

LAMPIRAN A
CONTOH PERHITUNGAN

A.1 Perhitungan Pembuatan Larutan Etsa

Perbandingan Larutan

10% H₂SO₄ : 90% Metanol

= 10 ml H₂SO₄ : 90 ml Metanol

A.2 Perhitungan Komposisi Media

a. *Pack Carbonitriding*

Perbandingan Komposisi = 40% Karbon : 40% Urea : 20% CaCO₃

Karbon = 650 gr × 40% = 260 gr

Urea = 650 gr × 40% = 260 gr

CaCO₃ = 650 gr × 20% = 130 gr

b. *Pack Carburizing*

Perbandingan Komposisi = 80% Karbon : 20% CaCO₃

Karbon = 650 gr × 80% = 520 gr

CaCO₃ = 650 gr × 20% = 130 gr

A.3 Perhitungan Nilai Kekerasan

$$Kekerasan (HV) = \frac{Indentasi\ 1 + Indentasi\ 2 + Indentasi\ 3 + Indentasi\ 4 + Indentasi\ 5}{Total\ Indentasi}$$

1. Tanpa Perlakuan

$$Kekerasan (HV) = \frac{239 + 241 + 254 + 248 + 245}{5} = 245,40\ HV$$

2. *Pack Carbonitriding*

a. Waktu Tahan 1 Jam

5CN1

$$Kekerasan (HV) = \frac{247,5 + 267,8 + 278,3 + 298,0 + 270,8}{5} = 272,48\ HV$$

6CN1

$$Kekerasan (HV) = \frac{281,1+291,6+280,4+283,2+292,4}{5} = 285,74 \text{ HV}$$

b. Waktu Tahan 2 Jam

5CN2

$$Kekerasan (HV) = \frac{275,5+297,2+298,9+297,2+261,2}{5} = 286,00 \text{ HV}$$

6CN2

$$Kekerasan(HV) = \frac{284,6+285,3+289,2+290,8+294,8}{5} = 288,94 \text{ HV}$$

c. Waktu Tahan 3 Jam

5CN3

$$Kekerasan (HV) = \frac{325,2+306,8+312,4+286,8+274,1}{5} = 301,06 \text{ HV}$$

6CN3

$$Kekerasan (HV) = \frac{258,2+260,0+272,7+269,0+293,2}{5} = 270,62 \text{ HV}$$

3. Pack Carburizing

a. Waktu Tahan 1 Jam

5C1

$$Kekerasan (HV) = \frac{281,8+294,8+284,6+281,8+249,2}{5} = 278,44 \text{ HV}$$

6C1

$$Kekerasan (HV) = \frac{263,6+291,6+294,8+288,4+292,4}{5} = 286,16 \text{ HV}$$

b. Waktu Tahan 2 Jam

5C2

$$Kekerasan (HV) = \frac{276,9+284,6+281,1+283,2+278,3}{5} = 280,82 \text{ HV}$$

6C2

$$Kekerasan (HV) = \frac{267,8+283,9+304,4+287,6+283,9}{5} = 285,52 \text{ HV}$$

c. Waktu Tahan 3 Jam

5C3

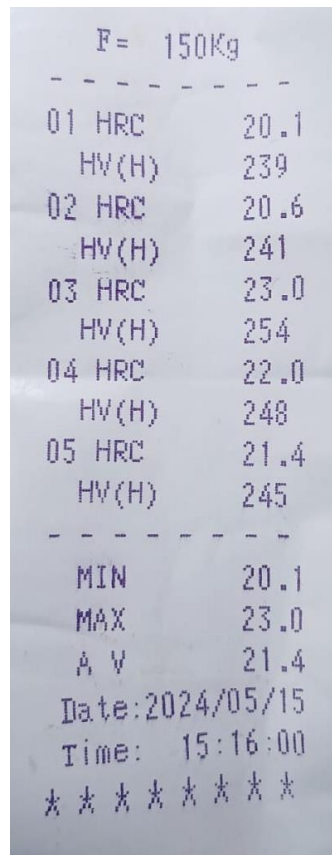
$$Kekerasan (HV) = \frac{260,6+278,3+21,4+275,5+270,2}{5} = 271,20 \text{ HV}$$

6C3

$$Kekerasan (HV) = \frac{275,5+279,0+280,4+287,6+274,8}{5} = 279,46 \text{ HV}$$

LAMPIRAN B
DATA PENELITIAN

B.1 Data Nilai Kekerasan Awal Spesimen



The image shows a digital display from a hardness testing machine. At the top, it indicates a load of F = 150Kg. Below this, it lists five specimens (01 to 05) with their corresponding HRC and HV(H) values. At the bottom, it shows the minimum, maximum, and average (A V) values, along with the date and time of the test.

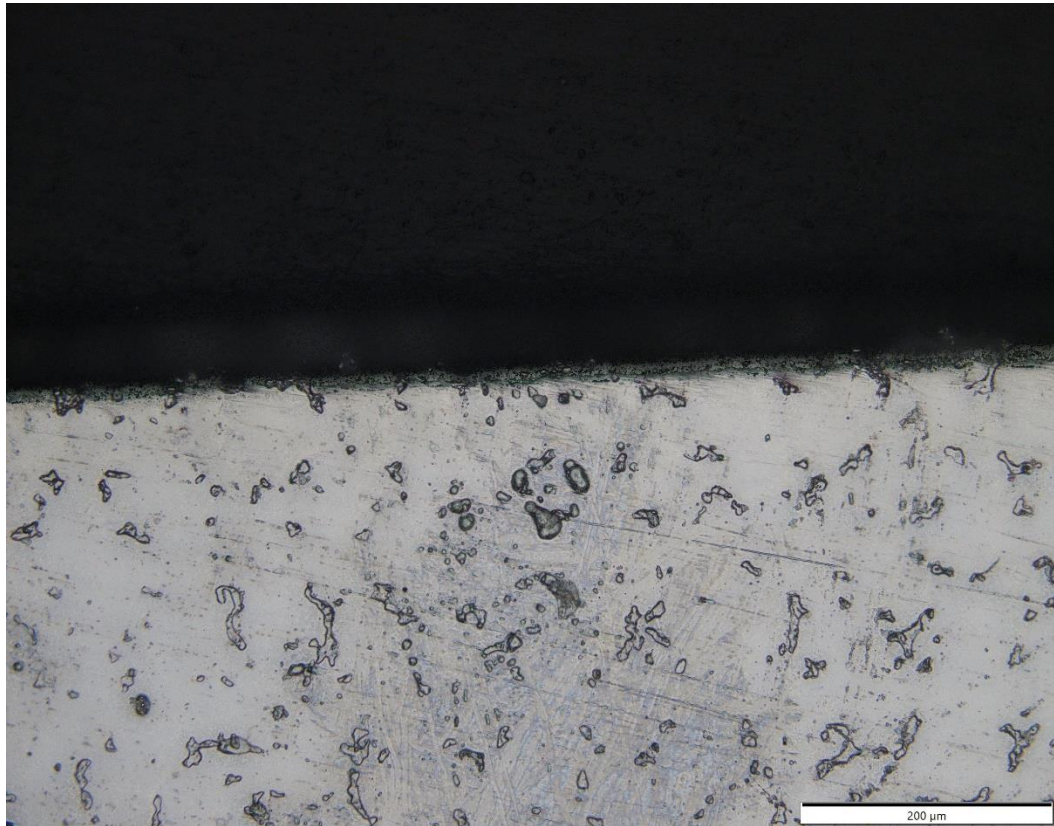
F = 150Kg	
01 HRC	20.1
HV(H)	239
02 HRC	20.6
HV(H)	241
03 HRC	23.0
HV(H)	254
04 HRC	22.0
HV(H)	248
05 HRC	21.4
HV(H)	245
MIN	20.1
MAX	23.0
A V	21.4
Date:	2024/05/15
Time:	15:16:00

