Lampiran 1
RANCANG CAMPUR BETON PORTLAND

Design Srength = Beton K-400
Agregat maksimum = 40 mm
Slump = 10 cm

SG Cement = 3,15
SG Sand = 2,6
SG Coarse Agregat = 2,65
FM Sand = 2,6

1. Menentukan Target Strength

$$T_{ts} = \frac{T_{ds}}{1 - t.V} = \frac{400}{1 - (0{,}883.0{,}15)} = 461{,}0685 \approx 461$$

Keterangan : t= Konstanta yang besarnya ditentukan berdasarkan perkiraan % benda uji. Oleh karena 80 % yang mau lolos,

maka t=0,883

V= Koefisien variasi, didapat dari penelitian sebelumnya = 0,15

2. Menentukan W/C dengan metode JSCE berdasarkan compressive Strength

Berdasarkan rumus dari Ijapan Cement Association

T28 = -113 + 214 C/W
461 = -113 + 214 C/W
C/W = 2,66355
W/C = 0,373

3. Menentukan S/A, jumlah air adukan (W), dan kandungan udara (A) dari Tabel 4.3 diperoleh

W = 165 kg
S/A = 36 %
A = 1,2 %

Nilai tersebut berlaku untuk beton yang menggunakan pasir alam FM = 2,8 dan slump 80 mm. Oleh karena itu, untuk menyesuaikan dengan nilai

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

sebenarnya, perhitungan menggunakan Tabel 4.4 dan perhitungan lengkapnya adalah sebagai berikut:

No	Change in material or proportion	Correction on S/A and W	
		S/A (%)	W (kg)
1	FM= 2.6	$36+\left(\left(\frac{2,6-2,8}{0,1}\right)0,5\right)=35\%$	No Correction
2	Slump 10 cm	No Correction	$165+\left(\frac{1,2}{100}(10-8)165\right)=168,96$
3	Using crushed CA	35+4 = 39 %	168,96 + 12 = 180,96
4	Increase in S/A	39 %	180,96 +((39-35)1,5) = 186,96

Setelah disesuaikan dengan keadaan sebenarnya, didapatkan nilai sebagai berikut:

S/A = 39,00 %

W = 186,96 kg

4. Dari W/C= 0,373 dan W = 186,96 kg, maka dapat dihitung berat semen yang dibutuhkan:

5. Menghitung volume total agregat (Ag):

$$Ag = 1-\frac{W}{1000}-\frac{C}{SG_{cement}}-A = 1-\frac{186,96}{1000}-\frac{501,532}{3150}-\frac{1,2}{100} = 0,6418$$

6. S/A = 39 % , maka dapat dihitung volume pasir dan agragar kasar, yaitu:

Volume S = 39 % x 0,6418 m^3 = 0,2503 m^3

S = 0,2503 m^3 x 2600 kg/ m^3 = 650,809 kg

Volume CA =Ag-S=0,6418 m^3-0,2503 m^3 = 0,3915 m^3

CA =0,3915 m^3 x 2650 kg/ m^3 = 1037,508 kg

Dari hasil perhitungan ini, untuk per m^3 beton didapat campuran sebagai berikut:

