100} \times 100 \% = 18 \%$$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 18 = 82 %

- Welding Metal

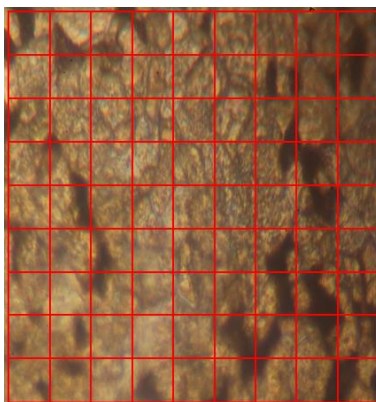


Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 =  $\frac{25}{100} \times 100 \% = 25 \%$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 25 = 75 %

b. Media Pendingin Oli

- Base Metal

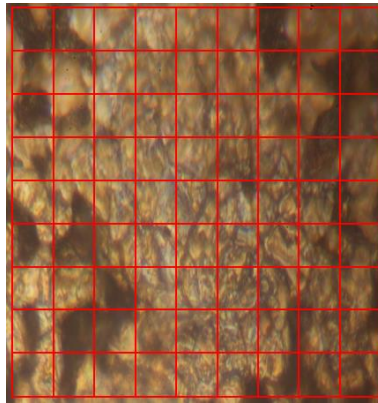


Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$

$$= \frac{18}{100} \times 100 \% = 18 \%$$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 18 = 82 %

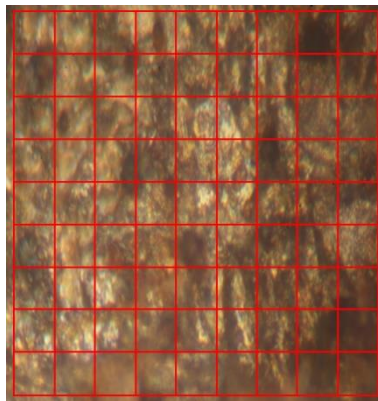
- HAZ



Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 =  $\frac{25}{100} \times 100 \% = 25 \%$

Presentase Ferit = 100 % - Presentase Perlit = %  
 = 100 % - 25 = 75 %

- Welding Metal

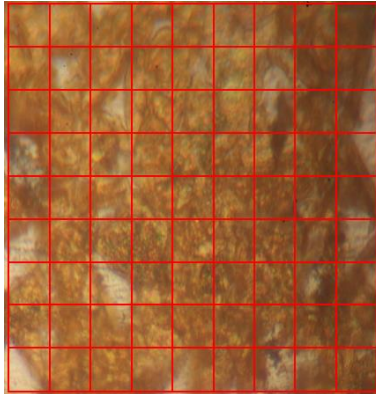


Presentase Perlit =  $\frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \%$   
 =  $\frac{12}{100} \times 100 \% = 12 \%$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 12 = 88 \% \end{aligned}$$

c. Media Pendingin Suhu Ruangan

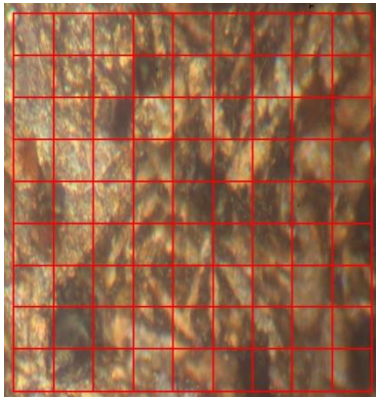
- Base Metal



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{20}{100} \times 100 \% = 20 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 20 = 80 \% \end{aligned}$$

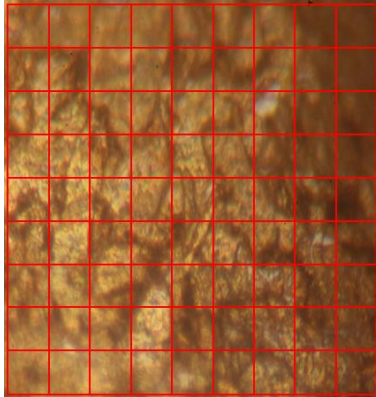
- HAZ



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{19}{100} \times 100 \% = 19 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 19 = 81 \% \end{aligned}$$

