

Lampiran 1. Tabel Perhitungan Densitas Teoritis Komposit Laminat Hibrid Al/SiC-Al/Al₂O₃

Komposit Al/SiC		Komposit Al/Al ₂ O ₃		Komposit Laminat Hibrid Al/SiC - Al/Al ₂ O ₃			Densitas Penyusun Komposit (gr/cm ³)			Densitas Komposit (gr/cm ³)
Vf Al (%)	Vf SiC (%)	Vf Al (%)	Vf Al ₂ O ₃ (%)	Vf Al (%)	Vf SiC (%)	Vf Al ₂ O ₃ (%)	Al	SiC	Al ₂ O ₃	
60	40	90	10	75	20	5	2,700	2,900	3,800	2,795
60	40	80	20	70	20	10	2,700	2,900	3,800	2,850
60	40	70	30	65	20	15	2,700	2,900	3,800	2,905
60	40	60	40	60	20	20	2,700	2,900	3,800	2,960

Lampiran 2. Tabel Perhitungan Densitas Eksperimental Komposit Laminat Hibrid Al/SiC-Al/Al₂O₃

Temperatur Sinter (°C)	Vf Penguat (%)		Berat Kering (gr)	Berat Dalam Air (gr)	Densitas Air (gr/cm ³)	Volume Sampel (cm ³)	Densitas Sampel (gr/cm ³)	Densitas rata-rata (gr/cm ³)	Standar Deviasi
	SiC	Al ₂ O ₃							
600	40	10	3,940	1,720	1,000	1,720	2,285	2,284	0,004
	40	10	3,970	1,740	1,000	1,740	2,287		
	40	10	4,080	1,790	1,000	1,790	2,280		
	40	20	4,120	1,750	1,000	1,750	2,348	2,340	0,022
	40	20	4,130	1,750	1,000	1,750	2,356		
	40	20	4,110	1,780	1,000	1,780	2,315		
	40	30	4,210	1,750	1,000	1,750	2,412	2,434	0,022
	40	30	4,230	1,740	1,000	1,740	2,434		
	40	30	4,360	1,780	1,000	1,780	2,455		
	40	40	4,340	1,740	1,000	1,740	2,495	2,510	0,030
	40	40	4,360	1,750	1,000	1,750	2,491		
	40	40	4,020	1,580	1,000	1,580	2,545		
650	40	10	4,100	1,790	1,000	1,790	2,286	2,285	0,031
	40	10	4,120	1,780	1,000	1,780	2,316		
	40	10	3,960	1,760	1,000	1,760	2,254		
	40	20	4,220	1,830	1,000	1,830	2,300	2,407	0,100
	40	20	4,200	1,730	1,000	1,730	2,424		
	40	20	4,010	1,610	1,000	1,610	2,498		
	40	30	4,270	1,740	1,000	1,740	2,450	2,478	0,036
	40	30	4,300	1,750	1,000	1,750	2,464		
	40	30	4,150	1,650	1,000	1,650	2,519		
	40	40	4,380	1,760	1,000	1,760	2,495	2,556	0,062
	40	40	4,380	1,720	1,000	1,720	2,553		
	40	40	4,510	1,720	1,000	1,720	2,619		

Temperatur Sinter (°C)	Vf Penguat (%)		Berat Kering (gr)	Berat Dalam Air (gr)	Densitas Air (gr/cm ³)	Volume Sampel (cm ³)	Densitas Sampel (gr/cm ³)	Densitas rata-rata (gr/cm ³)	Standar Deviasi
	SiC	Al ₂ O ₃							
700	40	10	4,140	1,790	1,000	1,790	2,315	2,378	0,097
	40	10	4,170	1,790	1,000	1,790	2,329		
	40	10	3,910	1,570	1,000	1,570	2,489		
	40	20	4,260	1,770	1,000	1,770	2,411	2,441	0,105
	40	20	4,250	1,800	1,000	1,800	2,355		
	40	20	4,180	1,630	1,000	1,630	2,558		
	40	30	4,330	1,750	1,000	1,750	2,470	2,512	0,065
	40	30	4,310	1,740	1,000	1,740	2,478		
	40	30	4,280	1,650	1,000	1,650	2,587		
	40	40	4,420	1,810	1,000	1,810	2,440	2,650	0,219
	40	40	4,410	1,680	1,000	1,680	2,632		
	40	40	4,690	1,630	1,000	1,630	2,877		

Lampiran 3. Tabel Perhitungan Porositas Eksperimental Komposit Laminat Hibrid Al/SiC-Al/Al₂O₃

Temperatur Sinter (°C)	Vf Penguat (%)		Berat Kering (gr)	Berat Dalam Air (gr)	Densitas Air (gr/cm ³)	Volume Sampel (cm ³)	Densitas Sampel (gr/cm ³)	Porositas rata-rata (%)	Standar Deviasi
	SiC	Al ₂ O ₃							
600	40	10	3,940	1,720	1,000	1,720	2,285	18,3	0,001
	40	10	3,970	1,740	1,000	1,740	2,287		
	40	10	4,080	1,790	1,000	1,790	2,280		
	40	20	4,120	1,750	1,000	1,750	2,348	17,9	0,008
	40	20	4,130	1,750	1,000	1,750	2,356		
	40	20	4,110	1,780	1,000	1,780	2,315		
	40	30	4,210	1,750	1,000	1,750	2,412	16,2	0,007
	40	30	4,230	1,740	1,000	1,740	2,434		
	40	30	4,360	1,780	1,000	1,780	2,455		
	40	40	4,340	1,740	1,000	1,740	2,495	15,2	0,010
	40	40	4,360	1,750	1,000	1,750	2,491		
	40	40	4,020	1,580	1,000	1,580	2,545		
650	40	10	4,100	1,790	1,000	1,790	2,286	18,2	0,011
	40	10	4,120	1,780	1,000	1,780	2,316		
	40	10	3,960	1,760	1,000	1,760	2,254		
	40	20	4,220	1,830	1,000	1,830	2,300	17,9	0,035
	40	20	4,200	1,730	1,000	1,730	2,424		
	40	20	4,010	1,610	1,000	1,610	2,498		
	40	30	4,270	1,740	1,000	1,740	2,450	16,1	0,013
	40	30	4,300	1,750	1,000	1,750	2,464		
	40	30	4,150	1,650	1,000	1,650	2,519		
	40	40	4,380	1,760	1,000	1,760	2,495	13,7	0,021
	40	40	4,380	1,720	1,000	1,720	2,553		
	40	40	4,510	1,720	1,000	1,720	2,619		

Lampiran 3. Tabel Perhitungan Porositas Eksperimental Komposit Laminat Hibrid Al/SiC-Al/Al₂O₃ (lanjutan)

Temperatur Sinter (°C)	Vf Penguat (%)		Berat Kering (gr)	Berat Dalam Air (gr)	Densitas Air (gr/cm ³)	Volume Sampel (cm ³)	Densitas Sampel (gr/cm ³)	Porositas rata-rata (%)	Standar Deviasi
	SiC	Al ₂ O ₃							
700	40	10	4,140	1,790	1,000	1,790	2,315	14,9	0,035
	40	10	4,170	1,790	1,000	1,790	2,329		
	40	10	3,910	1,570	1,000	1,570	2,489		
	40	20	4,260	1,770	1,000	1,770	2,411	14,3	0,037
	40	20	4,250	1,800	1,000	1,800	2,355		
	40	20	4,180	1,630	1,000	1,630	2,558		
	40	30	4,330	1,750	1,000	1,750	2,470	13,5	0,023
	40	30	4,310	1,740	1,000	1,740	2,478		
	40	30	4,280	1,650	1,000	1,650	2,587		
	40	40	4,420	1,810	1,000	1,810	2,440	10,5	0,074
	40	40	4,410	1,680	1,000	1,680	2,632		
	40	40	4,690	1,630	1,000	1,630	2,877		