Semen (C) = 501,532 kg

Air (W) = 186,960 kg

Pasir (S) = 650,809 kg

Agregat kasar(CA)= 1037,508 kg

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

1. Kuat Tekan Beton Geopolimer Abu Terbang

Sampel	berat sampel (Kg)	beban maksimal (Kg)	rata-rata beban max (kg)	rata-rata Kuat tekan (MPa)
	7775	61250	27.222222	
curing	7532	59000	26.222222	26.88888889
(2 minggu)	7707	61250	27.222222	
	7748	100250	44.555556	
BGA-K 7	7887	92000	40.888889	42.25925926
	7685	93000	41.333333	
	7760	104000	46.222222	
BGA-K28	7743	115000	51.111111	46.22222222
	7749	93000	41.333333	
	7868	97500	43.333333	
BGA-K56	7547	59000	26.222222	34.88888889
	7670	79000	35.111111	
	7806	95000	42.222222	
BGA-K90	7957	111000	49.333333	46.7037037
	7763	109250	48.555556	
	7844	88000	39.111111	
BGA-Aq7	7823	107000	47.555556	46.22222222
	7780	117000	52	
	7814	78000	34.666667	
BGA-Aq28	7970	93000	41.333333	37.62962963
	7536	83000	36.888889	
	7666	95750	42.555556	
BGA-Aq56	7769	73500	32.666667	38.7037037
	7794	92000	40.888889	
	7868	84000	37.333333	
BGA-Aq90	7868	104250	46.333333	45.96296296
	7901	122000	54.222222	
	7770	93000	41.333333	
BGA-AL7	7652	72500	32.222222	43.03703704
	7796	125000	55.555556	
	7699	99750	44.333333	
BGA-AL28	7607	106000	47.111111	48.03703704
	7837	118500	52.666667	
	7705	81500	36.222222	
BGA-AL56	7817	85500	38	36
	7822	76000	33.777778	

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

	7771	84500	37.555556	
BGA-AL90	7696	66750	29.666667	37.40740741
	7901	101250	45	

2. Kuat Tekan Beton Geopolimer Metakaolin

Sampel	berat sampel (Kg)	beban maksimal (Kg)	Kuat Tekan (MPa)	rata-rata Kuat tekan (MPa)
	7505	39000	17.333333	
curing	7631	48250	21.444444	20.37037
(1 minggu)	7430	50250	22.333333	
	7231	69250	30.777778	
BGM-K 7	7081	52000	23.111111	28.407407
	7301	70500	31.333333	
	7355	57750	25.666667	
BGM-K28	7339	71250	31.666667	28.111111
	7451	60750	27	
	7376	54750	24.333333	
BGM-K56	7279	74950	33.311111	24.992593
	6947	39000	17.333333	
	6971	62000	27.555556	
BGM-K90	7104	69750	31	28.814815
	6974	62750	27.888889	
	7534	64500	28.666667	
BGM-Aq7	7445	42750	19	24.148148
	7487	55750	24.777778	
	7404	52250	23.222222	
BGM-Aq28	7445	57750	25.666667	24.296296
	7445	54000	24	
	7258	44750	19.888889	
BGM-Aq56	7417	65750	29.222222	28
	7205	78500	34.888889	
	7372	72250	32.111111	
BGM-Aq90	7358	63750	28.333333	28.703704
	7348	57750	25.666667	
	7481	55500	24.666667	
BGM-AL7	7568	60000	26.666667	17.596296
	7505	3275	1.4555556	
	7464	45750	20.333333	
BGM-AL28	7281	41500	18.444444	20.333333
	7516	50000	22.222222	
	7231	52500	23.333333	

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

BGM-AL56	7582	59250	26.333333	24.518519
	7659	53750	23.888889	
	7422	51500	22.888889	
BGM-AL90	7623	56000	24.888889	24.814815
	7524	60000	26.666667	

3. Kuat Tekan Beton Portland

Sampel	berat sampel (Kg)	beban maksimal (Kg)	Kuat Tekan (MPa)	rata-rata Kuat tekan (MPa)
	7864	94000	41.777778	
curing	7874	88000	39.111111	40.44444444
	7732	75250	33.444444	
PC-K 7	7761	75000	33.333333	33
	7754	72500	32.222222	
	7752	68000	30.222222	
PC-K28	7715	45750	20.333333	25.62962963
	7831	59250	26.333333	
	7747	85250	37.888889	
PC-K56	7761	90250	40.111111	27.55925926
	7800	10525	4.6777778	
	7803	86500	38.444444	
PC-K90	7739	102750	45.666667	40.44444444
	7771	83750	37.222222	
	7773	107500	47.777778	
PC-Aq7	7874	116000	51.555556	50.48148148
	7834	117250	52.111111	
	7881	70750	31.444444	
PC-Aq28	7701	72500	32.222222	45.05555556
	7822	59500	26.444444	
	7858	84000	37.333333	
PC-Aq56	7835	86250	38.333333	38.88888889
	7856	92250	41	
	7769	50500	22.444444	
PC-Aq90	7787	67500	30	26.96296296
	7759	64000	28.444444	
	7777	101000	44.888889	
PC-AL7	7821	95000	42.222222	42.74074074
	7807	92500	41.111111	
	7891	91000	40.444444	
PC-AL28	7779	75000	33.333333	36.62962963
	7801	81250	36.111111	