- Welding Metal

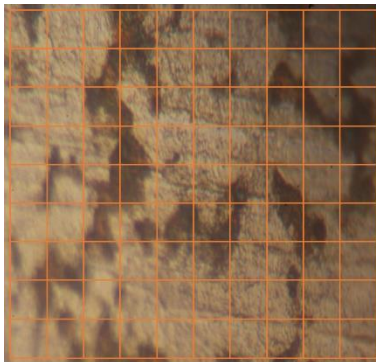


$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{11}{100} \times 100 \% = 11\% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 11 = 89 \% \end{aligned}$$

#### 4. No Treatment

- Base Metal

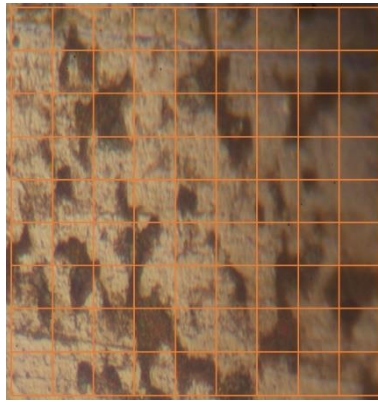


$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{20}{100} \times 100 \% = 20 \% \end{aligned}$$

$$\text{Presentase Ferit} = 100 \% - \text{Presentase Perlit} = \%$$

$$= 100 \% - 20 = 80 \%$$

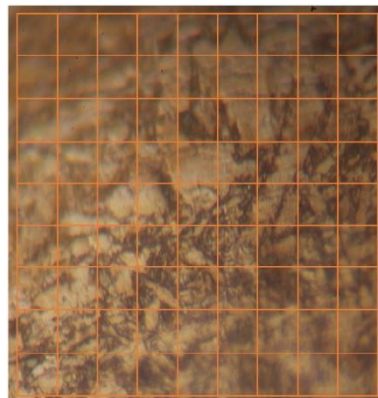
- HAZ



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{26}{100} \times 100 \% = 26 \% \end{aligned}$$


$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 26 = 74\% \end{aligned}$$

- Welding Metal



$$\begin{aligned} \text{Presentase Perlit} &= \frac{\text{Jumlah fasa Perlit}}{\text{Jumlah Titik}} \times 100 \% = \% \\ &= \frac{16}{100} \times 100 \% = 16 \% \end{aligned}$$

$$\begin{aligned} \text{Presentase Ferit} &= 100 \% - \text{Presentase Perlit} = \% \\ &= 100 \% - 16 = 84 \% \end{aligned}$$

	<b>Laboratorium Pengujian Bahan &amp; Pelapisan Logam</b> <b>Jurusan Teknik Mesin – Fakultas Teknik</b> <b>Universitas Negeri Surabaya</b>
	Post Weld Heat Treatment (PWHT) Nabertherm Furnace

Dibawah ini menyatakan bahwa :

NO	Nama Mahasiswa	NBI	Email	NO HP
1.	Dedi Cahyadi	1421800161	Deddycahyadi35@gmail.com	081330621454

Telah Menggunakan Furnace di Laboraturium Pelapisan Logam Jurusan Teknik Mesin Universitas Negeri Surabaya selama 2 hari pada tanggal 20-22 Maret 2022 dengan variasi Temperatur dan Waktu Media Pendingin 100°C, 200°C, 300°C dan media pendingin air, media pendingin oli, dan media pendingin suhu ruangan

Demikian surat keterangan ini dibuat untuk di gunakan sebagaimana mestinya.



Surabaya, 22 Maret 2022  
 KaSubLab  
 Pengujian Bahan & Pelapisan Logam



( Tri Hartutuk Ningsti, S.T.,M.T )



## Nilai Hasil Pengujian Kekerasan

	<b>LABORATORIUM MATERIAL TEKNIK</b> <b>TEKNIK MESIN UNTAG'45-SURABAYA</b> <b>LEMBAR DATA UJI KEKERASAN / METODE</b> <b>ROCKWELL</b>		
	Nama : DEDI CAHYADI NBI : 142 1000161 Tanggal Pengujian :		