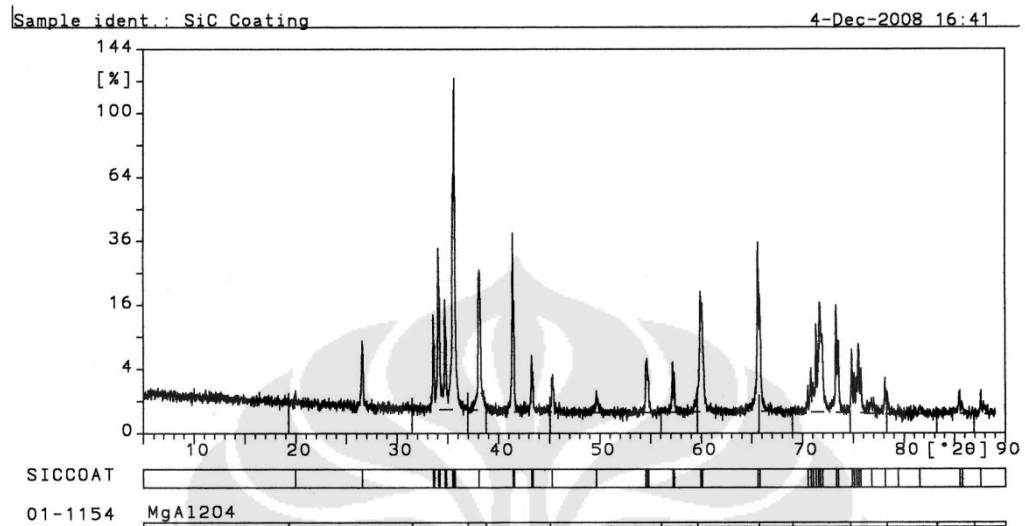
Lampiran 4. Tabel Perhitungan Modulus Elastisitas Eksperimental Komposit Laminat Hibrid Al/SiC-Al/Al₂O₃

Temperatur Sinter (°C)	Vf Al ₂ O ₃ (%)	d (mm)	b (mm)	L (mm)	F (N)	h (mm)	m (N/mm)	L ³ (mm ³)	d ³ (mm ³)	4b (mm)	E (GPa)	E rata-rata (GPa)	Standar Deviasi	
600	10	2,040	10,000	66,000	200,000	1,983	100,843	287496,000	8,490	40,000	85,374	85,569	2,760	
	10	2,070	10,000	66,000	200,000	1,833	109,118	287496,000	8,870	40,000	88,421			
	10	2,070	10,000	66,000	200,000	1,955	102,319	287496,000	8,870	40,000	82,912			
	20	2,080	10,000	66,000	200,000	1,569	127,495	287496,000	8,999	40,000	101,830	101,279	5,676	
	20	2,090	10,000	66,000	200,000	1,476	135,477	287496,000	9,129	40,000	106,659			
	20	2,080	10,000	66,000	200,000	1,675	119,378	287496,000	8,999	40,000	95,347			
	30	2,100	10,000	66,000	200,000	200,000	1,241	161,149	287496,000	9,261	40,000	125,067	123,608	4,947
	30	2,130	10,000	66,000	200,000	1,165	171,644	287496,000	9,664	40,000	127,662			
	30	2,110	10,000	66,000	200,000	1,296	154,351	287496,000	9,394	40,000	118,096			
	40	2,160	10,000	66,000	200,000	200,000	0,944	211,850	287496,000	10,078	40,000	151,091	146,793	6,418
	40	2,190	10,000	66,000	200,000	0,913	219,020	287496,000	10,503	40,000	149,873			
	40	2,210	10,000	66,000	200,000	0,955	209,370	287496,000	10,794	40,000	139,415			
650	10	2,080	10,000	66,000	200,000	2,113	94,659	287496,000	8,999	40,000	75,604	84,200	8,047	
	10	2,060	10,000	66,000	200,000	1,796	111,354	287496,000	8,742	40,000	91,554			
	10	2,110	10,000	66,000	200,000	1,791	111,673	287496,000	9,394	40,000	85,442			
	20	2,110	10,000	66,000	200,000	1,382	144,678	287496,000	9,394	40,000	110,695	111,715	3,548	
	20	2,090	10,000	66,000	200,000	1,447	138,182	287496,000	9,129	40,000	108,789			
	20	2,150	10,000	66,000	200,000	1,251	159,930	287496,000	9,938	40,000	115,661			
	30	2,140	10,000	66,000	200,000	200,000	1,088	183,762	287496,000	9,800	40,000	134,768	132,908	6,217
	30	2,160	10,000	66,000	200,000	1,034	193,471	287496,000	10,078	40,000	137,983			
	30	2,110	10,000	66,000	200,000	1,215	164,647	287496,000	9,394	40,000	125,973			
	40	2,170	10,000	66,000	200,000	200,000	0,878	227,880	287496,000	10,218	40,000	160,287	153,782	7,421
	40	2,190	10,000	66,000	200,000	0,881	227,039	287496,000	10,503	40,000	155,360			
	40	2,140	10,000	66,000	200,000	200,000	1,007	198,666	287496,000	9,800	40,000	145,698		

Lampiran 4. Tabel Perhitungan Modulus Elastisitas Eksperimental Komposit Laminat Hibrid Al/SiC-Al/Al₂O₃ (lanjutan)

Temperatur Sinter (°C)	Vf Al ₂ O ₃ (%)	d (mm)	b (mm)	L (mm)	F (N)	h (mm)	m (N/mm)	L ³ (mm ³)	d ³ (mm ³)	4b (mm)	E (GPa)	E rata-rata (GPa)	Standar Deviasi	
700	10	2,110	10,000	66,000	200,000	1,567	127,665	287496,000	9,394	40,000	97,678	94,019	3,422	
	10	2,080	10,000	66,000	200,000	1,709	117,044	287496,000	8,999	40,000	93,483			
	10	2,050	10,000	66,000	200,000	1,836	108,953	287496,000	8,615	40,000	90,897			
	20	2,140	10,000	66,000	200,000	1,248	160,317	287496,000	9,800	40,000	117,574	114,658	2,535	
	20	2,120	10,000	66,000	200,000	1,330	150,362	287496,000	9,528	40,000	113,423			
	20	2,080	10,000	66,000	200,000	1,414	141,453	287496,000	8,999	40,000	112,978			
	30	2,150	10,000	66,000	200,000	1,042	191,886	287496,000	9,938	40,000	138,771	138,466	4,331	
	30	2,160	10,000	66,000	200,000	1,000	199,996	287496,000	10,078	40,000	142,637			
	30	2,120	10,000	66,000	200,000	1,126	177,628	287496,000	9,528	40,000	133,991			
	40	2,210	10,000	66,000	200,000	200,000	0,807	247,915	287496,000	10,794	40,000	165,081	165,122	3,244
	40	2,190	10,000	66,000	200,000	200,000	0,813	246,074	287496,000	10,503	40,000	168,386		
	40	2,150	10,000	66,000	200,000	200,000	0,893	223,866	287496,000	9,938	40,000	161,899		