Gambar B.1 Hasil Pengujian Kekerasan Awal

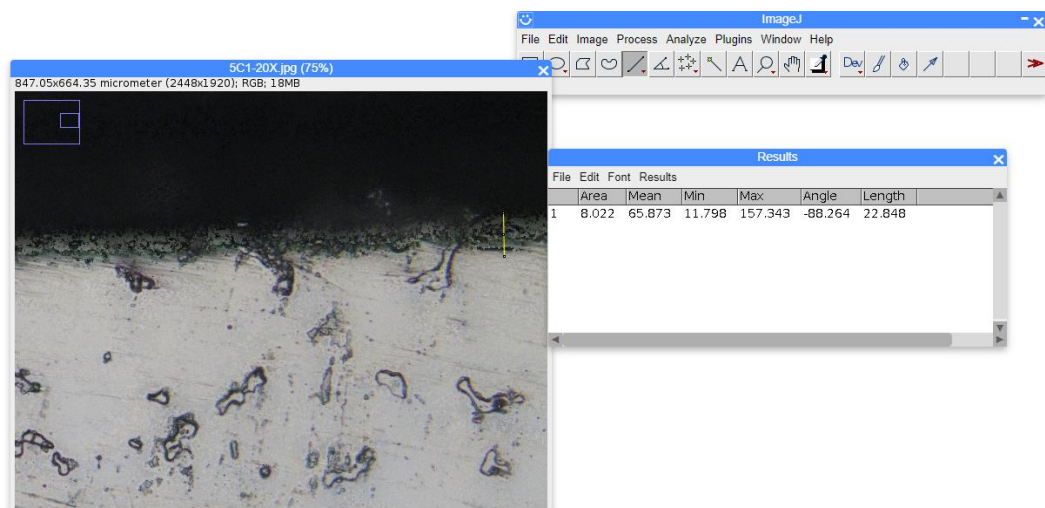
Tabel B.1 Nilai Kekerasan Awal Spesimen

Nilai Kekerasan <i>Vickers</i> (VHN)	
No.	<i>As-cast</i> CoCrMo
1	239
2	241
3	254
4	248
5	245
Rata-rata	245,40

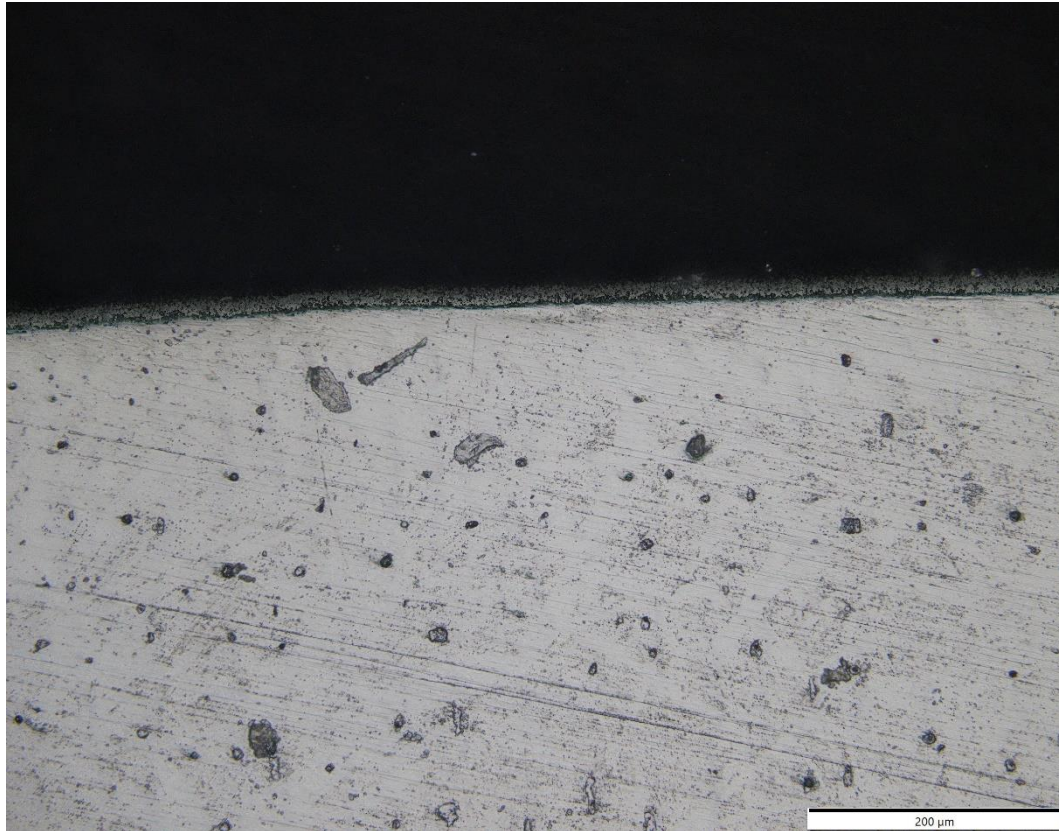
B.2 Struktur Mikro Lapisan Difusi



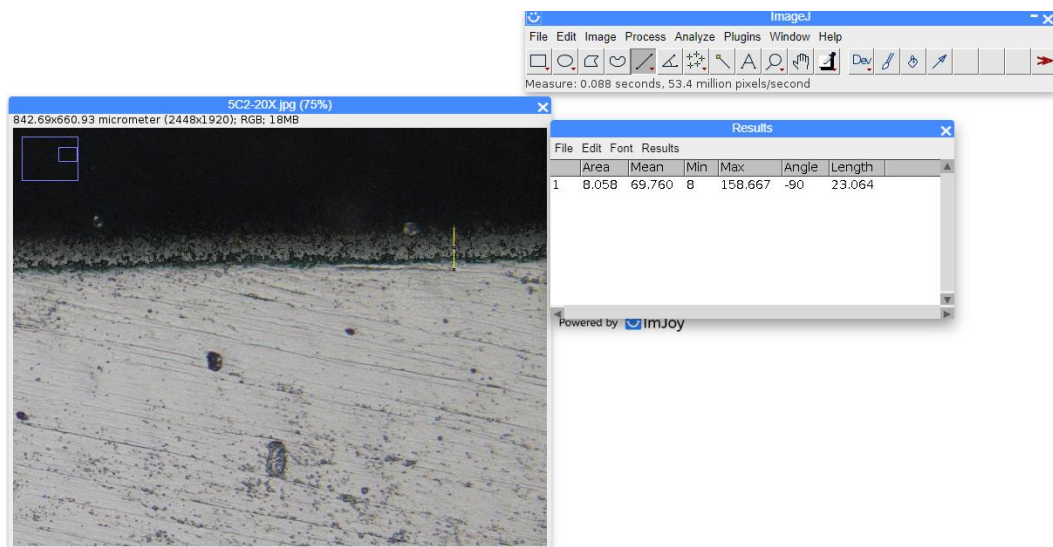
Gambar B.2 Struktur Mikro Spesimen 5C1 Perbesaran 20x



