

LAMPIRAN

Lampiran 1. Dokumentasi Preparasi Sampel



Batu kapur



Penghalusan sampel

Larutan Ca(OH)₂

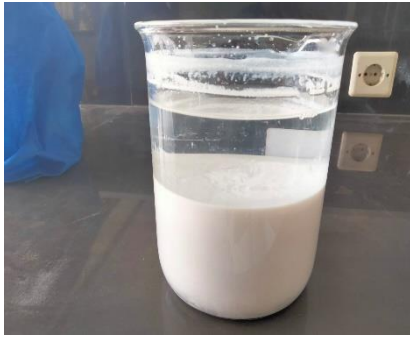
Pembuatan Hidroksiapatit



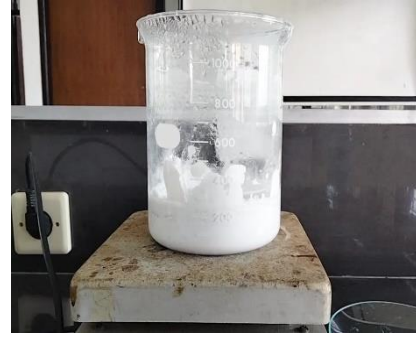
Kalsinasi Hidroksiapatit



Bubuk Hidroksiapatit



Pengendapan Komposit



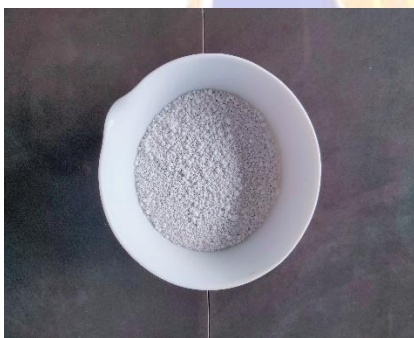
Pengeringan Komposit



Penghalusan Komposit



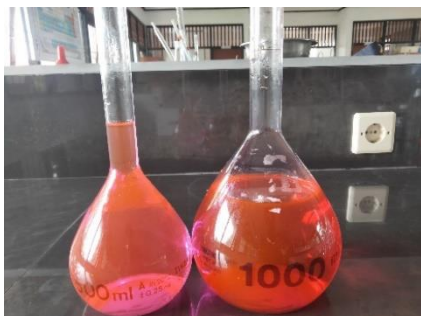
Kalsinasi Komposit



Komposit ZnO-Hidroksiapatit



Lampiran 2. Uji Fotodegradasi Zat Warna Rhodamin B



Larutan Standar Rhodamin B



Bubuk Rhodamin B



Variasi pH sebelum perombakan



Variasi pH setelah perombakan



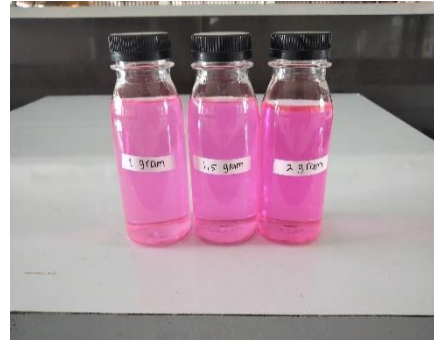
Variasi konsentrasi



Setelah perombakan



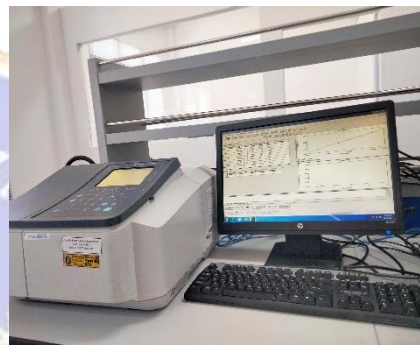
Proses Fotodegradasi



Variasi komposit

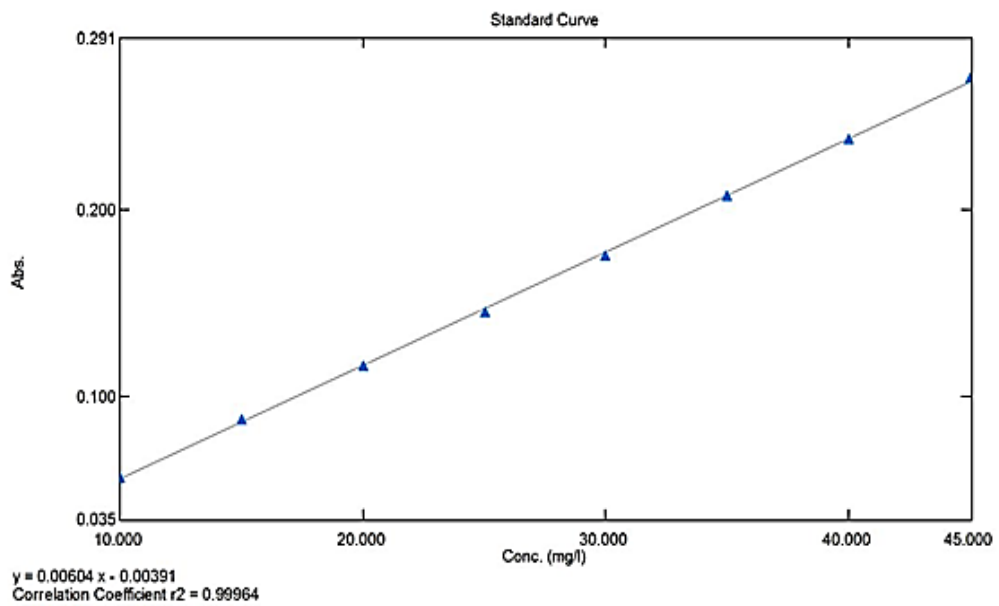


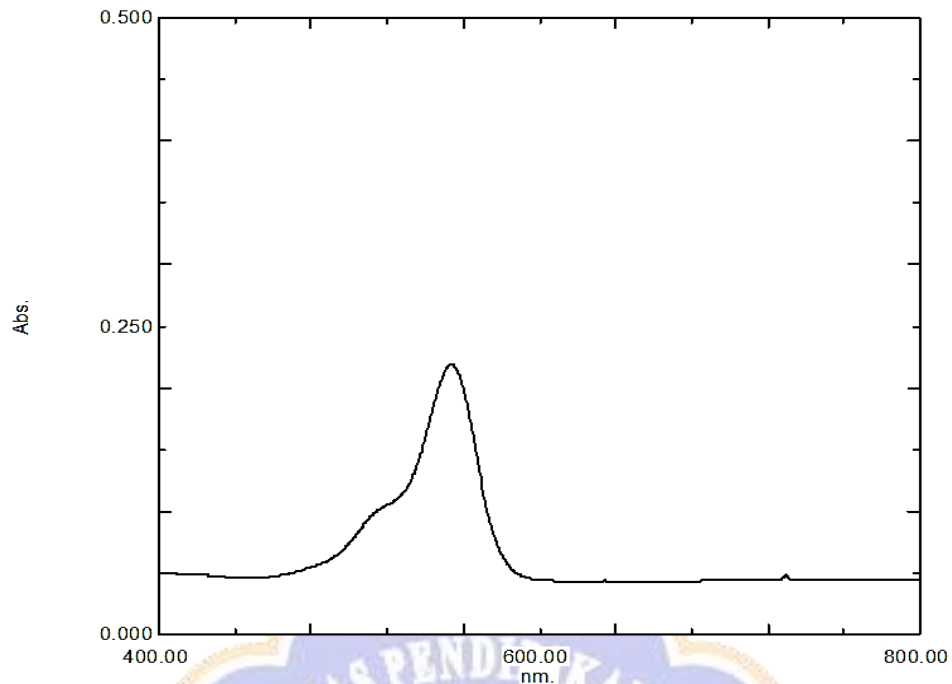
Setelah Perombakan



Alat UV-Vis

Lampiran 3. Kurva Kalibrasi dan Panjang Gelombang Maksimum Rhodamin B





No.	Wavelength (nm)	Abs.