Lampiran 5. Berkas Hasil Pengujian XRD *SiC Coating*



Lampiran 5. Berkas Hasil Pengujian XRD SiC Coating (lanjutan)

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: SiCCoat.DI
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Philips Analytical X-Ray B.V.
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Sample identification: SiC Coating
Data measured at: 4-Dec-2008 8:46:00

Diffractometer type: PW1710 BASED
Tube anode: Cu
Generator tension [kV]: 40
Generator current [mA]: 30
Wavelength Alpha1 [Å]: 1.54056
Wavelength Alpha2 [Å]: 1.54439
Intensity ratio (alpha2/alpha1): 0.500
Divergence slit: AUTOMATIC
Irradiated length [mm]: 12
Receiving slit: 0.2
Monochromator used: YES

Start angle [°2θ]: 5.000
End angle [°2θ]: 89.000
Step size [°2θ]: 0.020
Maximum intensity: 4121.640
Time per step [s]: 1.000
Type of scan: CONTINUOUS
Intensities converted to: FIXED

Minimum peak tip width: 0.00
Maximum peak tip width: 1.00
Peak base width: 2.00
Minimum significance: 0.75
Number of peaks: 48

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4-Dec-2008 9:56
Department of Metallurgy UI
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Angle [°2θ]	d-value α1 [Å]	d-value α2 [Å]	Peak width [°2θ]	Peak int [counts]	Back. int [counts]	Rel. int [%]	Signif.
19.990	4.4381	4.4491	0.160	26	52	0.6	0.77
26.555	3.3539	3.3622	0.120	339	32	8.2	6.21
33.570	2.6674	2.6740	0.040	462	21	11.2	30.37
33.670	2.6597	2.6663	0.040	231	21	5.6	3.52
34.085	2.6282	2.6347	0.100	1163	19	28.2	8.84
34.185	2.6208	2.6273	0.040	605	19	14.7	4.01
34.715	2.5820	2.5884	0.060	576	19	14.0	2.67
34.820	2.5744	2.5808	0.040	299	19	7.3	3.88
35.500	2.5266	2.5329	0.060	2034	19	49.3	3.34
35.620	2.5184	2.5247	0.060	4122	19	100.0	6.22
35.730	2.5109	2.5171	0.040	1714	18	41.6	0.98
38.050	2.3630	2.3688	0.080	625	17	15.2	2.71
41.420	2.1782	2.1836	0.060	1018	13	24.7	4.22
41.535	2.1724	2.1778	0.060	471	13	11.4	3.10
43.265	2.0895	2.0946	0.060	154	13	3.7	1.59
43.380	2.0842	2.0894	0.060	77	12	1.9	1.02
45.250	2.0023	2.0073	0.060	67	12	1.6	2.58
49.650	1.8347	1.8392	0.060	28	10	0.7	1.78
54.540	1.6812	1.6853	0.060	102	9	2.5	0.86
54.665	1.6776	1.6818	0.060	108	9	2.6	0.81
54.795	1.6739	1.6781	0.060	52	9	1.3	0.77
57.190	1.6094	1.6134	0.060	98	9	2.4	1.27

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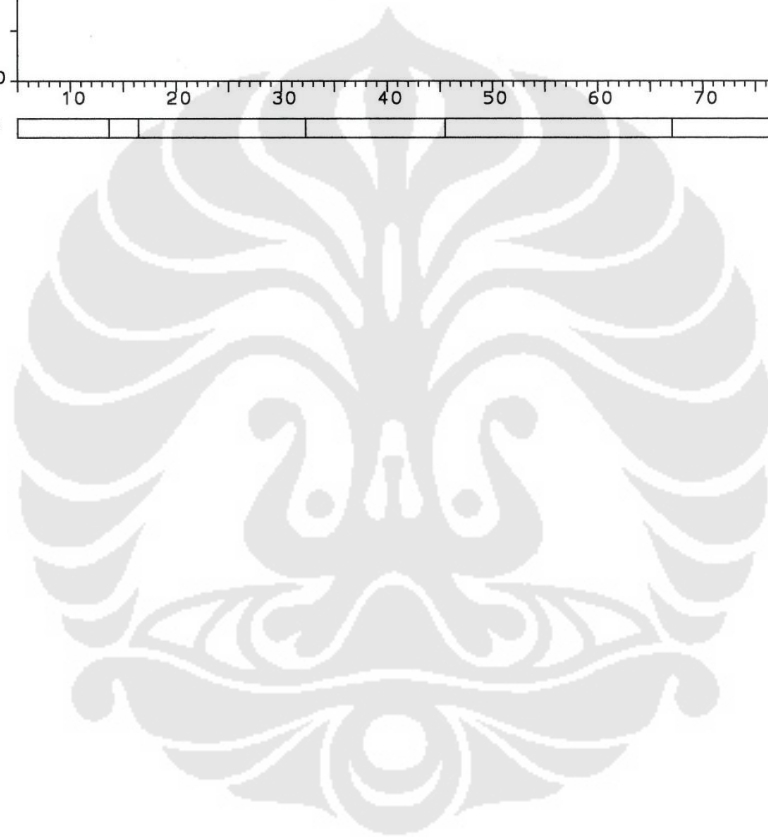
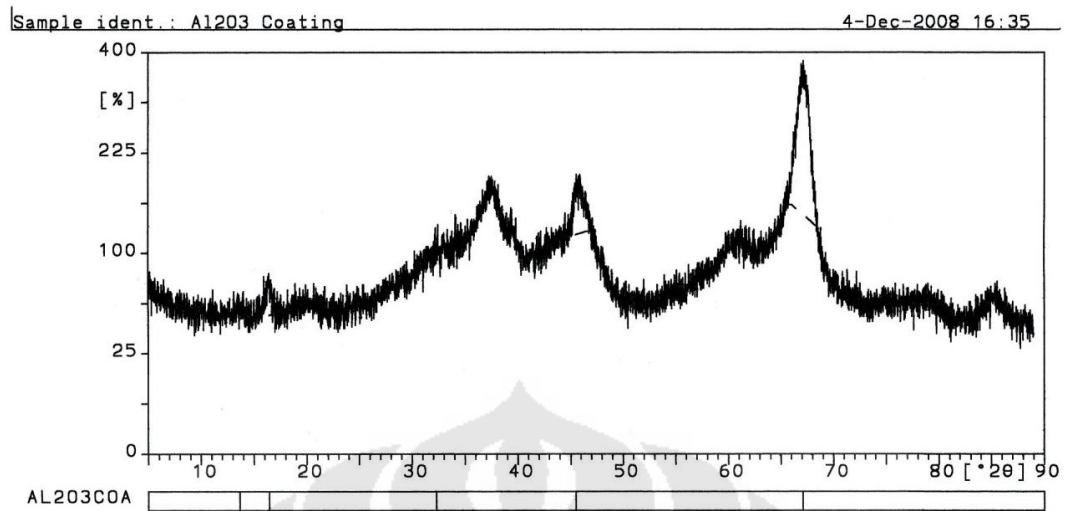
4-Dec-2008 9:56

Philips Analytical X-Ray B.V.