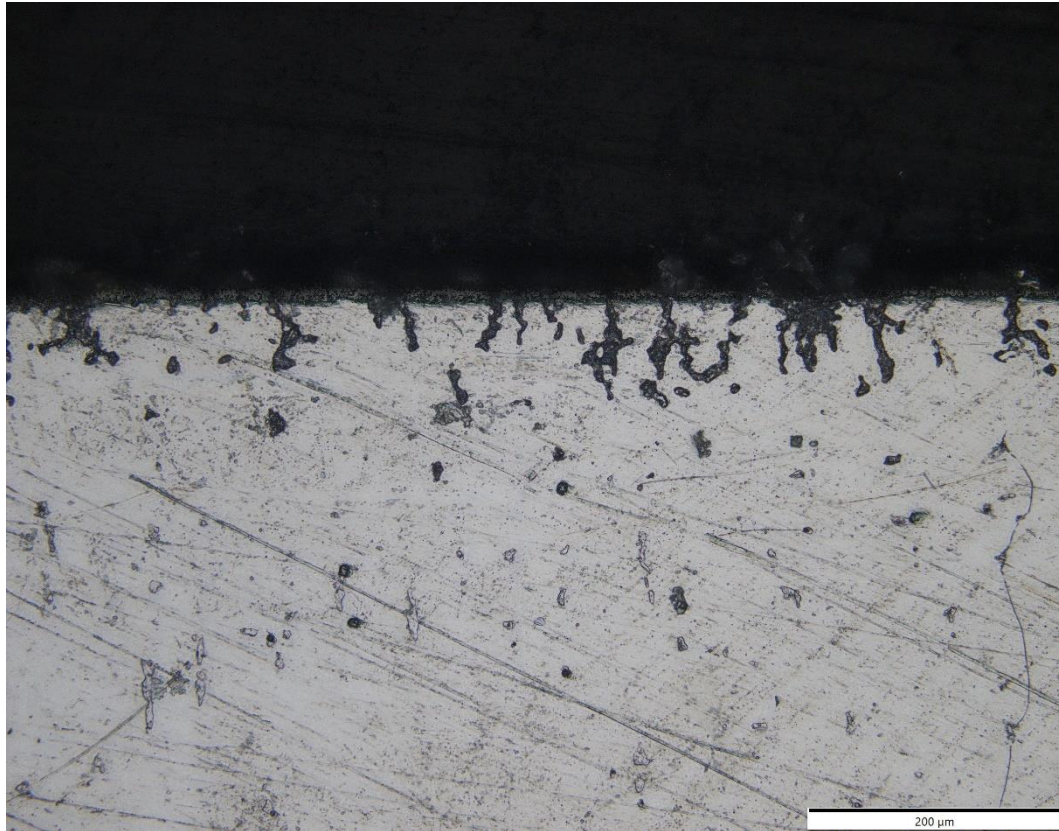
Gambar B.3 Hasil Pengamatan Lapisan Difusi Spesimen 5C1



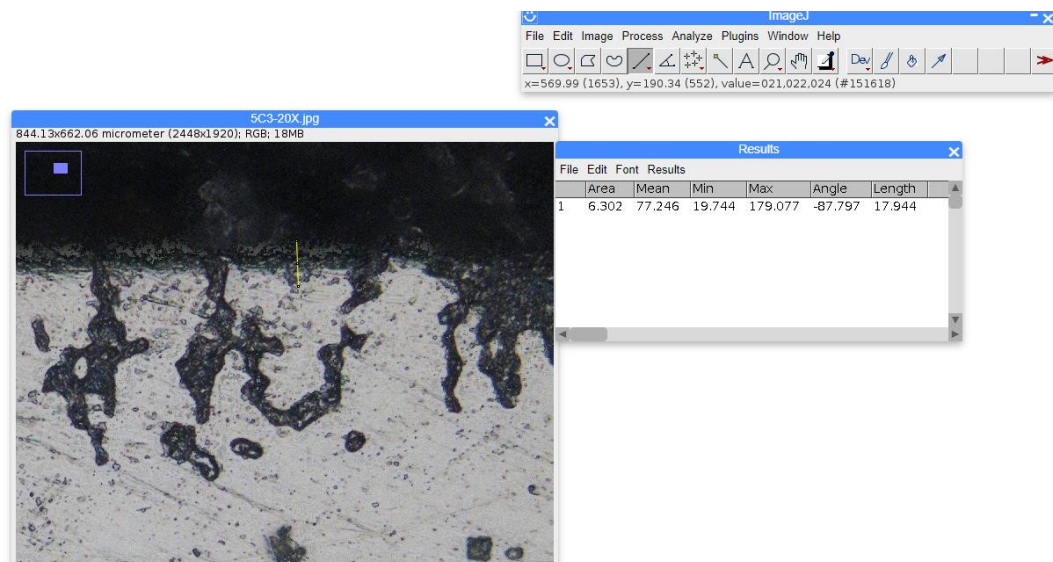
Gambar B.4 Struktur Mikro Spesimen 5C2 Perbesaran 20x



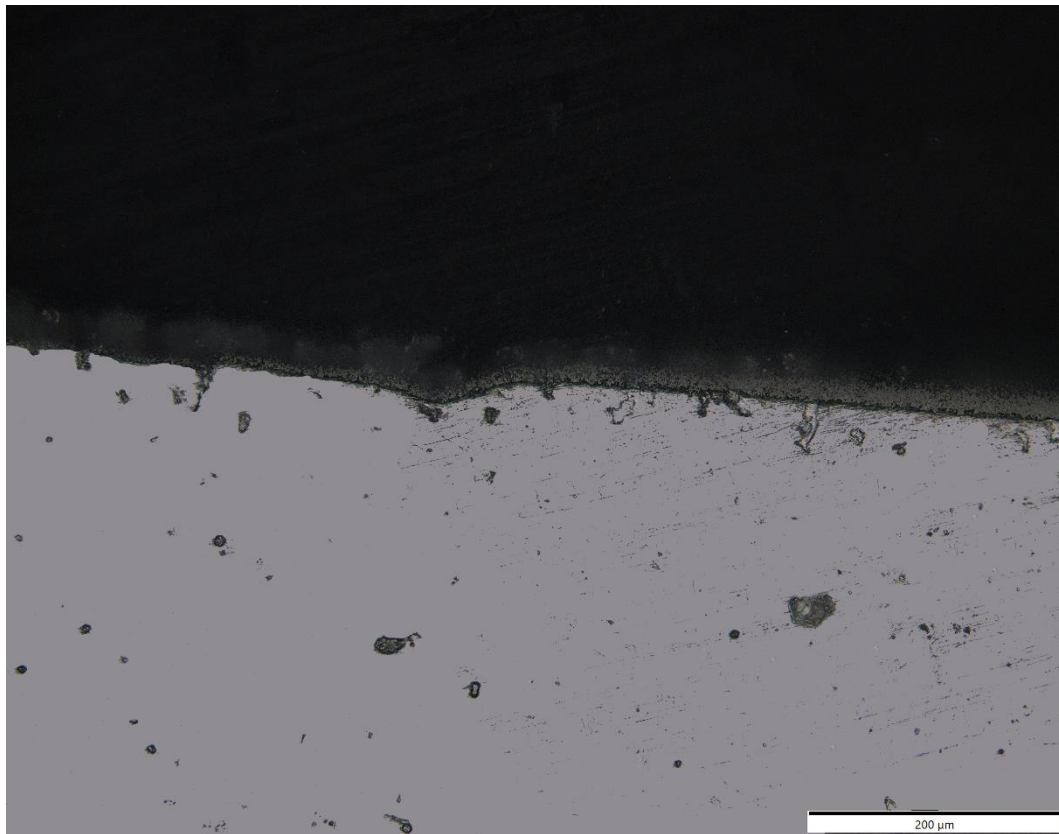
Gambar B.5 Hasil Pengamatan Lapisan Difusi Spesimen 5C2