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

	7858	84000	37.333333	
PC-AL56	7835	86250	38.333333	37.40740741
	7856	82250	36.555556	
	7802	62000	27.555556	
PC-AL90	7867	58500	26	27.51851852
	7785	65250	29	

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lab. Afiliasi

LABORATORY TEST RESULTS

Job. Number : 139 / IV / 010 Date : 29 - 04 - 2010

Customer : **Sdri. Niken Swastika** Attention :

Parameters : Natrium (Na)
Date Received : 16 - 04 - 2010
Sample Matrix : Liquid

No.	Sample Code	Result	Unit	Method
1.	BGM - L	1.38	%	AAS
2.	BGM - A	0.25	%	
3.	BGA - L	1.38	%	
4.	BGA - A	0.21	%	

April 29th, 2010

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Director

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University of Indonesia, Depok 16424
Phone 021-7872720, Fax 021-7872720

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lab. Afiliasi

LABORATORY TEST RESULTS

Job. Number : 139 / IV / 010 Date : 29 - 04 - 2010

Customer : **Sdri. Niken Swastika** Attention :

Parameters : Calcium (Ca)
Date Received : 16 - 04 - 2010
Sample Matrix : Liquid

No.	Sample Code	Result	Unit	Method
1.	BGA - L	126.10	µg/g	AAS
2.	BGA - A	54.80	µg/g	

April 29th, 2010

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Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lab. Afiliasi

LABORATORY TEST RESULTS

Job. Number : 139 / IV / 010 Date : 29 - 04 - 2010

Customer : **Sdri. Niken Swastika** Attention :

Parameters : Iron (Fe)
Date Received : 16 - 04 - 2010
Sample Matrix : Liquid

No.	Sample Code	Result	Unit	Method
1.	BGA - L	1.77	µg/g	AAS
2.	BGA - A	9.70	µg/g	

April 29th, 2010

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Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lab. Afiliasi

Lampiran 4
Analisis AAS Na Silikat (Waterglass)

LABORATORY TEST RESULTS

Job. Number : 152 / V / 010 Date : 18 - 05 - 2010

Customer : Sdri. Niken Swastika Attention :

Sample Code : **AF 152**
Date Received : 03-05-2010
Sample Matrix : Waterglass

No.	Parameters	Sample Result	Unit	Method
1.	Natrium (Na)	12.45	%	AAS
2.	Silica (Si)	21.46	%	

May 18th, 2010

Drs. Sunardi M.Si
Director

Page 2 of 2
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Analisis ketahanan..., Niken Swastika, FT UI, 2010.