1	729.50	0.048
2	554.00	0.219

Lampiran 4. Perhitungan Larutan Standar

Larutan Induk 1000 ppm

$$\frac{1000 \text{ mg}}{L} = \frac{1000 \text{ mg}}{1000 \text{ ml}}$$

Pembuatan larutan 100 ppm

$$M_1 \times V_1 = M_2 \times V_2$$

$$= 1000 \frac{\text{mg}}{L} \times V_1 = 100 \frac{\text{mg}}{L} \times 500 \text{ ml}$$

$$= 1000 \times V_1 = 50000$$

$$V_1 = \frac{50000}{1000} = 50 \text{ mL}$$

Pembuatan larutan 80 ppm

$$M1 \times V1 = M2 \times V2$$

$$= 100 \frac{mg}{L} \times V1 = 80 \frac{mg}{L} \times 150 \text{ ml}$$

$$= 100 \times V1 = 12000$$

$$V1 = \frac{12000}{100} = 120 \text{ mL}$$

Pembuatan larutan 60 ppm

$$M1 \times V1 = M2 \times V2$$

$$= 100 \frac{mg}{L} \times V1 = 60 \frac{mg}{L} \times 150 \text{ ml}$$

$$= 100 \times V1 = 9000$$

$$V1 = \frac{9000}{100} = 90 \text{ mL}$$

Pembuatan larutan 40 ppm

$$M1 \times V1 = M2 \times V2$$

$$= 100 \frac{mg}{L} \times V1 = 40 \frac{mg}{L} \times 150 \text{ ml}$$

$$= 100 \times V1 = 6000$$

$$V1 = \frac{6000}{100} = 60 \text{ mL}$$