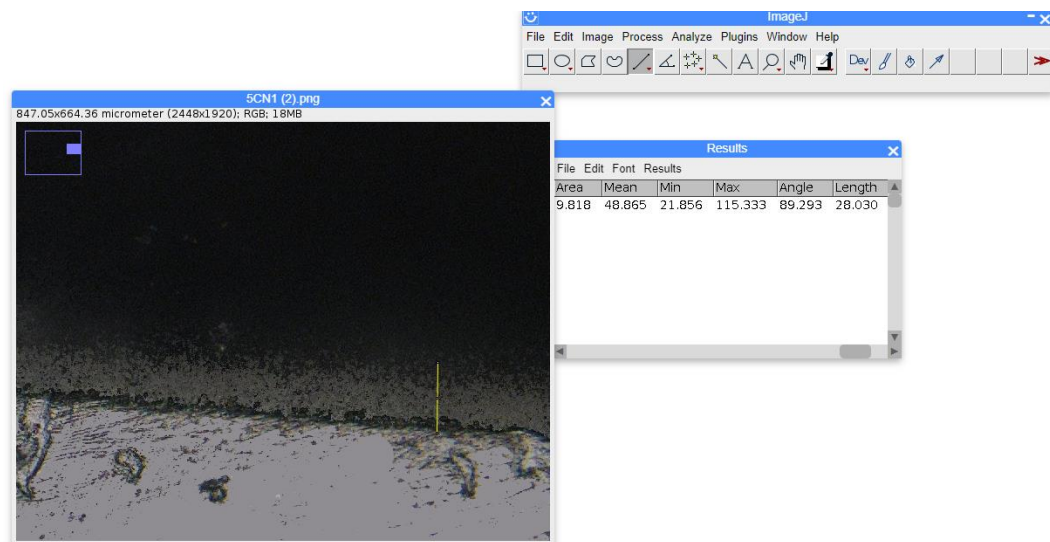
Gambar B.6 Struktur Mikro Spesimen 5C3 Perbesaran 20x



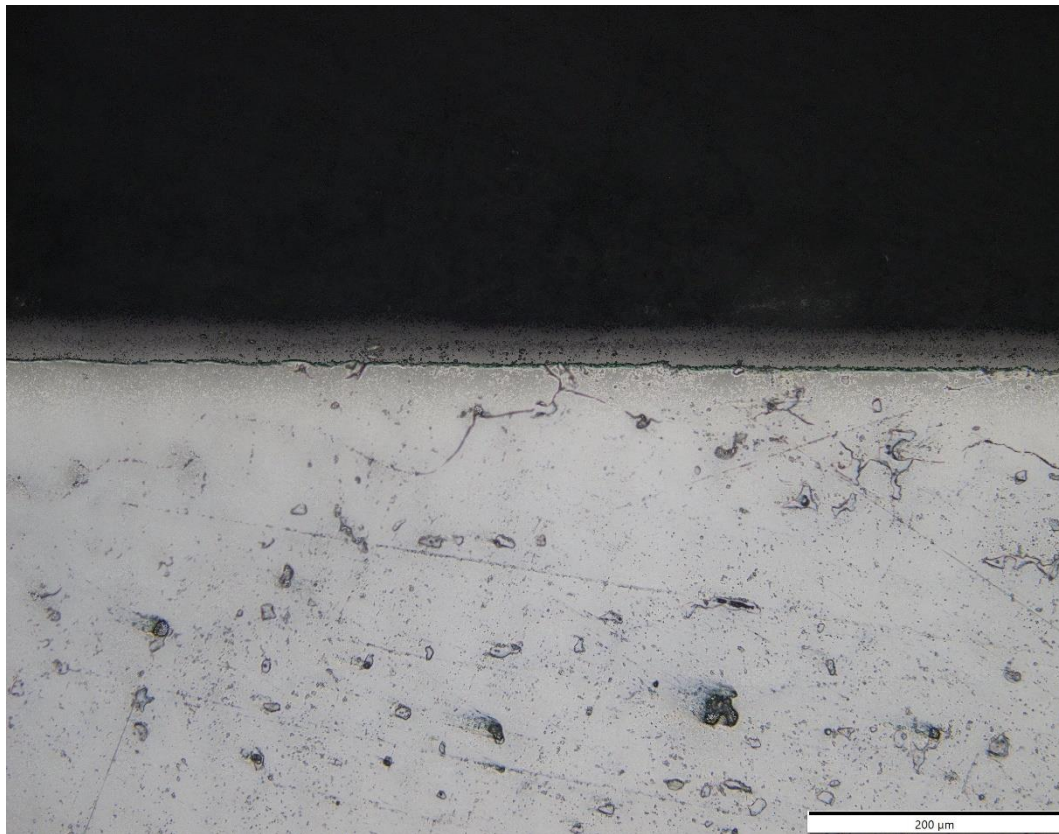
Gambar B.7 Hasil Pengamatan Lapisan Difusi Spesimen 5C3



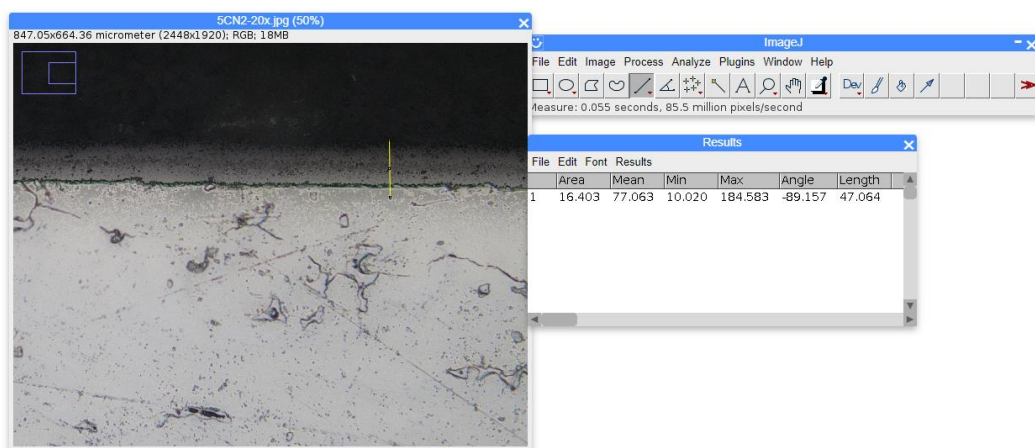
Gambar B.8 Struktur Mikro Spesimen 5CN1 Perbesaran 20x



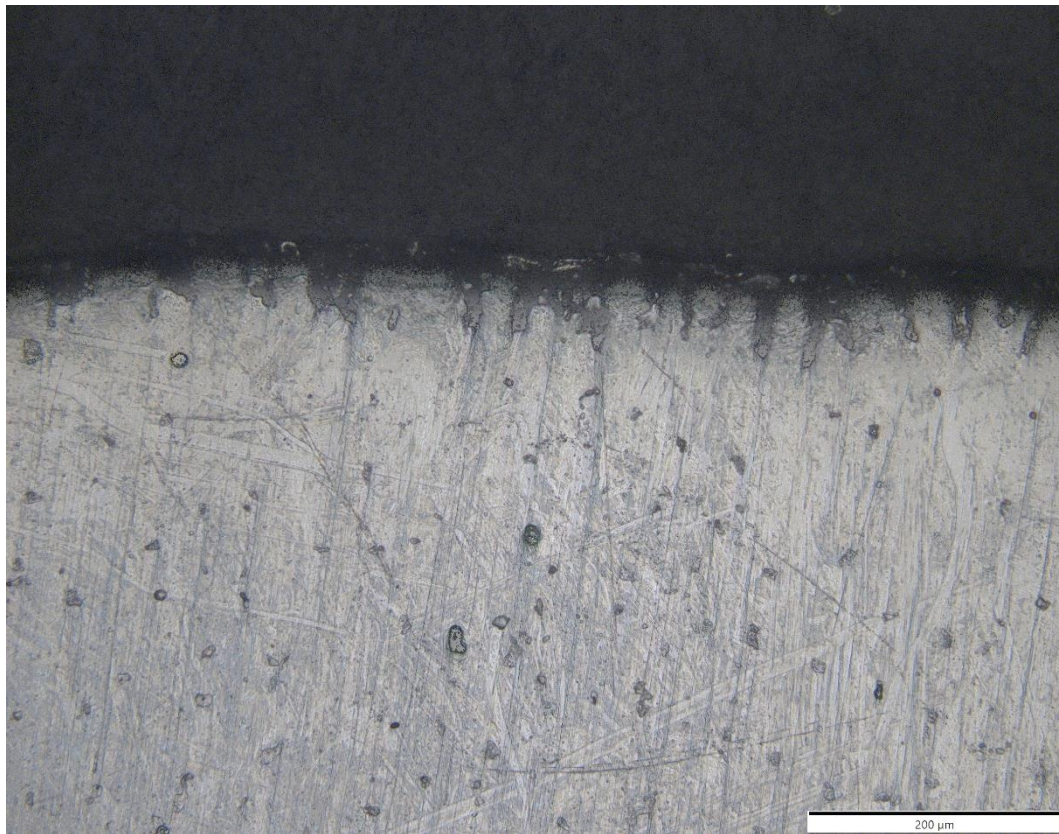
Gambar B.9 Hasil Pengamatan Lapisan Difusi Spesimen 5CN1