Department of Metallurgy UI

Angle [°2 θ]	d-value a_1 [Å]	d-value a_2 [Å]	Peak width [°2 θ]	Peak int [counts]	Back. int [counts]	Rel. int [%]	Signif.
57.340	1.6055	1.6095	0.060	66	9	1.6	1.25
59.935	1.5421	1.5459	0.060	408	10	9.9	1.50
60.100	1.5382	1.5421	0.060	310	9	7.5	1.19
65.605	1.4219	1.4254	0.100	666	9	16.1	8.83
65.800	1.4181	1.4216	0.120	346	9	8.4	7.73
70.515	1.3344	1.3377	0.060	30	8	0.7	4.28
70.835	1.3291	1.3325	0.080	66	8	1.6	2.24
71.045	1.3257	1.3290	0.100	37	8	0.9	1.30
71.330	1.3211	1.3244	0.060	199	8	4.8	2.29
71.535	1.3179	1.3211	0.040	104	8	2.5	3.43
71.705	1.3151	1.3184	0.120	279	8	6.8	6.72
71.980	1.3108	1.3141	0.120	123	7	3.0	3.43
73.315	1.2902	1.2934	0.080	272	7	6.6	5.57
73.535	1.2869	1.2901	0.060	137	7	3.3	1.66
74.865	1.2673	1.2704	0.080	94	7	2.3	3.01
75.090	1.2640	1.2672	0.080	44	7	1.1	1.78
75.310	1.2609	1.2640	0.080	36	7	0.9	1.28
75.520	1.2579	1.2610	0.080	128	7	3.1	3.12
75.745	1.2547	1.2578	0.060	64	7	1.6	0.96
76.795	1.2402	1.2432	0.120	12	6	0.3	1.12
78.135	1.2222	1.2252	0.080	41	6	1.0	1.79
79.410	1.2058	1.2088	0.120	4	6	0.1	0.99
81.550	1.1794	1.1824	0.280	5	6	0.1	1.25
85.490	1.1349	1.1377	0.120	21	6	0.5	1.87
85.735	1.1323	1.1351	0.120	8	6	0.2	0.82
87.565	1.1132	1.1160	0.060	21	5	0.5	2.62

Lampiran 6. Berkas Hasil XRD Al_2O_3 Coating



Lampiran 6. Berkas Hasil XRD Al₂O₃ Coating (lanjutan)

AL2O3COA.DI 4-Dec-2008 12:56
 =====
 hilips Analytical X-Ray B.V. Department of Metallurgy UI

Sample identification: Al2O3 Coating
 Data measured at: 4-Dec-2008 11:39:00

Diffraction type: PW1710 BASED
 Tube anode: Cu
 Generator tension [kV]: 40
 Generator current [mA]: 30
 Wavelength Alpha1 [Å]: 1.54056
 Wavelength Alpha2 [Å]: 1.54439
 Intensity ratio (alpha2/alpha1): 0.500
 Divergence slit: AUTOMATIC
 Irradiated length [mm]: 12
 Receiving slit: 0.2
 Monochromator used: YES

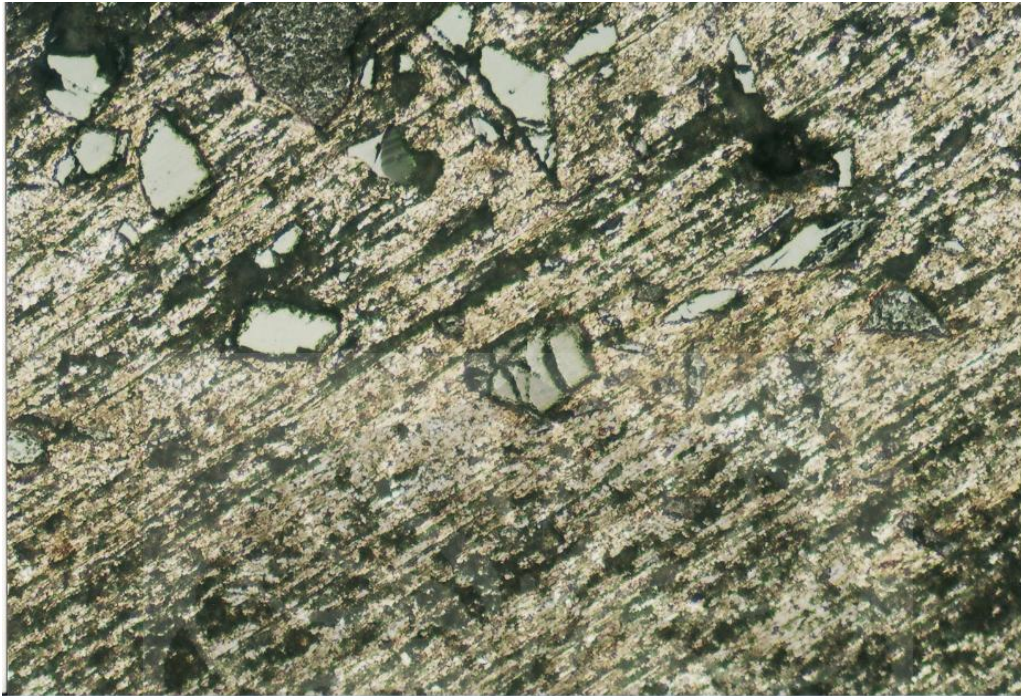
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 End angle [°2θ]: 89.000
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 Maximum intensity: 144.0000
 Time per step [s]: 1.000
 Type of scan: CONTINUOUS

Intensities converted to: FIXED

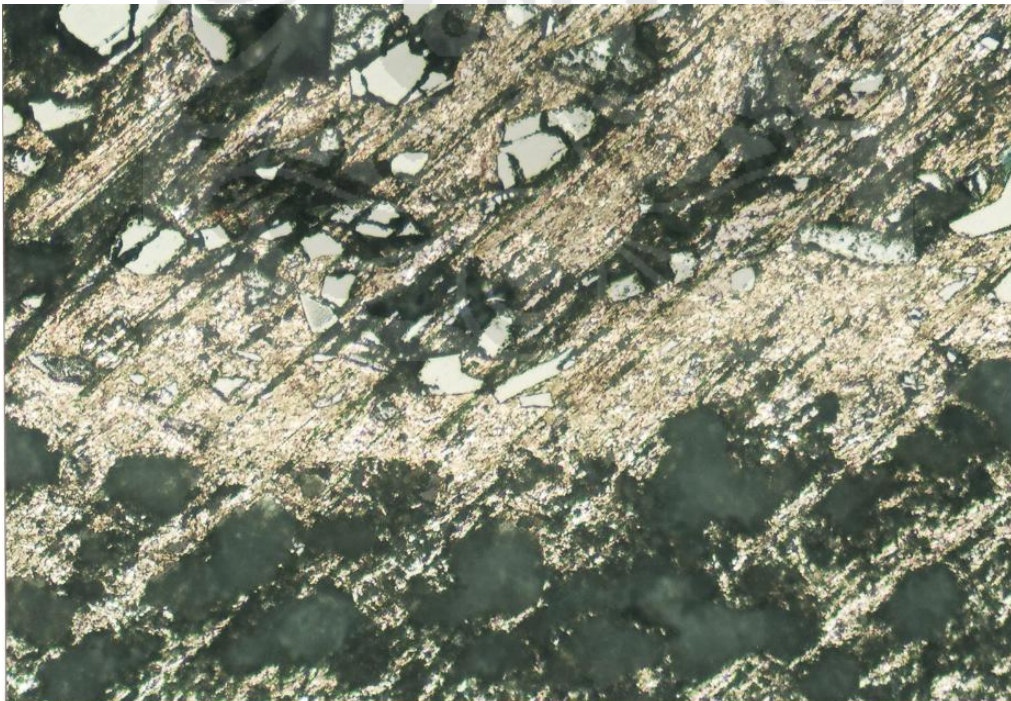
Minimum peak tip width: 0.00
 Maximum peak tip width: 1.00
 Peak base width: 2.00
 Minimum significance: 0.75
 Number of peaks: 5