### DATA HASIL PENGUJIAN KEKERASAN

#### Suhu 100°C Media pendingin air

No	Material	P	t	Skala Hitam	Skala
1	HAZ	P = 150 KG	t = 5 detik	Diamond Cone (Skala Hitam)	54
					53
					54
					53
					52
					53.2
2	WELDING METAL	P = 150 KG	t = 5 detik	Diamond Cone (Skala Hitam)	49.5
					50
					51
					54
					53.5
					51.2
3	BASE METAL	P = 150 KG	t = 5 detik	Diamond Cone (Skala Hitam)	51
					49
					50.5
					48
					48.5
					49.4

#### Suhu 100°C Media pendingin oli

No	Material	P	t	Skala Hitam	Skala
1	HAZ	P = 150 KG	t = 5 detik	Diamond Cone (Skala Hitam)	52
					53.5
					53
					53
					51.5
					52.6
2	WELDING METAL	P = 150 KG	t = 5 detik	Diamond Cone (Skala Hitam)	52.5
					51
					50
					49.5
					49
					50.4
3	BASE METAL	P = 150 KG		Diamond Cone (Skala Hitam)	50
					50

		t = 5 detik		47	40.3
				48	
				46.5	

**Suhu 100°C Media pendingin suhu ruangan**

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	51.5	49.8
				49	
				48	
				50	
				50.5	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	49.5	49
				48.5	
				48	
				50	
				49	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	45	47.2
				48	
				48.5	
				47	
				47.5	

Surabaya, 2022

  
  
 AS. LAB MATERIAL TEKNIK  
 LAB. LOGAM  
 UNTAG 45  
 SURABAYA



LABORATORIUM MATERIAL TEKNIK  
TEKNIK MESIN UNTAG'45-SURABAYA  
LEMBAR DATA UJI KEKERASAN / METODE  
ROCKWELL



Nama : DEDI CAHYADI  
NBI : 142 1800 161  
Tanggal Pengujian :

DATA HASIL PENGUJIAN KEKERASAN

Suhu 200°C Media pendingin air

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	51.5	53
				53	
				54.5	
				54	
				52	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	51	50.3
				50.5	
				51	
				49	
				50	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	48	48.5
				47.5	
				47	
				49	
				51	

Suhu 200°C Media pendingin oli

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	50	51.6
				50.5	
				53	
				52	
				52.5	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	50.5	49.4
				51	
				50	
				48.5	
				47	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	43	45.3
				45.5	
				44.5	

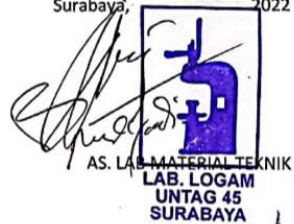
				46	
				47.5	

**Suhu 200°C Media pendingin suhu ruangan**

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	<del>45.5</del> 52	49.3
				<del>51.5</del> 46	
				46 51.5	
				<del>51</del> 47	
				<del>48</del> 49.5	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	45.5	48.6
				52.5	
				46	
				51	
				48	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	46.5	47.4
				45.5	
				46	
				49	
				50	

Surabaya,

2022





**LABORATORIUM MATERIAL TEKNIK**  
**TEKNIK MESIN UNTAG'45-SURABAYA**  
**LEMBAR DATA UJI KEKERASAN / METODE**  
**ROCKWELL**



Nama : DEDI CAHYADI  
NBI : 142 1000161  
Tanggal Pengujian :

**DATA HASIL PENGUJIAN KEKERASAN**

**Suhu 300°C Media pendingin air**

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	50.5	51
				51	
				51	
				50	
				52.5	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	52	50.1
				49	
				48	
				50	
				51.5	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	42.5	46.5
				49	
				45.5	
				46	
				44.5	

**Suhu 300°C Media pendingin oli**

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	51.5	49.8
				49	
				48	
				50	
				50.5	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	48.5	49.1
				50	
				47	
				51	
				49	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	48.5	46.4
				49	
				45.5	

				43	
				46	

**Suhu 300°C Media pendingin suhu ruangan**

1	HAZ	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	42.5	49.6
				49	
				51	
				50	
				50.5	
2	WELDING METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	49.5	46.8
				49	
				47	
				45	
				43.5	
3	BASE METAL	P = 150 KG t = 5 detik	Diamond Cone (Skala Hitam)	43.5	43.8
				43.5	
				44	
				43	
				45	

Surabaya,

2022