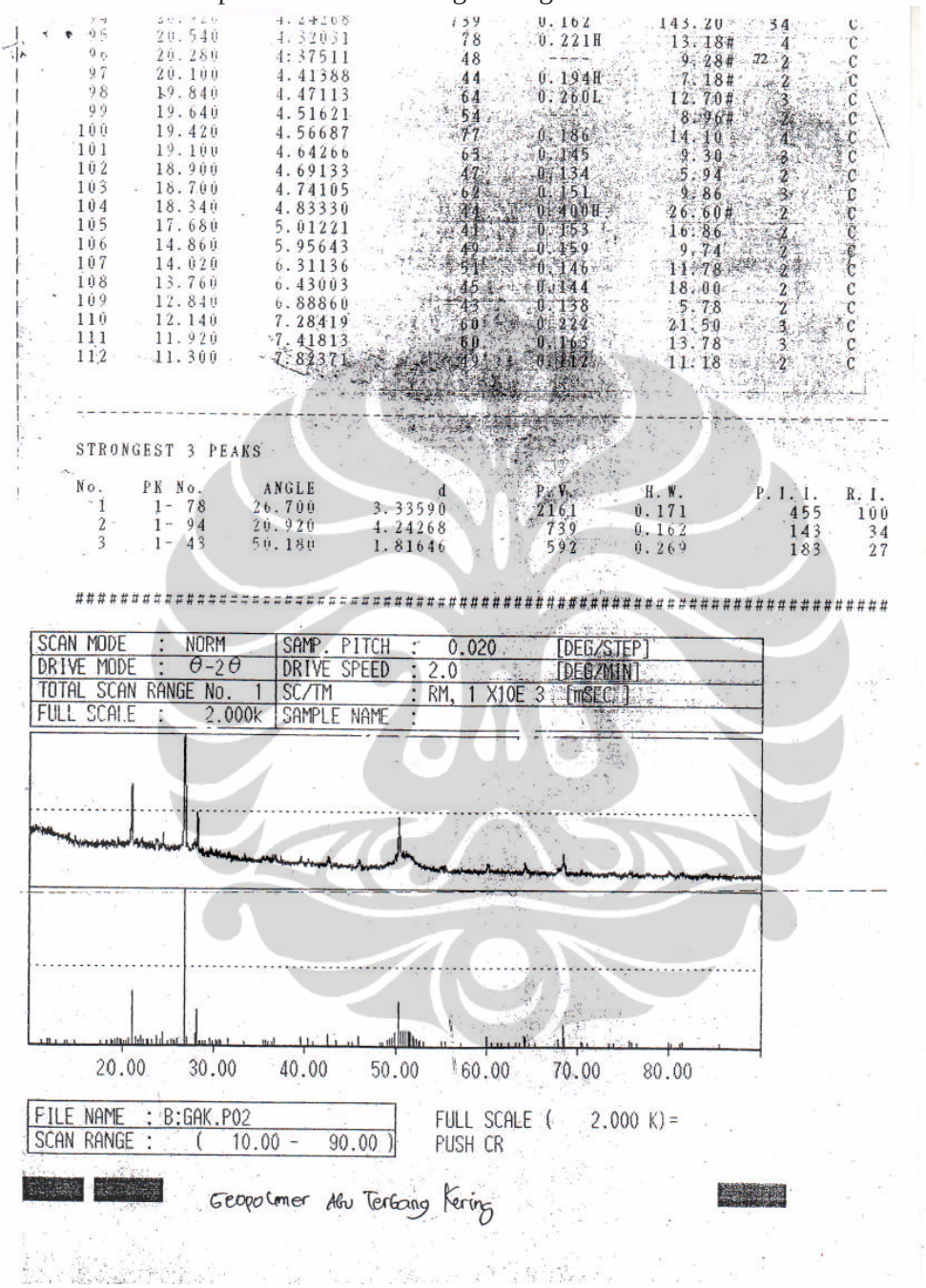
KADAR AIR NA SILIKAT

Keterangan	Berat Wadah+ sampel (g)	Berat sampel (g)
Wadah kosong	8.23	
wadah+isi basah	8.8	0.57
wadah+isi kering 1	8.7	
wadah+isi kering 2	8.69	0.46
selisih air		0.11
kadar air (%)		0.192982

Keterangan:
Temperatur oven =60 ^{o}C
Lama pemanasan = lebih dari 4 hari

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lampiran 6
Analisis XRD Geopolimer Abu Terbang Kering