Angle [°2θ]	d-value a1 [Å]	d-value a2 [Å]	Peak width [°2θ]	Peak int [counts]	Back. int [counts]	Rel. int [%]	Signif.
13.655	6.4795	6.4956	0.960	18	146	12.2	1.08
16.455	5.3827	5.3960	0.320	61	121	42.2	1.00
32.270	2.7718	2.7787	0.400	14	123	10.0	0.86
45.500	1.9919	1.9968	0.320	52	112	36.0	0.85
67.070	1.3943	1.3978	0.240	144	94	100.0	0.84

Lampiran 7. Gambar Struktur Mikro dengan MO perbesaran 100X



Temperatur Sinter 600°C, Waktu Sinter 6 Jam 40% Vf SiC/10% Vf Al₂O₃

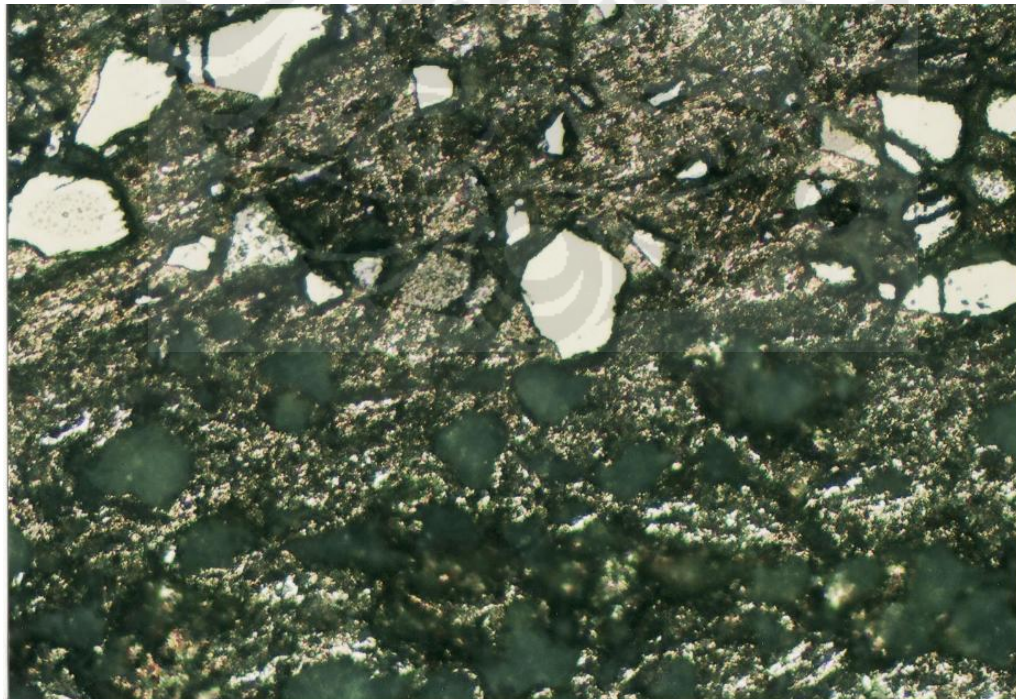


Temperatur Sinter 600°C, Waktu Sinter 6 Jam 40% Vf SiC/20% Vf Al₂O₃