Pembuatan larutan 20 ppm

$$M1 \times V1 = M2 \times V2$$

$$= 100 \frac{mg}{L} \times V1 = 20 \frac{mg}{L} \times 150 \text{ ml}$$

$$= 100 \times V1 = 3000$$

$$V1 = \frac{3000}{100} = 30 \text{ mL}$$

Lampiran 5. Perhitungan Efisiensi

Data perombakan pada variasi pH

pH	Abs. Awal	Abs. Akhir	Efisiensi (%)
4	1,668	0,242	85,49
7	1,720	0,194	88,72
9	1,630	0,131	91,96

Data Perombakan Pada Variasi Kosentrasi Rhodamin B

Kosentrasi (ppm)	Abs. Awal	Abs. Akhir	Efisiensi (%)
20	0,550	0,021	96,18
40	0,837	0,042	94,98
60	1,089	0,067	93,84
80	1,347	0,095	92,94
100	1,630	0,131	91,96

Data Perombakan Pada Variasi Massa Komposit Zno-Hidroksiapatit

Massa (gram)	Abs. Awal	Abs. Akhir	Efisiensi (%)
1	0,550	0,021	96,18
1,5	0,550	0,001	99,81
2	0,550	0,011	97,91

Lampiran 6. Uji Tosksisitas Hasil Perombakan Rhodamin B



Data Perkecambahan

Hari Ke	Blanko	RHB1	RHB0
1	0	0	0
2	4	2	0
3	7	5	0
4	9	7	1
5	12	11	2

Perhitungan:

$$\text{Tingkat Perkecambahan} = \frac{\% \text{perkecambahan uji}}{\% \text{perkecambahan blanko}} \times 100$$