95	20.540	4.32031	78	0.221H	13.18#	4	C
96	20.280	4.37511	48	----	9.28#	2	C
97	20.100	4.41388	44	0.194H	7.18#	2	C
98	19.840	4.47113	64	0.260L	12.70#	3	C
99	19.640	4.51621	54	----	8.96#	2	C
100	19.420	4.56687	77	0.186	14.10	4	C
101	19.100	4.64266	63	0.145	9.30	3	C
102	18.900	4.69133	47	0.134	5.94	2	C
103	18.700	4.74105	62	0.151	9.86	3	C
104	18.340	4.83330	44	0.400H	26.60#	2	C
105	17.680	5.01221	41	0.153	16.86	2	C
106	14.860	5.95643	49	0.159	9.74	2	C
107	14.020	6.31136	51	0.146	11.78	2	C
108	13.760	6.43003	45	0.144	18.00	2	C
109	12.840	6.88860	43	0.138	5.78	2	C
110	12.140	7.28419	60	0.222	21.50	3	C
111	11.920	7.41813	60	0.163	13.78	3	C
112	11.300	7.82371	49	0.112	11.18	2	C

STRONGEST 3 PEAKS

No.	PK No.	ANGLE	d	P.V.	H.W.	P.I.I.	R.I.
1	1- 78	26.700	3.33590	2161	0.171	455	100
2	1- 94	20.920	4.24268	739	0.162	143	34
3	1- 43	50.180	1.81646	592	0.269	183	27

SCAN MODE	: NORM	SAMP. PITCH : 0.020	[DEG/STEP]
DRIVE MODE	: θ-2θ	DRIVE SPEED : 2.0	[DEG/MIN]
TOTAL SCAN RANGE No.	1	SC/TM : RM, 1 X10E 3	[mSEC]
FULL SCALE :	2.000k	SAMPLE NAME :	

20.00 30.00 40.00 50.00 60.00 70.00 80.00

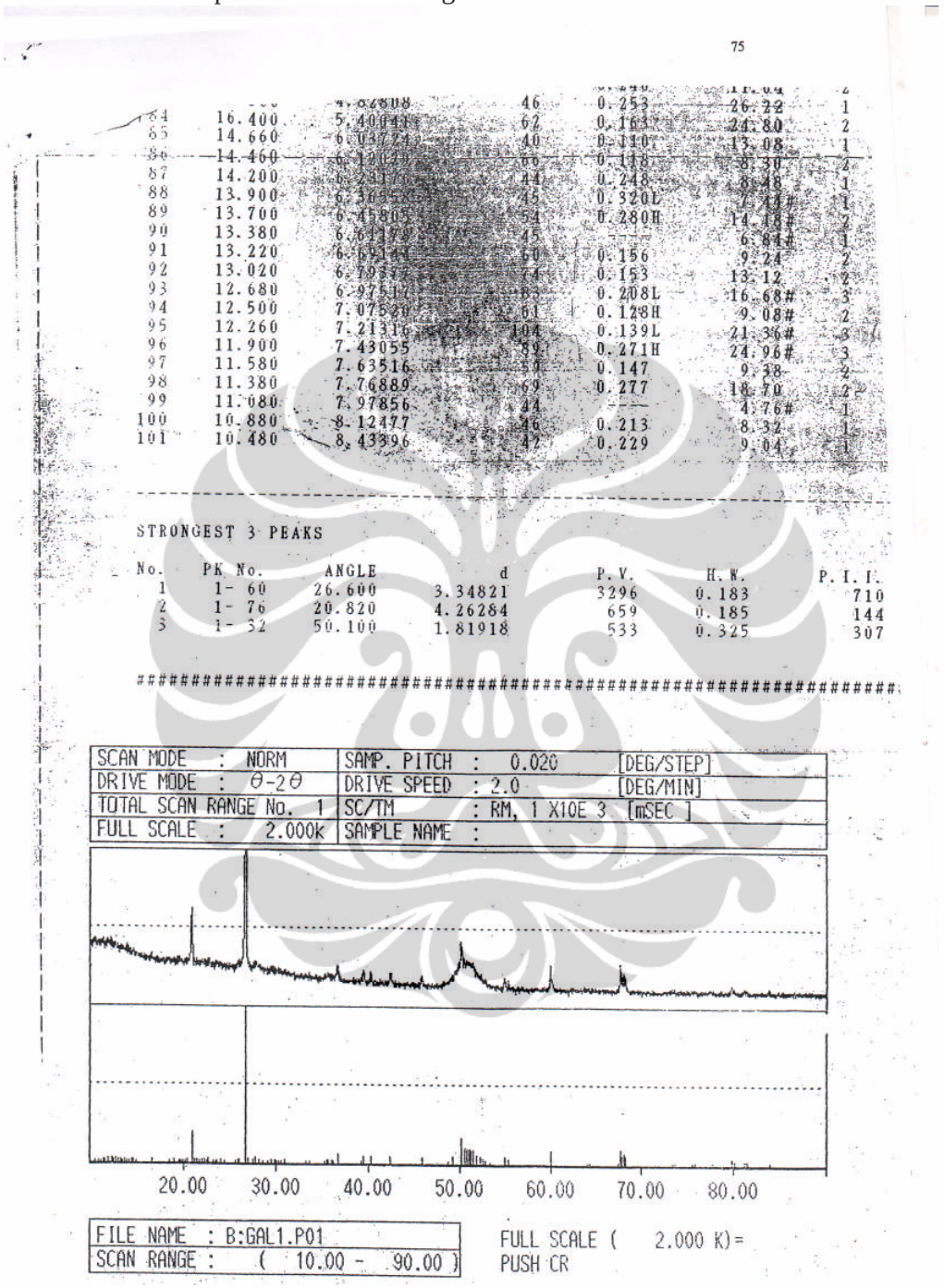
FILE NAME	: B:GAK.P02
SCAN RANGE	: (10.00 - 90.00)