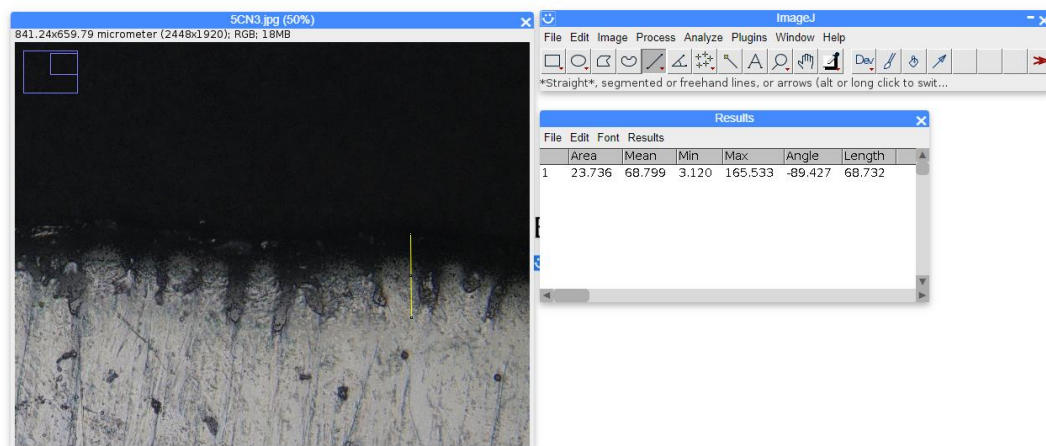
Gambar B.10 Struktur Mikro Spesimen 5CN2 Perbesaran 20x



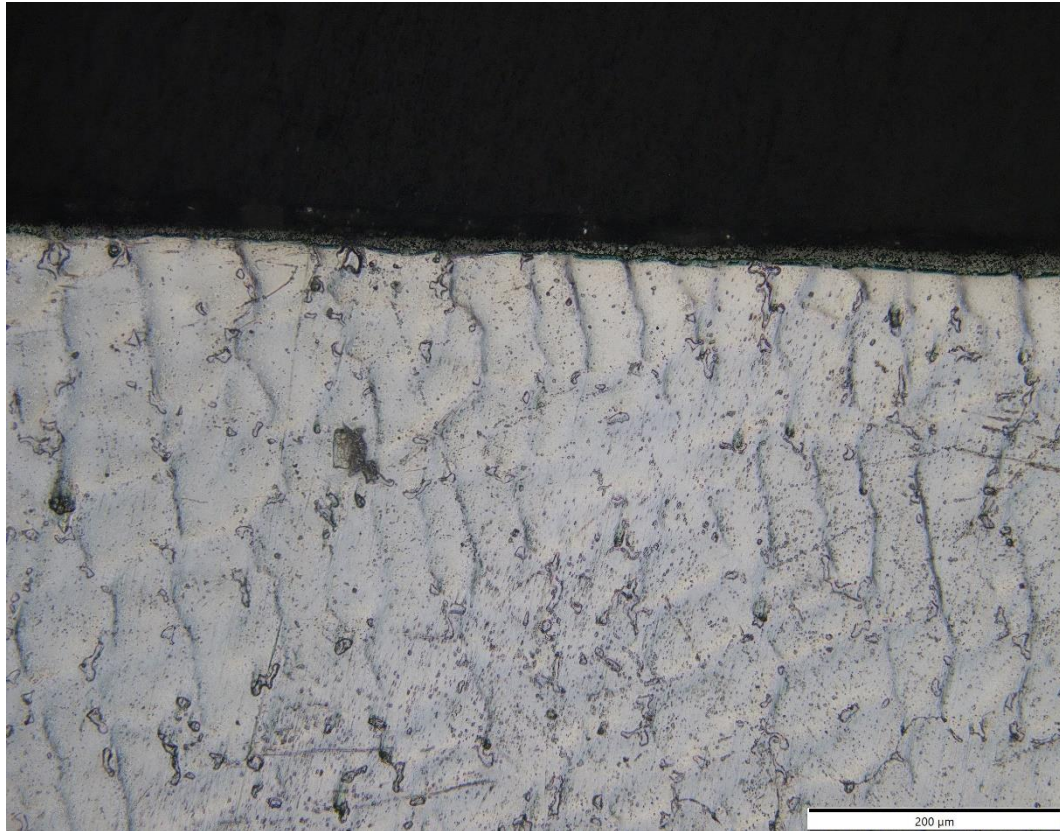
Gambar B.11 Hasil Pengamatan Lapisan Difusi Spesimen 5CN2



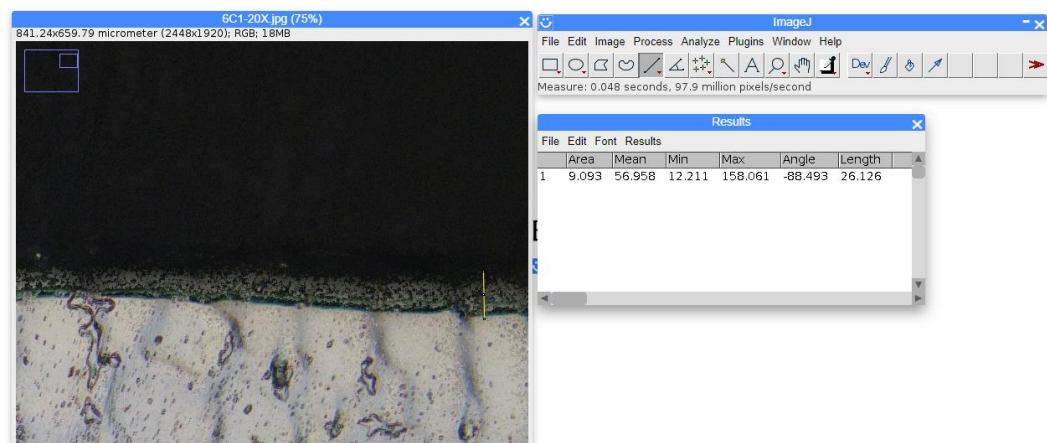
Gambar B.12 Struktur Mikro Spesimen 5CN3 Perbesaran 20x