Tingkat Perkecambahan Pada Rhodamin B Hasil Fotodegradasi (RHB1)

$$\text{Hari ke-1} = \frac{0\%}{0\%} \times 100 = 0 \%$$

$$\text{Hari ke-2} = \frac{10\%}{20\%} \times 100 = 50 \%$$

$$\text{Hari ke-3} = \frac{26\%}{35\%} \times 100 = 74 \%$$

$$\text{Hari ke-4} = \frac{38\%}{45\%} \times 100 = 84 \%$$

$$\text{Hari ke-5} = \frac{55\%}{60\%} \times 100 = 92 \%$$

Tingkat Perkecambahan Pada Rhodamin B Tanpa Fotodegradasi (RHB0)

$$\text{Hari ke-1} = \frac{0\%}{0\%} \times 100 = 0 \%$$

$$\text{Hari ke-2} = \frac{0\%}{20\%} \times 100 = 0 \%$$

$$\text{Hari ke-3} = \frac{0\%}{35\%} \times 100 = 0 \%$$

$$\text{Hari ke-4} = \frac{5\%}{45\%} \times 100 = 11 \%$$

$$\text{Hari ke-5} = \frac{10\%}{60\%} \times 100 = 16 \%$$

Lampiran 7. Karakterisasi XRD ZnO, Hidroksiapatit, dan Komposit ZnO-Hidroksiapatit

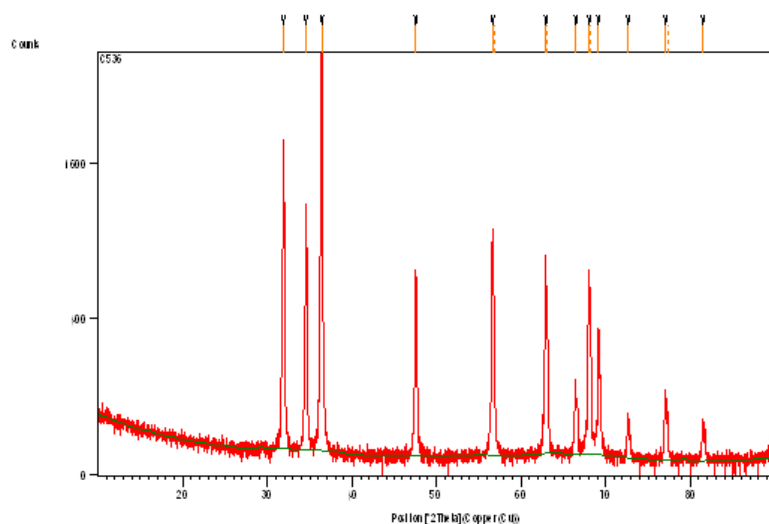
Anchor Scan Parameters

Dataset Name: C536
 File name: E:\X'Pert Data\2024\JULY\03 Jul 24\C536\C536.xrdml
 Sample Identification: C536
 Comment: Theta (10-90)
 Configuration=Stage Flat Samples, Owner=User-1, Creation date=3/15/2009 2:20:30 PM
 Goniometer=Pw3050/60 (Theta/Theta); Minimum step size 2Theta:0.001; Minimum step size Omega:0.001
 Sample stage=Pw3071/xx Bracket
 Diffractometer system=XPERT-PRO
 Measurement program=Theta (10-90), Owner=User-1, Creation date=1/25/2018 8:59:22 AM
 0.02 degpermin 46 min
 7/3/2024 1:14:10 PM
 State Univ of Malang
 XRD measurement (*.XRDML)

Measurement Date / Time:
 Operator:
 Raw Data Origin:
 Scan Axis:
 Start Position [*2Th.]:
 End Position [*2Th.]:
 Step Size [*2Th.]:
 Scan Step Time [s]:
 Scan Type:
 Offset [*2Th.]:
 Divergence Slit Type:
 Divergence Slit Size [°]:
 Specimen Length [mm]:
 Receiving Slit Size [mm]:
 Measurement Temperature [°C]:
 Anode Material:
 K-Alpha1 [Å]:
 K-Alpha2 [Å]:
 K-Beta [Å]:
 K-A2 / K-A1 Ratio:
 Generator Settings:
 Diffractometer Type:
 Diffractometer Number:
 Goniometer Radius [mm]:
 Dist. Focus-Diverg. Slit [mm]:
 Incident Beam Monochromator:
 Spinning:

C536
 1600
 800
 0
 20 30 40 50 60 70 80
 Position [*2Theta] (degrees)

Graphics



Peak List

Pos. [°2Th.]	Height[cts]	FWHM[°2Th.]	d-spacing[Å]	Rel. Int. [%]
31.8831	1829.69	0.2362	2.80692	62.37
34.5297	1153.65	0.1771	2.59759	39.33
36.3659	2933.55	0.1771	2.47054	100.00
47.6444	692.08	0.1181	1.90873	23.59
56.6905	977.28	0.1440	1.62242	33.31
56.8830	428.50	0.0720	1.62141	14.61
62.9556	799.02	0.1680	1.47519	27.24
63.1396	395.01	0.0960	1.47499	13.47
66.4663	131.38	0.1920	1.40553	4.48
68.0430	639.06	0.1440	1.37675	21.78
68.2160	398.25	0.1440	1.37710	13.58
69.1718	348.14	0.1200	1.35702	11.87
72.6522	53.12	0.1440	1.30035	1.81
77.0371	113.16	0.1440	1.23690	3.86
77.3058	53.69	0.1440	1.23633	1.83
81.4671	42.55	0.1920	1.18046	1.45
89.6814	219.23	0.1440	1.09241	7.47

Document History

Insert Measurement:

- File name = "C536.xrdml"
- Modification time = "7/5/2024 1:14:57 PM"
- Modification editor = "State Univ of Malang"

Default properties:

- Measurement step axis = "None"
- Internal wavelengths used from anode material: Copper (Cu)
- Original K-Alpha1 wavelength = "1.54060"
- Used K-Alpha1 wavelength = "1.54060"
- Original K-Alpha2 wavelength = "1.54443"
- Used K-Alpha2 wavelength = "1.54443"
- Original K-Beta wavelength = "1.39225"
- Used K-Beta wavelength = "1.39225"
- Dist. focus to div. slit = "91.00000"
- Irradiated length = "10.00000"
- Spinner used = "No"
- Linear detector mode = "None"
- Length linear detector = "2"
- Step axis value = "0.00000"
- Offset = "0.00000"
- Sample length = "10.00000"
- Modification time = "7/5/2024 1:14:57 PM"
- Modification editor = "State Univ of Malang"

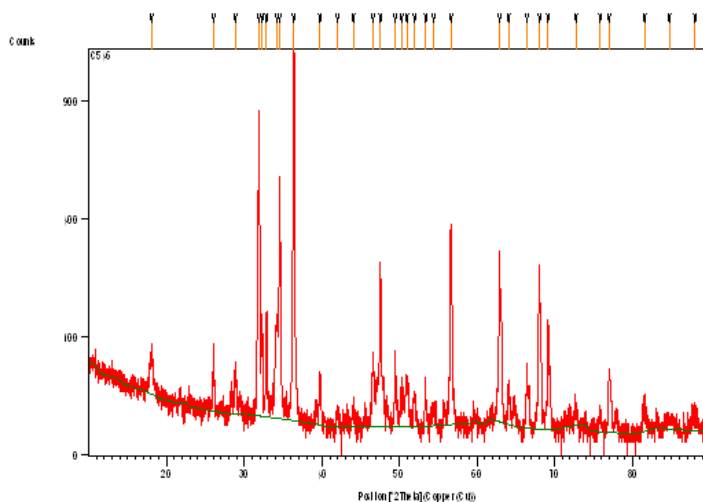
Search Peaks:

- Minimum significance = "2.00"
- Minimum tip width = "0.01"
- Maximum tip width = "1.00"
- Peak base width = "2.00"
- Method = "Top of smoothed peak"
- Modification time = "4/17/2017 8:55:59 AM"
- Modification editor = "State Univ of Malang"

Anchor Scan Parameters

Dataset Name: C546
 File name: E:\Pert Data\2024\JULY\04 Jul 24\C546\C546.xrml
 Sample Identification: C546
 Comment: Theta (10-90)
 Configuration=Stage Flat Samples, Owner=User-1, Creation date=9/15/2009 2:20:30 PM
 Goniometer=Pw3050/60 (Theta/Theta); Minimum step size 2Theta:0.001; Minimum step size Omega:0.001
 Sample stage=Pw3071/wx Bracket
 Diffractometer system=XPERT-PRO
 Measurement program=Theta (10-90), Owner=User-1, Creation date=1/25/2018 8:59:22 AM
 0.02 degpermin 46 min
 Measurement Date / Time: 7/4/2024 2:10:46 PM
 Operator: State Univ of Malang
 Raw Data Origin: XRD measurement (*.XRDML)
 Scan Axis: Gonio
 Start Position [°2Th.]: 10.0100
 End Position [°2Th.]: 89.9900
 Step Size [°2Th.]: 0.0200
 Scan Step Time [s]: 0.7000
 Scan Type: Continuous
 Offset [°2Th.]: 0.0000
 Divergence Slit Type: Fixed
 Divergence Slit Size [°]: 0.9570
 Specimen Length [mm]: 10.00
 Receiving Slit Size [mm]: 0.1000
 Measurement Temperature [°C]: 25.00
 Anode Material: Cu
 K-Alpha1 [Å]: 1.54060
 K-Alpha2 [Å]: 1.54443
 K-Beta [Å]: 1.39225
 K-A2 / K-A1 Ratio: 0.50000
 Generator Settings: 30 mA, 40 kV
 Diffractometer Type: 0000000011063758
 Diffractometer Number: 0
 Goniometer Radius [mm]: 240.00
 Dist. Focus-Diverg. Slit [mm]: 91.00
 Incident Beam Monochromator: No
 Spinning: No

Graphics



Peak List

Pos. [°2Th.]	Height [cts]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
18.0683	49.80	0.3936	4.90971	4.25
26.0277	72.95	0.1574	3.42355	6.22
28.8443	44.24	0.1968	3.09533	3.77
31.8549	820.99	0.1771	2.80933	70.03
32.2738	114.10	0.1574	2.77382	9.73
32.8339	138.49	0.1771	2.72777	11.81
34.1433	127.63	0.1968	2.62610	10.89
34.5190	511.72	0.1378	2.59837	43.65
36.3432	1172.30	0.0984	2.47203	100.00
39.6875	39.54	0.2362	2.27109	3.37
41.9314	6.83	0.3149	2.15461	0.58
43.9943	13.13	0.2362	2.05824	1.12
46.6581	61.24	0.1968	1.94675	5.22
47.6186	246.34	0.1181	1.90971	21.01
49.5499	73.46	0.0984	1.83970	6.27
50.3590	28.66	0.2362	1.81203	2.45
51.0228	34.88	0.3149	1.79000	2.98
52.0231	18.66	0.2362	1.75791	1.59
53.4105	27.84	0.1181	1.71548	2.38
54.4602	8.19	0.6298	1.68487	0.70
56.6691	374.83	0.1181	1.62433	31.97
62.9464	277.89	0.0984	1.47661	23.70
64.0764	28.06	0.1574	1.45327	2.39
66.4448	50.18	0.1181	1.40710	4.28
68.0316	243.34	0.0984	1.37810	20.76
69.1640	128.32	0.1378	1.35828	10.95
72.7109	9.67	0.3149	1.30052	0.83
75.8398	8.31	0.4723	1.25445	0.71
77.0154	46.43	0.1574	1.23821	3.96
81.5499	10.34	0.6298	1.18045	0.88
84.6761	4.04	0.9446	1.14467	0.34
88.0118	9.05	0.4723	1.10969	0.77
89.6756	76.25	0.1200	1.09246	6.50