**Lampiran 7. Gambar Struktur Mikro dengan MO perbesaran 100X
(lanjutan)**

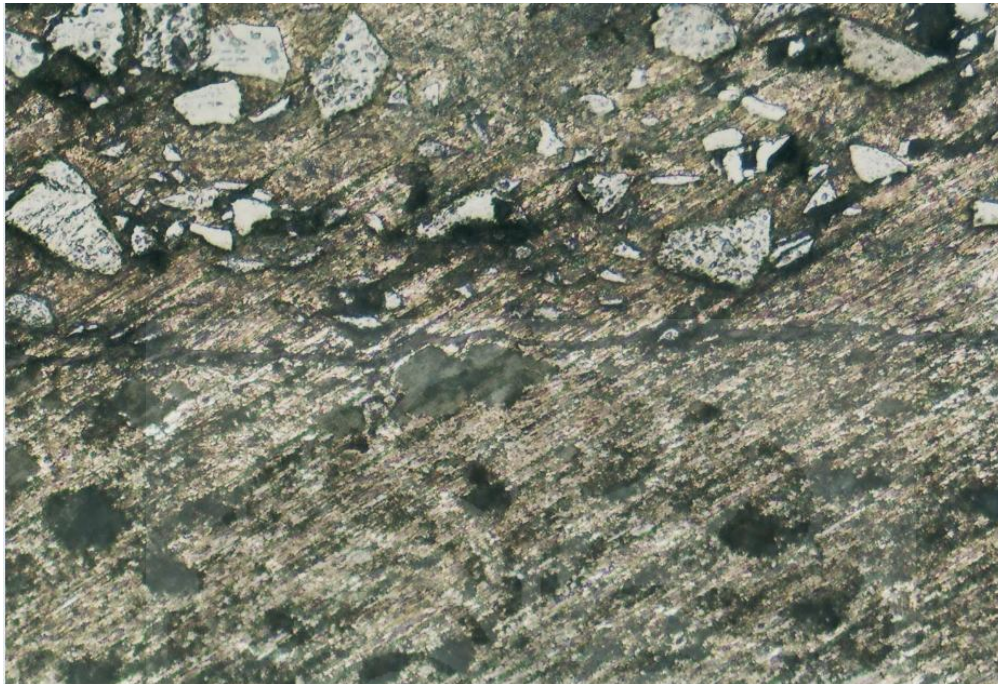


Temperatur Sinter 600°C, Waktu Sinter 6 Jam 40% Vf SiC/30% Vf Al₂O₃

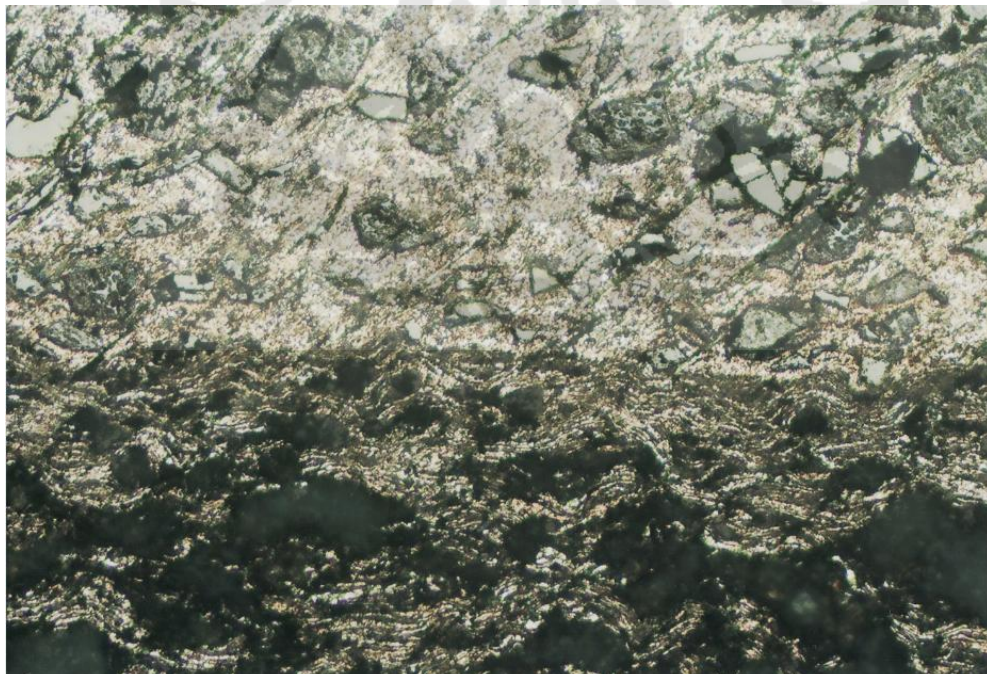


Temperatur Sinter 600°C, Waktu Sinter 6 Jam 40% Vf SiC/40% Vf Al₂O₃

**Lampiran 7. Gambar Struktur Mikro dengan MO perbesaran 100X
(lanjutan)**

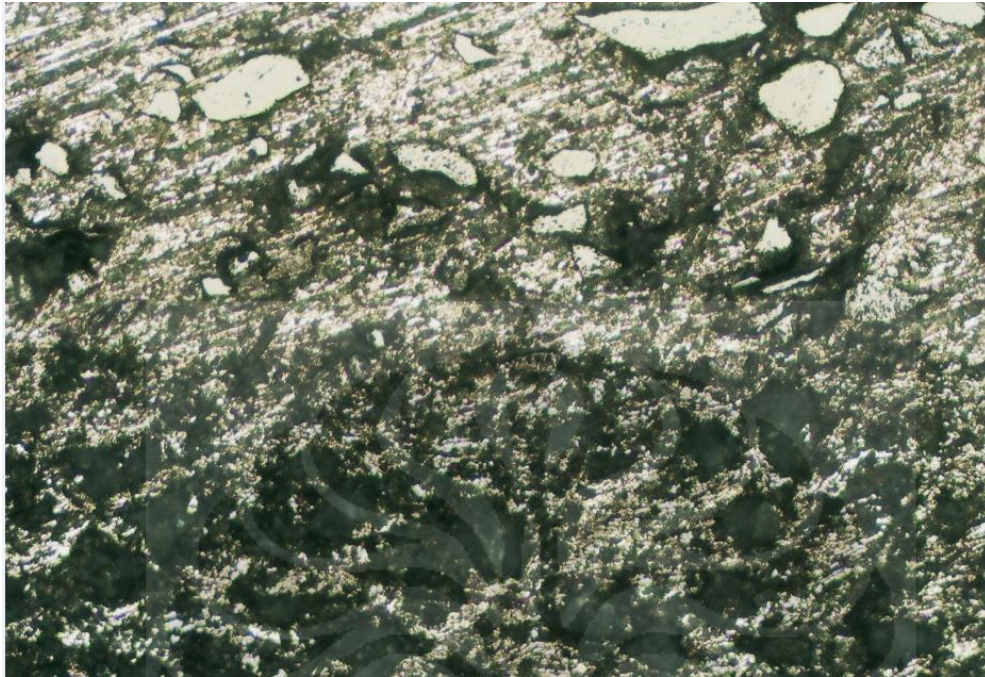


Temperatur Sinter 650°C, Waktu Sinter 6 Jam 40% Vf SiC/10% Vf Al₂O₃

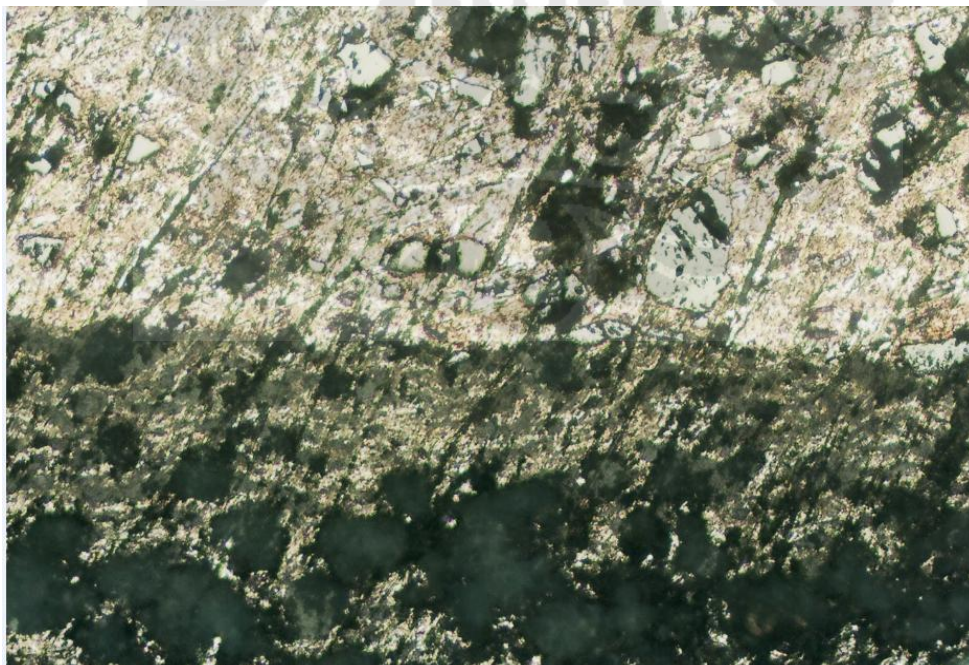


Temperatur Sinter 650°C, Waktu Sinter 6 Jam 40% Vf SiC/20% Vf Al₂O₃

**Lampiran 7. Gambar Struktur Mikro dengan MO perbesaran 100X
(lanjutan)**