FULL SCALE (2.000 K)=
PUSH CR

Geopolimer Abu Terbang Kering

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lampiran 7
Analisis XRD Geopolimer Abu Terbang –Air laut



75

84	16.400	5.40044	46	0.253	26.22	1
85	14.660	6.03724	62	0.163	24.80	2
86	14.460	6.12027	40	0.110	13.08	1
87	14.200	6.23170	66	0.118	8.30	4
88	13.900	6.36655	44	0.248	8.48	1
89	13.700	6.45805	45	0.320L	7.44#	1
90	13.380	6.61190	54	0.280H	14.18#	2
91	13.220	6.69144	45		6.84#	1
92	13.020	6.79547	60	0.156	9.24	2
93	12.680	6.97517	74	0.153	13.12	2
94	12.500	7.07520	83	0.208L	16.68#	3
95	12.260	7.21316	61	0.128H	9.08#	2
96	11.900	7.43055	104	0.139L	21.36#	3
97	11.580	7.63516	89	0.271H	24.96#	3
98	11.380	7.76889	50	0.147	9.38	2
99	11.080	7.97856	69	0.277	18.70	2
100	10.880	8.12477	44		4.76#	1
101	10.480	8.43396	46	0.213	8.32	1
			42	0.229	9.04	1

STRONGEST 3 PEAKS

No.	PK No.	ANGLE	d	P.V.	H.W.	P.I.I.
1	1- 60	26.600	3.34821	3296	0.183	710
2	1- 76	20.820	4.26284	659	0.185	144
3	1- 52	50.100	1.81918	533	0.325	307

##########

SCAN MODE	: NORM	SAMP. PITCH	: 0.020 [DEG/STEP]
DRIVE MODE	: θ-2θ	DRIVE SPEED	: 2.0 [DEG/MIN]
TOTAL SCAN RANGE No.	1	SC/TM	: RM, 1 X10E 3 [mSEC]
FULL SCALE	: 2.000k	SAMPLE NAME	:

20.00 30.00 40.00 50.00 60.00 70.00 80.00

FILE NAME	: B:GAL1.P01
SCAN RANGE	: (10.00 - 90.00)