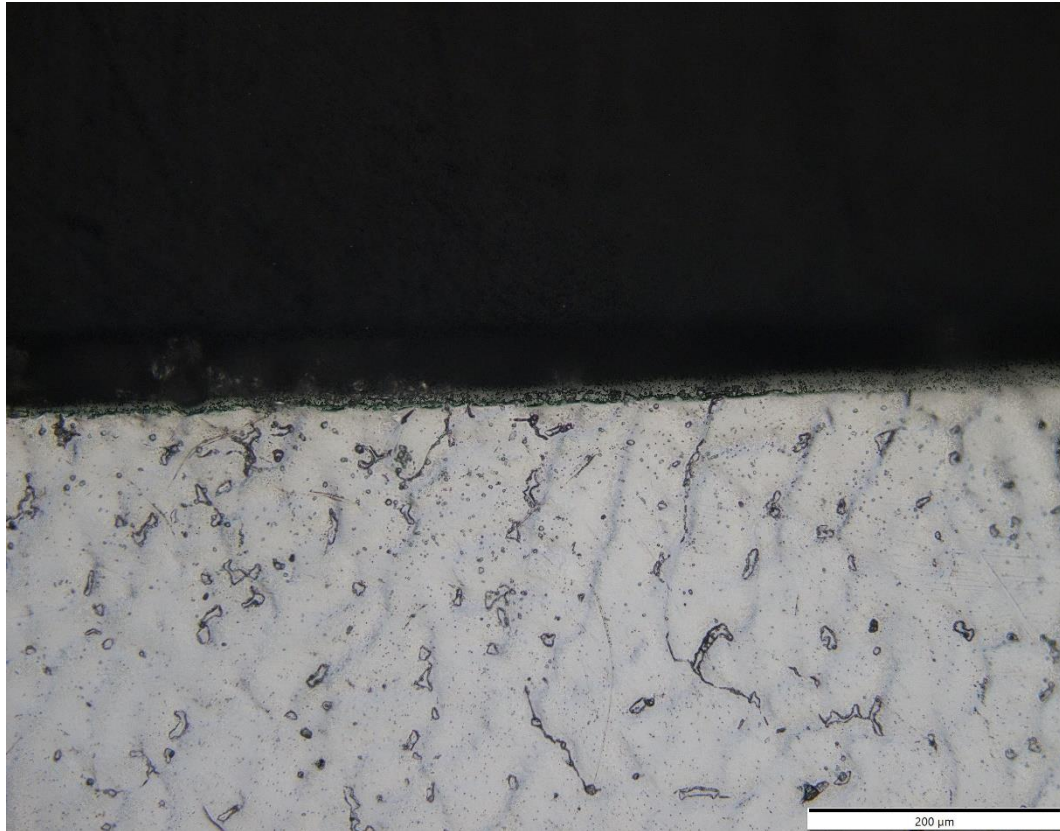
Gambar B.13 Hasil Pengamatan Lapisan Difusi Spesimen 5CN3



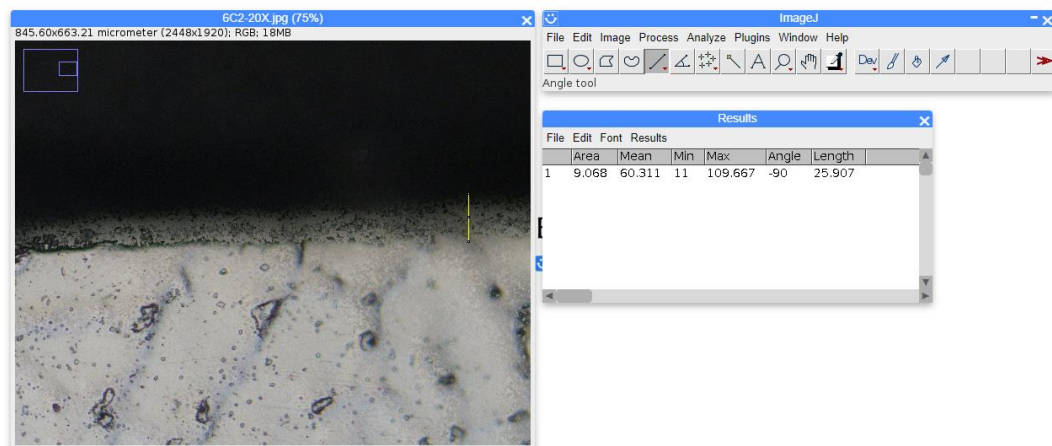
Gambar B.14 Struktur Mikro Spesimen 6C1 Perbesaran 20x



Gambar B.15 Hasil Pengamatan Lapisan Difusi Spesimen 6C1



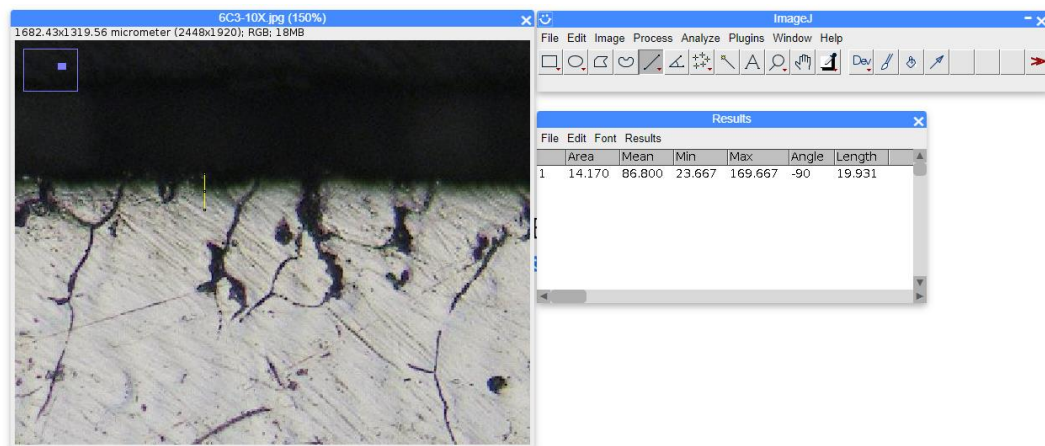
Gambar B.16 Struktur Mikro Spesimen 6C2 Perbesaran 20x



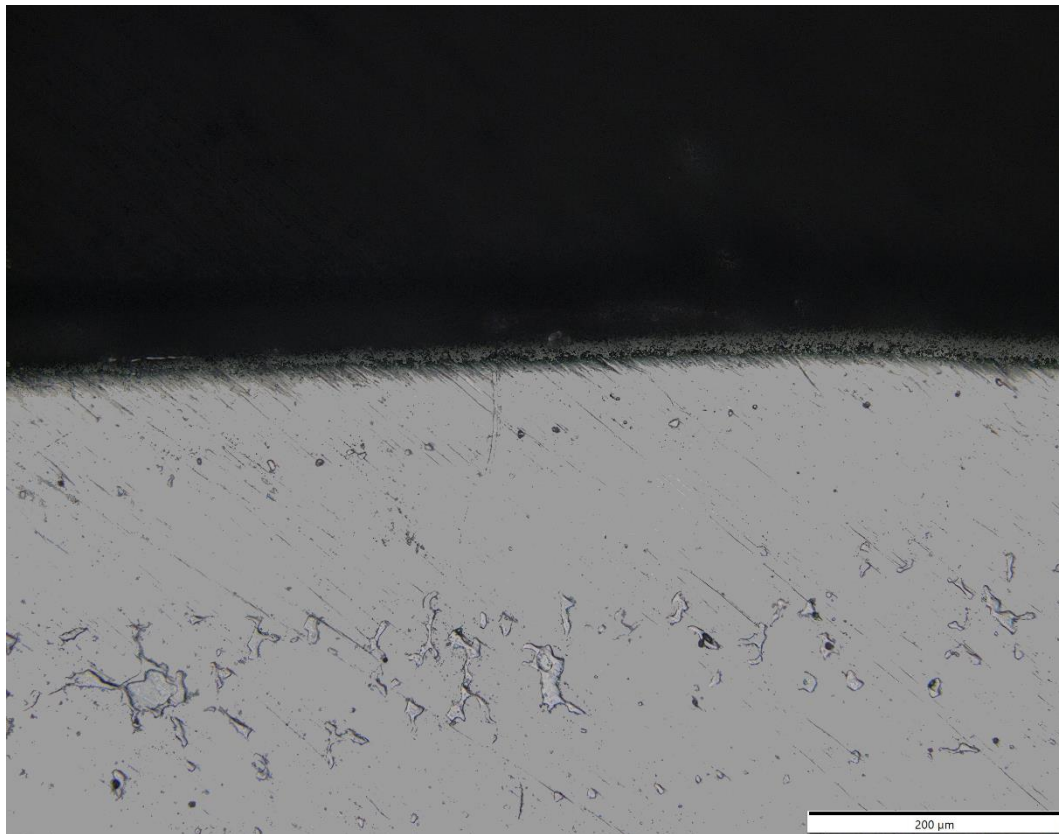
Gambar B.17 Hasil Pengamatan Lapisan Difusi Spesimen 6C2