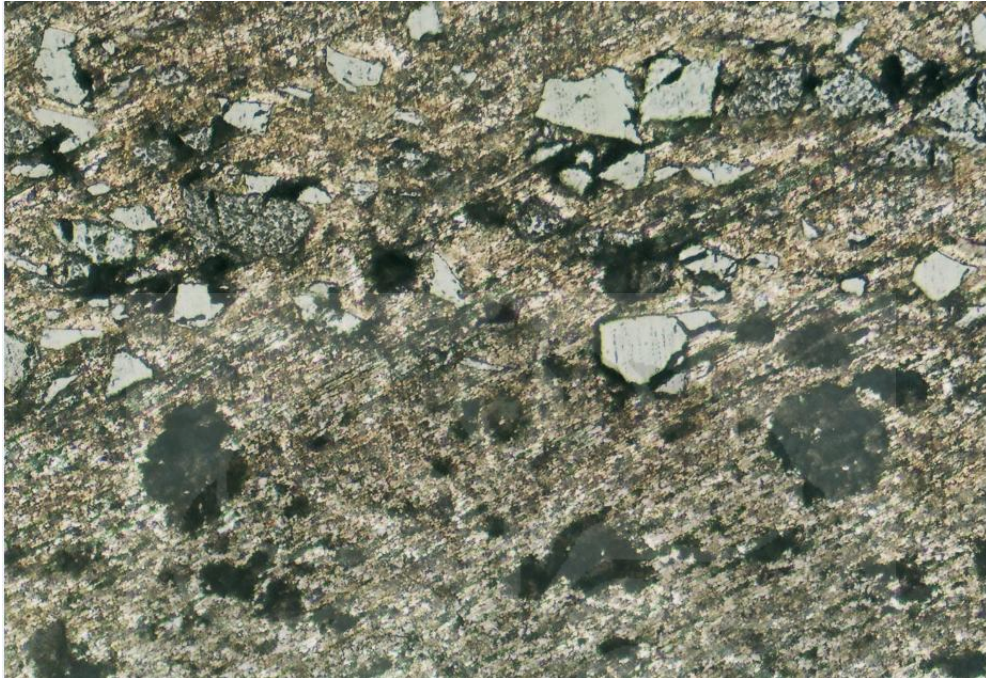


Temperatur Sinter 650°C, Waktu Sinter 6 Jam 40% Vf SiC/30% Vf Al₂O₃



Temperatur Sinter 650°C, Waktu Sinter 6 Jam 40% Vf SiC/40% Vf Al₂O₃

**Lampiran 7. Gambar Struktur Mikro dengan MO perbesaran 100X
(lanjutan)**

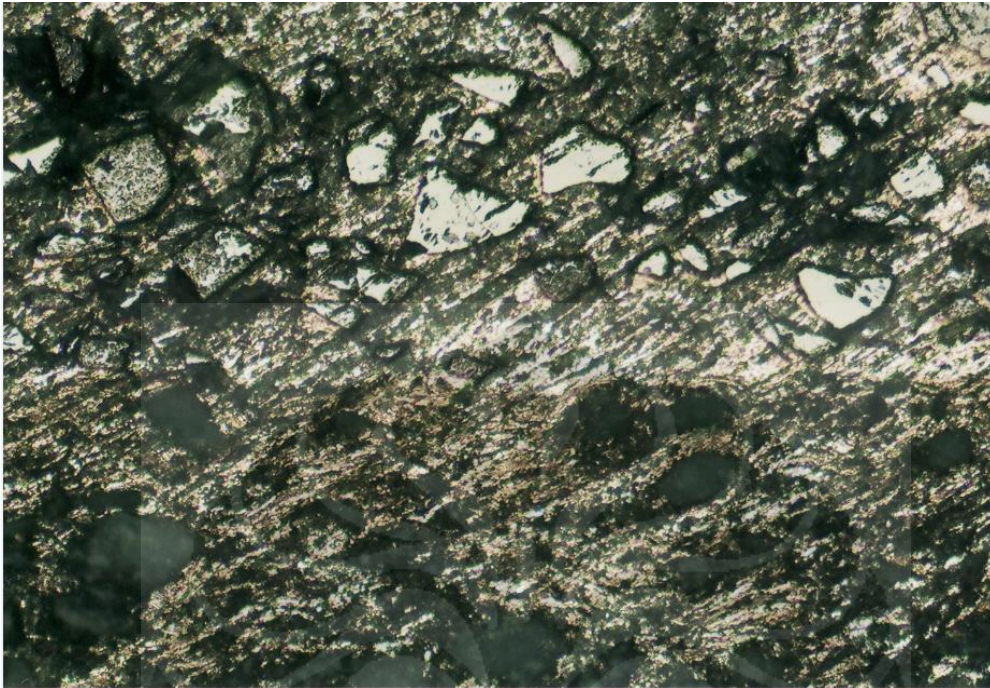


Temperatur Sinter 700°C, Waktu Sinter 6 Jam 40% Vf SiC/10% Vf Al₂O₃

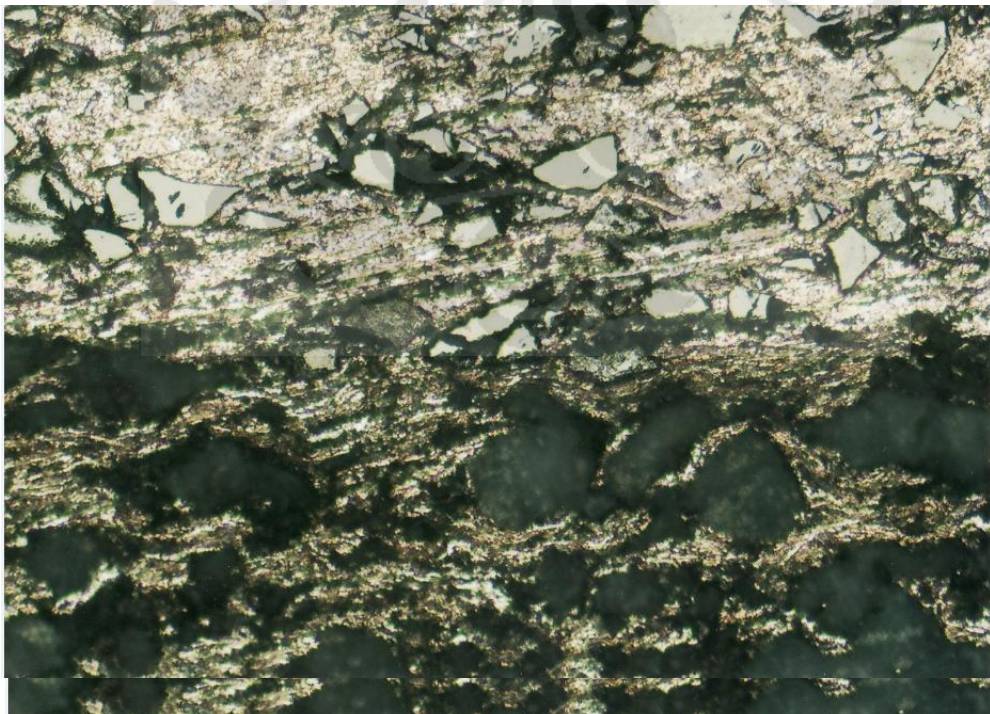


Temperatur Sinter 700°C, Waktu Sinter 6 Jam 40% Vf SiC/20% Vf Al₂O₃

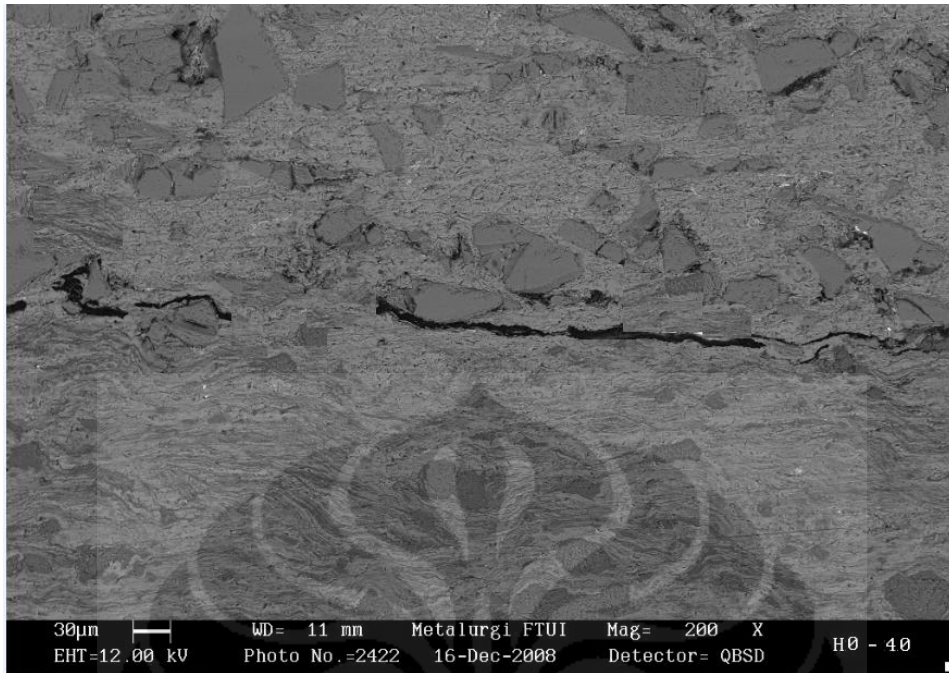
**Lampiran 7. Gambar Struktur Mikro dengan MO perbesaran 100X
(lanjutan)**