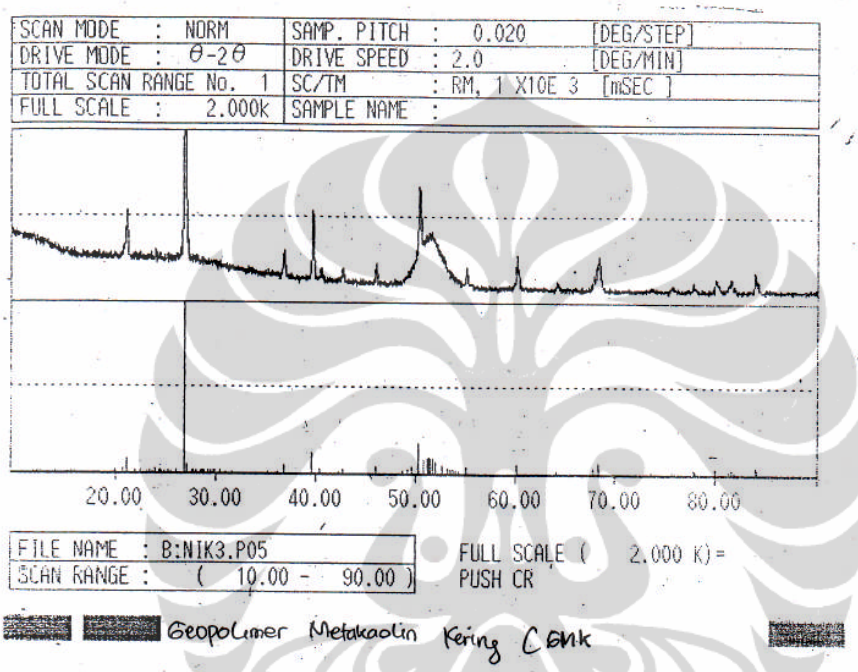
FULL SCALE (2.000 K)=
PUSH CR

Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lampiran 8
Analisis XRD Geopolimer Metakaolin Kering