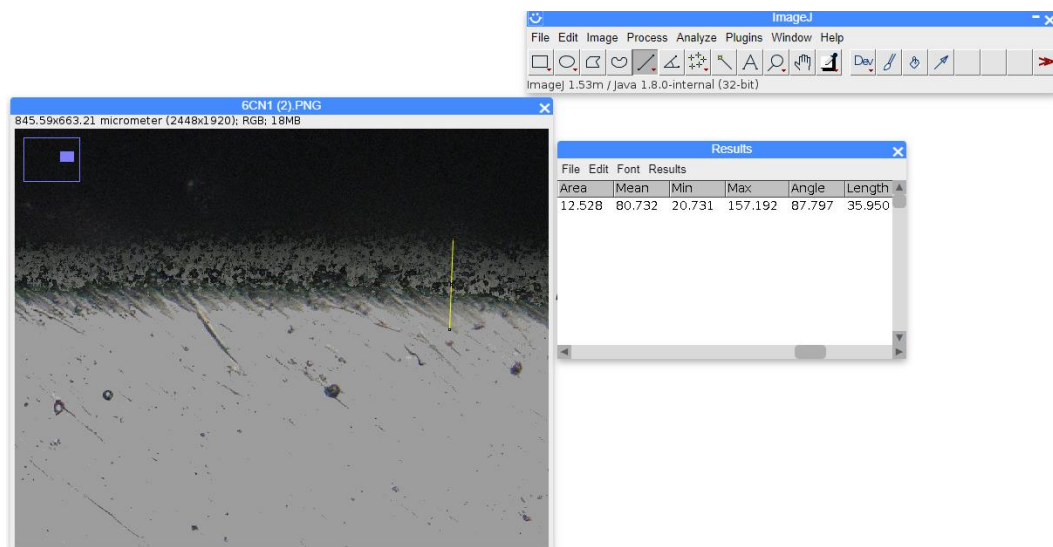
Gambar B.18 Struktur Mikro Spesimen 6C3 Perbesaran 10x



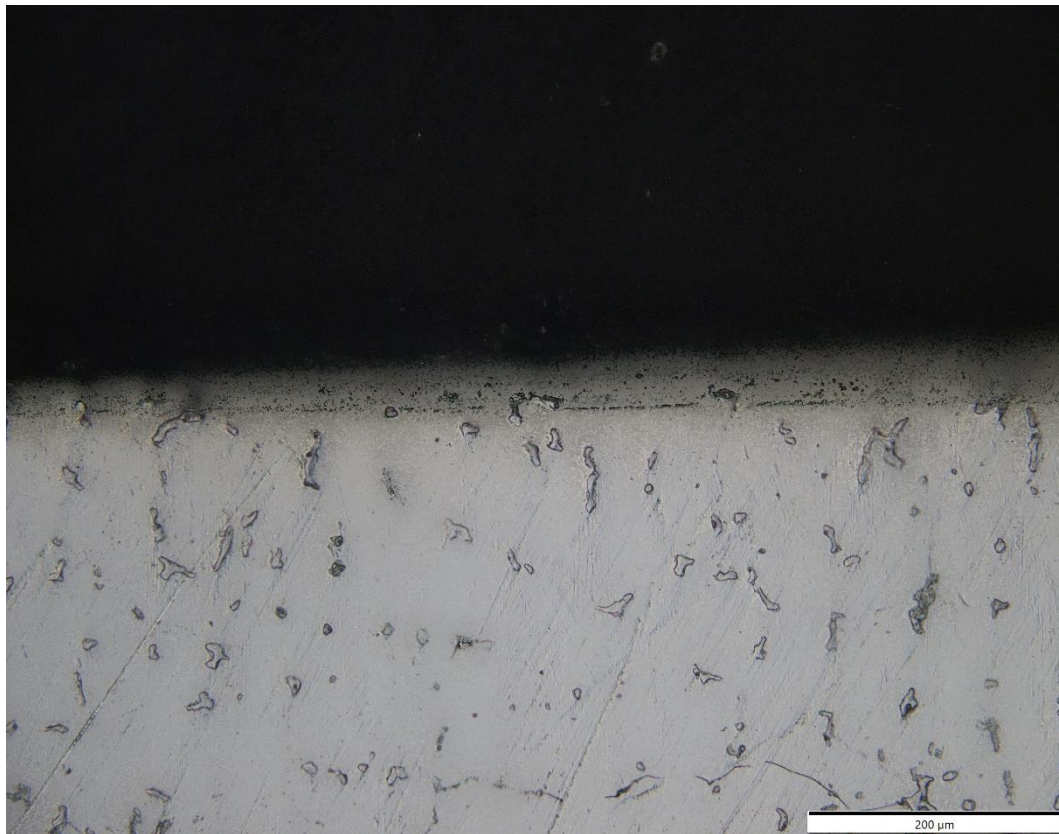
Gambar B.19 Hasil Pengamatan Lapisan Difusi Spesimen 6C3



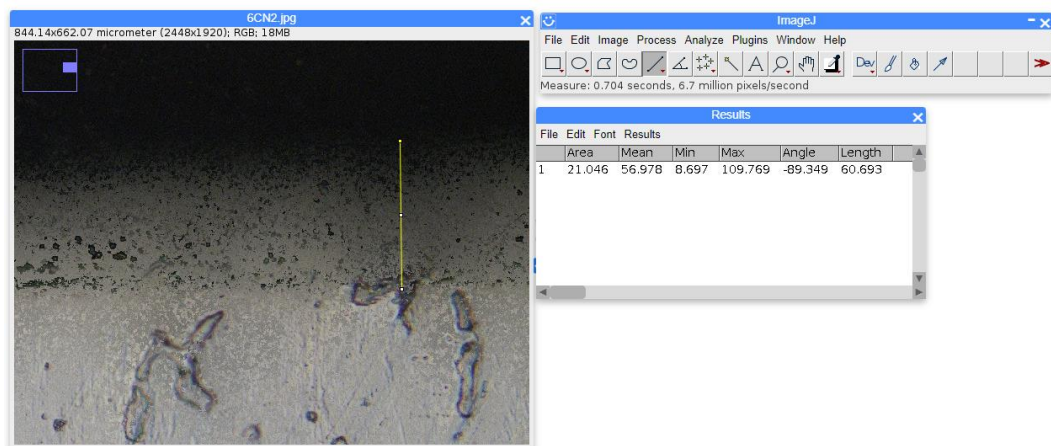
Gambar B.20 Struktur Mikro Spesimen 6CN1 Perbesaran 20x