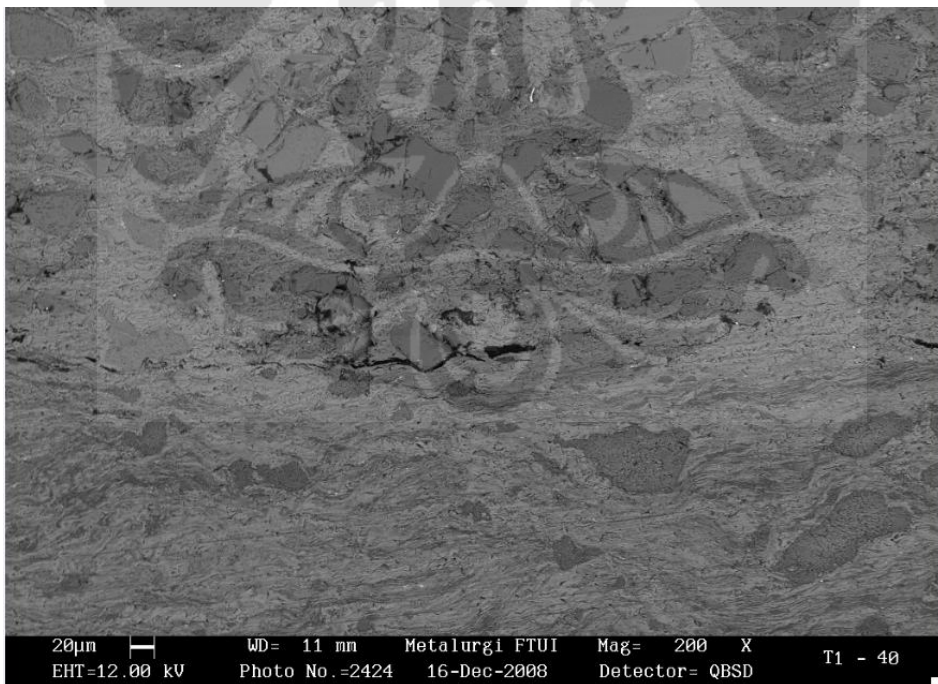
Temperatur Sinter 700°C, Waktu Sinter 6 Jam 40% Vf SiC/30% Vf Al₂O₃



Temperatur Sinter 700°C, Waktu Sinter 6 Jam 40% Vf SiC/40% Vf Al₂O₃

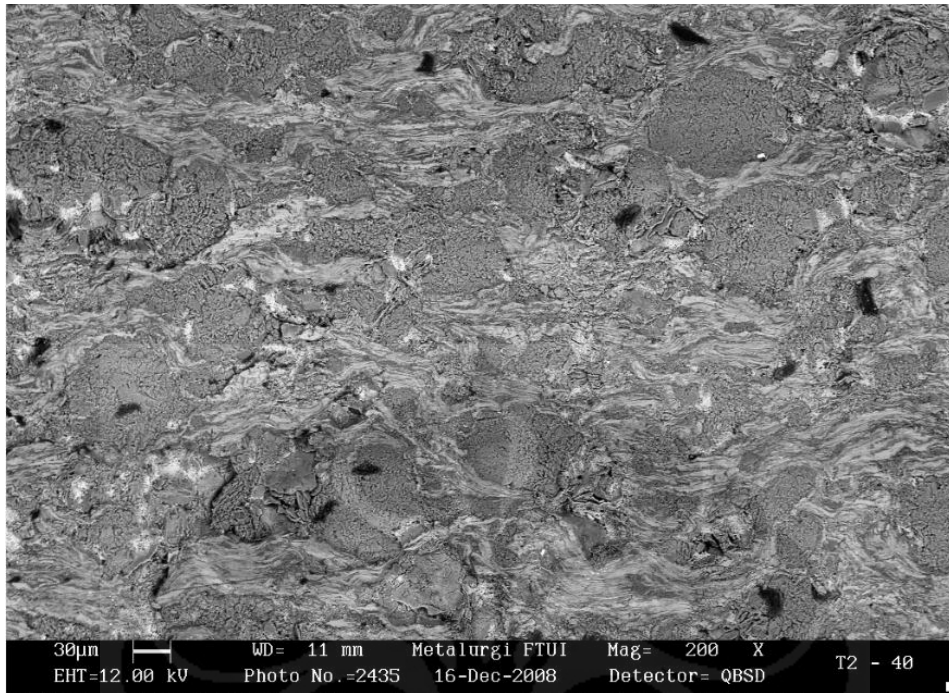
Lampiran 8. Gambar Struktur Mikro dengan SEM perbesaran 200X

Temperatur Sinter 600°C, Waktu Sinter 6 Jam 40% Vf SiC/40% Vf Al₂O₃

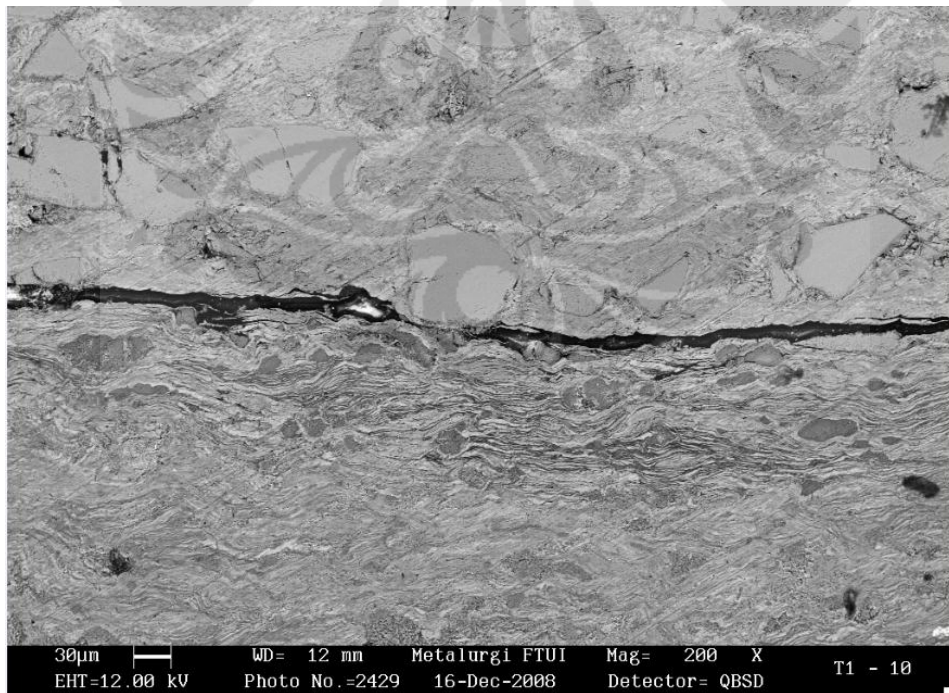


Temperatur Sinter 650°C, Waktu Sinter 6 Jam 40% Vf SiC/40% Vf Al₂O₃

**Lampiran 8. Gambar Struktur Mikro dengan SEM perbesaran 200X
(lanjutan)**



Temperatur Sinter 700°C, Waktu Sinter 6 Jam 40% Vf SiC/40% Vf Al₂O₃



Temperatur Sinter 650°C, Waktu Sinter 6 Jam 40% Vf SiC/10% Vf Al₂O₃