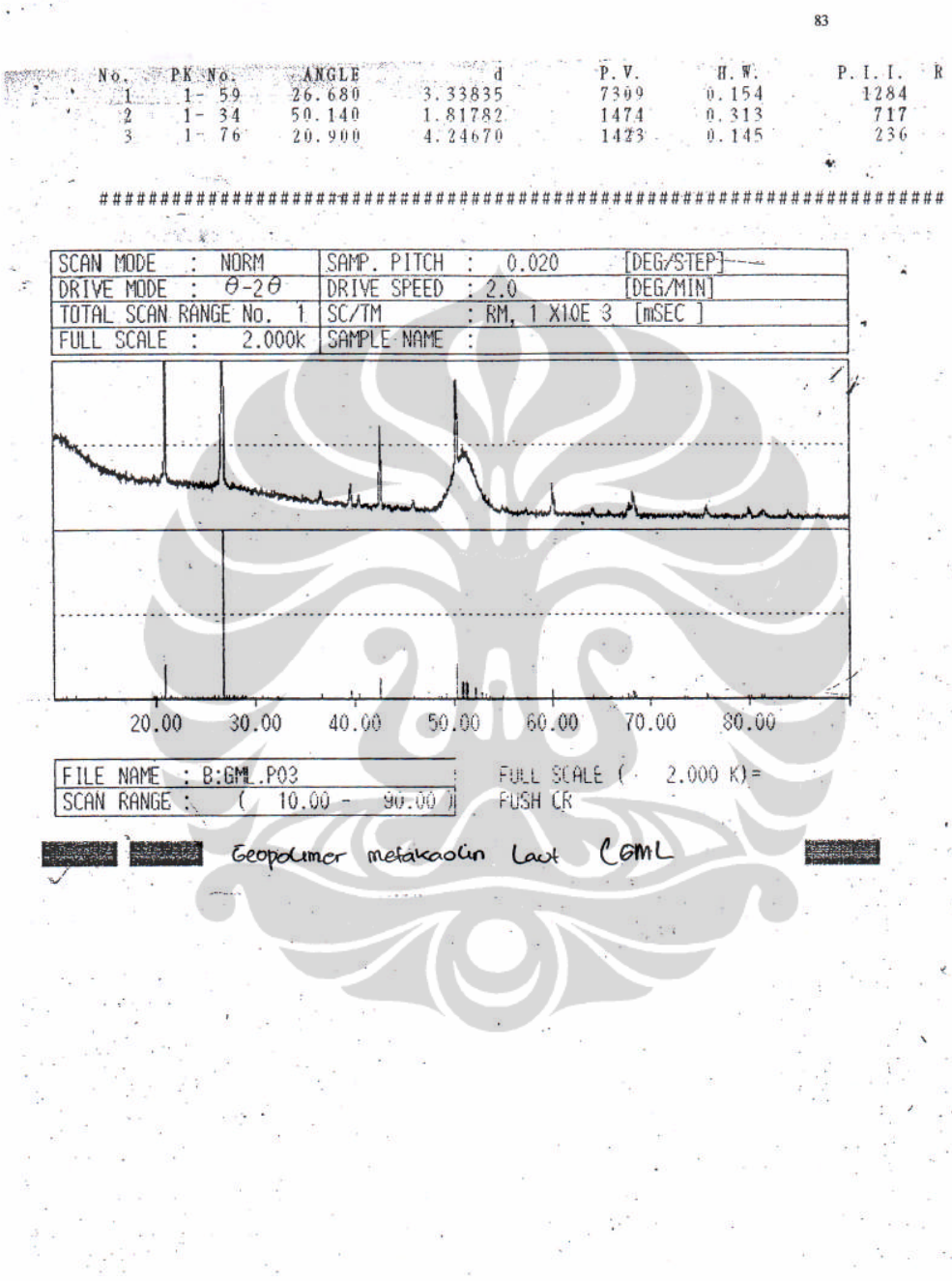
No.	PK No.	ANGLE	d	P.V.	H.W.	P.I.I.	R.I.
1	1- 58	26.760	3.32855	6451	0.167	1276	100
2	1- 31	50.240	1.81443	1088	0.358	500	17
3	1- 39	39.580	2.27500	728	0.203	195	11

##########



Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Lampiran 9
Analisis XRD Geopolimer Metakaolin –Air laut



83

No.	PK No.	ANGLE	d	P.V.	H.W.	P.I.I.	R
1	1- 59	26.680	3.33835	7309	0.154	1284	
2	1- 34	50.140	1.81782	1474	0.313	717	
3	1- 76	20.900	4.24670	1423	0.145	236	

##########

SCAN MODE : NORM	SAMP. PITCH : 0.020 [DEG/STEP]
DRIVE MODE : θ-2θ	DRIVE SPEED : 2.0 [DEG/MIN]
TOTAL SCAN RANGE No. 1	SC/TM : RM, 1 X10E 3 [mSEC]
FULL SCALE : 2.000k	SAMPLE NAME :

FILE NAME : B:GML.P03	FULL SCALE (2.000 K)=
SCAN RANGE : (10.00 - 90.00)	PUSH CR

[redacted] [redacted] Geopolimer metakaolin Laut GML [redacted]

Lampiran 10
Analisis AAS kadar Fe dalam Rendaman Geopolimer Metakaolin –Aquades

Lab. Afiliasi

LABORATORY TEST RESULTS

Job. Number : 266 / VII / 010 Date : 21 - 07 - 2010

Customer : Sdri. Niken Swastika Attention :

Sample Code : **AF 266**/ BGM - A90

Sample Matrix : Liquid

No.	Parameters	Sample Result	Unit	Method
1.	Iron (Fe)	1.35	µg/mL	AAS

Jakarta, 21 Juli 2010

Drs. Sunardi, M.Si
Director

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Analisis ketahanan..., Niken Swastika, FT UI, 2010.

Analisis ketahanan..., Niken Swastika, FT UI, 2010.