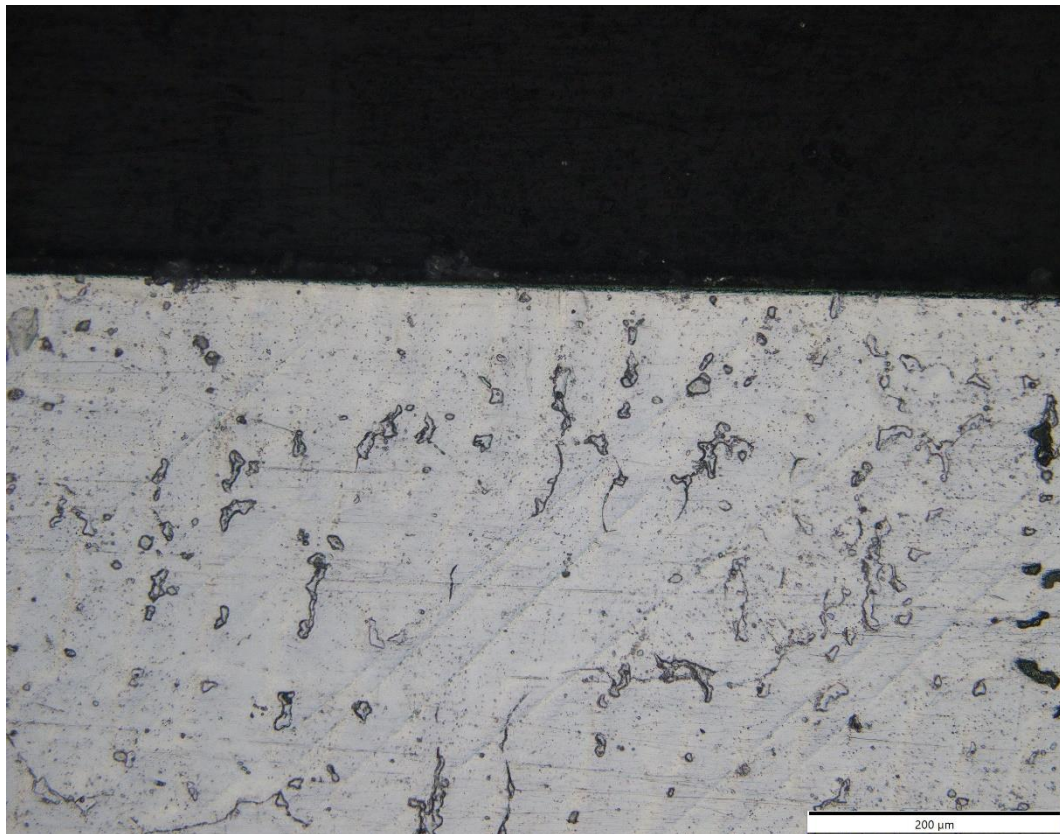
Gambar B.21 Hasil Pengamatan Lapisan Difusi Spesimen 6CN1



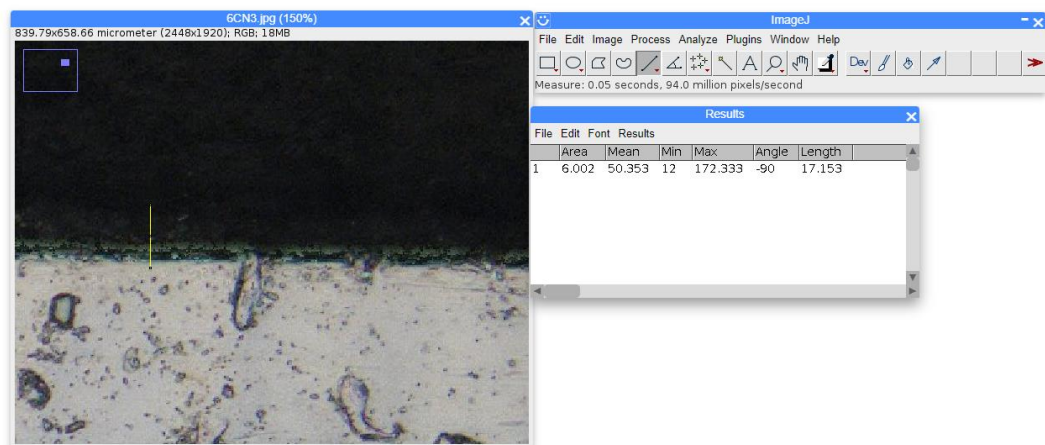
Gambar B.22 Struktur Mikro Spesimen 6CN2 Perbesaran 20x



Gambar B.23 Hasil Pengamatan Lapisan Difusi Spesimen 6CN2



Gambar B.24 Struktur Mikro Spesimen 6CN3 Perbesaran 20x



Gambar B.25 Hasil Pengamatan Lapisan Difusi Spesimen 6CN3

B.3 Data Nilai Kekerasan Setelah Dilakukan *Surface Treatment*

Tabel B.2 Nilai Kekerasan Spesimen *Pack Carbonitriding*

Waktu (Jam)	500° C		Rata-rata (VHN)	600° C		Rata-rata (VHN)
	HRC	VHN		HRC	VHN	
1	21,90	247,50	272,48	27,30	281,10	285,74
	25,30	267,80		28,70	291,60	
	26,90	278,30		27,20	280,40	
	29,50	298,00		27,60	283,20	
	25,80	270,80		28,80	292,40	
2	26,50	275,50	286,00	27,80	284,60	288,94
	29,40	297,20		27,90	285,30	
	29,60	298,90		28,40	289,20	
	29,40	297,20		28,50	290,80	
	24,20	261,20		29,10	294,80	
3	32,80	325,20	301,06	23,70	258,20	270,62
	30,60	306,80		24,00	260,00	
	31,30	312,40		26,10	272,70	
	28,10	286,80		25,50	269,00	
	26,30	274,10		28,90	293,20	

Tabel B.3 Nilai Kekerasan Spesimen *Pack Carburizing*

Waktu (Jam)	500° C		Rata-rata (VHN)	600°		Rata-rata (VHN)
	HRC	VHN		HRC	VHN	
1	27,40	281,80	278,44	24,60	263,60	286,16
	29,10	294,80		28,70	291,60	
	27,80	284,60		29,10	294,80	
	27,40	281,80		28,30	288,40	
	22,20	249,20		28,80	292,40	

Tabel B.3 (Lanjutan)

Waktu (Jam)	500° C		Rata-rata (VHN)	600° C		Rata-rata (VHN)
	HRC	VHN		HRC	VHN	
2	26,70	276,90	280,82	25,30	267,80	285,52
	27,80	284,60		27,70	283,90	
	27,30	281,10		30,30	304,40	
	27,60	283,20		28,20	287,60	
	26,90	278,30		27,70	283,90	
3	24,10	260,60	271,20	26,50	275,50	279,46
	26,90	278,30		27,00	279,00	
	25,90	271,40		27,20	280,40	
	26,50	275,50		28,20	287,60	
	25,70	270,20		26,40	274,80	

B.4 Data Ketebalan Lapisan Difusi**Tabel B.4** Hasil Pengujian Kedalaman Difusi Spesimen

Spesimen	Kedalaman Difusi (μm)
5CN1	28,03
5CN2	47,06
5CN3	68,73
6CN1	35,95
6CN2	60,69
6CN3	17,15
5C1	22,85
5C2	23,06
5C3	17,94
6C1	26,13
6C2	25,91
6C3	19,93

LAMPIRAN C
ALAT DAN BAHAN



Gambar C.1 *Muffle Furnace*



Gambar C.2 *Cutting Machine*



Gambar C.3 *Mikroskop Optik*



Gambar C.4 *Mesin Grinding dan Polishing*



Gambar C.5 *Mesin Mounting*



Gambar C.6 *Mesin Kekerasan Micro-Vickers*



Gambar C.7 *Amplas Grid*



Gambar C.8 *Gelas Beaker*



Gambar C.9 Pupuk Urea



Gambar C.10 Labu Ukur



Gambar C.11 Gelas Ukur



Gambar C.12 Neraca Digital



Gambar C.13 Hair Dryer



Gambar C.14 Wadah Media Pendingin



Gambar C.15 Bubuk Karbon



Gambar C.16 Kalsium Karbonat



Gambar C.17 Spesimen CoCrMo



Gambar C.18 Larutan Metanol