Document History

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- Modification time = "7/5/2024 1:22:10 PM"
- Modification editor = "State Univ of Malang"

Default properties:

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- Internal wavelengths used from anode material: Copper (Cu)
- Original K-Alpha1 wavelength = "1.54060"
- Used K-Alpha1 wavelength = "1.54060"
- Original K-Alpha2 wavelength = "1.54443"
- Used K-Alpha2 wavelength = "1.54443"
- Original K-Beta wavelength = "1.39225"
- Used K-Beta wavelength = "1.39225"
- Dist. focus to div. slit = "91.00000"
- Irradiated length = "10.00000"
- Spinner used = "No"
- Linear detector mode = "None"
- Length linear detector = "2"
- Step axis value = "0.00000"
- Offset = "0.00000"
- Sample length = "10.00000"
- Modification time = "7/5/2024 1:22:10 PM"
- Modification editor = "State Univ of Malang"

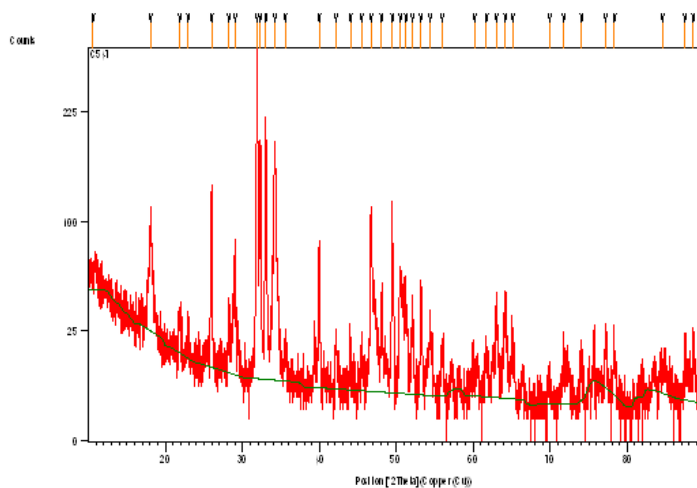
Search Peaks:

- Minimum significance = "2.00"
- Minimum tip width = "0.01"
- Maximum tip width = "1.00"
- Peak base width = "2.00"
- Method = "Top of smoothed peak"

Anchor Scan Parameters

Dataset Name: C547
 File name: E:\X'Pert Data\2024\JULY\04 Jul 24\C547\C547.xrdml
 Sample Identification: C547
 Comment: Theta (10-90)
 Configuration=Stage Flat Samples, Owner=User-1, Creation date=9/15/2009 2:20:30 PM
 Goniometer=Pw3050/60 (Theta/Theta); Minimum step size 2Theta 0.001; Minimum step size
 Omega:0.001
 Sample stage=Pw3071/xx Bracket
 Diffractometer system=X'PERT-PRO
 Measurement program=Theta (10-90), Owner=User-1, Creation date=1/25/2018 8:59:22 AM
 0.02 degpermin 46 min
 7/4/2024 3:00:46 PM
 State Univ of Malang
 XRD measurement (*.XRDML)
 Scan Axis: Gonio
 Start Position [°2Th.]: 10.0100
 End Position [°2Th.]: 89.9900
 Step Size [°2Th.]: 0.0200
 Scan Step Time [s]: 0.7000
 Scan Type: Continuous
 Offset [°2Th.]: 0.0000
 Divergence Slit Type: Fixed
 Divergence Slit Size [°]: 0.9570
 Specimen Length [mm]: 10.00
 Receiving Slit Size [mm]: 0.1000
 Measurement Temperature [°C]: 25.00
 Anode Material: Cu
 K-Alpha1 [Å]: 1.54060
 K-Alpha2 [Å]: 1.54443
 K-Beta [Å]: 1.39225
 K-A2 / K-A1 Ratio: 0.50000
 Generator Settings: 30 mA, 40 kV
 Diffractometer Type: 0000000011063758
 Diffractometer Number: 0
 Goniometer Radius [mm]: 240.00
 Dist. Focus-Diverg. Slit [mm]: 91.00
 Incident Beam Monochromator: No
 Spinning: No

Graphics



Peak List

Pos.[°2Th.]	Height[cts]	FWHM[°2Th.]	d-spacing[Å]	Rel.Int.[%]
10.6259	12.70	0.9446	8.32587	4.25
18.0832	71.90	0.3149	4.90569	24.06
21.8293	16.69	0.3149	4.07156	5.59
22.9215	17.43	0.2362	3.87997	5.83
25.9614	107.50	0.1181	3.43214	35.97
28.2221	26.53	0.1574	3.16215	8.88
28.9982	61.41	0.1574	3.07925	20.55
31.8884	298.86	0.0984	2.80645	100.00
32.2932	180.53	0.1574	2.77220	60.41
33.0063	212.31	0.1181	2.71392	71.04
34.1620	170.66	0.2362	2.62471	57.10
35.5462	15.12	0.2362	2.52561	5.06
39.9150	73.34	0.1968	2.25867	24.54
42.1003	15.63	0.1968	2.14635	5.23
43.9485	16.21	0.1968	2.06028	5.42
45.3922	16.98	0.1181	1.99806	5.68
46.8152	100.70	0.1574	1.94059	33.69
48.1827	41.47	0.1574	1.88866	13.87
49.5553	98.05	0.1181	1.83951	32.81
50.5894	54.80	0.2362	1.80432	18.34
51.3533	39.80	0.2362	1.77926	13.32
52.1829	37.45	0.3149	1.75291	12.53
53.2656	44.12	0.2362	1.71980	14.76
54.4895	18.26	0.4723	1.68403	6.11
56.0046	12.45	0.2362	1.64201	4.17
60.2072	5.13	0.7872	1.53706	1.72
61.7434	15.92	0.2362	1.50246	5.33
63.0644	33.25	0.2362	1.47413	11.13
64.1907	33.94	0.3936	1.45096	11.36
65.1645	18.99	0.3936	1.43161	6.35
69.9485	3.72	0.4723	1.34495	1.24
71.7485	13.57	0.2362	1.31557	4.54
74.0882	11.14	0.3936	1.27971	3.73
77.2115	15.31	0.2362	1.23556	5.12
78.3169	12.32	0.2362	1.22087	4.12
84.5463	7.39	0.4723	1.14609	2.47
87.4880	18.67	0.2362	1.11498	6.25
88.5372	18.21	0.2880	1.10354	6.09

Document History

Insert Measurement:

- File name = "C547.xrdml"
- Modification time = "7/5/2024 1:22:41 PM"
- Modification editor = "State Univ of Malang"

Default properties:

- Measurement step axis = "None"
- Internal wavelengths used from anode material: Copper (Cu)
- Original K-Alpha1 wavelength = "1.54060"
- Used K-Alpha1 wavelength = "1.54060"
- Original K-Alpha2 wavelength = "1.54443"
- Used K-Alpha2 wavelength = "1.54443"
- Original K-Beta wavelength = "1.39225"
- Used K-Beta wavelength = "1.39225"
- Dist. focus to div. slit = "91.00000"
- Irradiated length = "10.00000"
- Spinner used = "No"
- Linear detector mode = "None"
- Length linear detector = "2"
- Step axis value = "0.00000"
- Offset = "0.00000"
- Sample length = "10.00000"
- Modification time = "7/5/2024 1:22:41 PM"
- Modification editor = "State Univ of Malang"