

## Lampiran 1. Hasil Analisis Komposisi Air

WATER ANALYSIS REPORT					
To :			Date : October 07, 2008		
			Ref. No : W-002/LAB/10/08		
Kind of sample	D5	CT.01	CT.02	CT.03	
Sampling point					
Sampling date	September 26, 2008				
Sampling time					
1	Color (Pt-Co-degree)	n.a.	n.a.	n.a.	n.a.
2	Turbidity	< 1	< 1	< 1	< 1
3	pH (at 25°C)	6.3	6.5	6.2	6.3
4	Electrical conductivity ( $\mu\text{S}/\text{cm}$ )	262	241	252	297
5	P-Alkalinity (as $\text{CaCO}_3$ )	n.a.	n.a.	n.a.	n.a.
6	M-Alkalinity (as $\text{CaCO}_3$ )	23	24	18	21
7	Total Hardness (as $\text{CaCO}_3$ )	< 1	8	4	< 1
8	Calcium Hardness (as $\text{CaCO}_3$ )	< 1	5	3	< 1
9	Chloride ion (as $\text{Cl}^-$ )	< 2	< 2	< 2	< 2
10	Sulfate ion (as $\text{SO}_4^{2-}$ )	n.a.	n.a.	n.a.	n.a.
11	Soluble Silica (as $\text{SiO}_2$ )	1.65	1.50	0.67	0.15
12	Phosphate ion (as $\text{PO}_4^{3-}$ )	n.a.	n.a.	n.a.	n.a.
13	Total Phosphate (as $\text{PO}_4^{3-}$ )	n.a.	< 0.1	< 0.1	< 0.1
14	Total iron (as Fe)	0.14	0.06	0.07	0.13
15	Hydrazine (as $\text{N}_2\text{H}_4$ )	n.a.	n.a.	n.a.	n.a.
16	Nitrite ion (as $\text{NO}_2^-$ )	n.a.	n.a.	n.a.	n.a.
17					
18					
19					
20					
Comment :					(Unit : mg/l)

## Lampiran 2. Kalkulator Online Indeks Saturasi

Search :

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This calculator helps you determine the scaling potential of the water by using the Langelier Saturation Index.

Give the values of your water analysis. All the fields with \* are required.

If you do not have a water analysis you can use the values in table 2. Click on a button at the bottom of table 2

**Table 1: Input table**

pH	<input type="text"/>	*	
Conductivity in TDS	<input type="text"/>	*	mg/L <input type="button" value="v"/>
[Ca <sup>2+</sup> ]	<input type="text"/>	*	mg/L <input type="button" value="v"/>
[HCO <sub>3</sub> <sup>-</sup> ]	<input type="text"/>	*	mg/L <input type="button" value="v"/>
Water temperature	<input type="text"/>	*	degree C <input type="button" value="v"/>

**Table 2 : Additional data**

pH =	7.7	8	8.6	
TDS =	20	34483	273	mg/l
[Ca <sup>2+</sup> ] =	5	400	49	mg/l
[HCO <sub>3</sub> <sup>-</sup> ] =	10	140	121	mg/l
T =	20	20	20	degree C
	<input type="button" value="Example"/>	<input type="button" value="Seawater"/>	<input type="button" value="Tap water"/>	

**Table 3: Results Langelier Saturation Index**

pH <sub>s</sub>	<input type="text"/>
LSI	<input type="text"/>
Indication based on Langelier (1936)	<input type="text"/>
Indication based on improved Langelier by Carrier (1965)	<input type="text"/>

The Langelier Saturation Index formula is

$$LSI = pH - pH_s$$

For an explanation of the formula click [here](#).

Search :

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This calculator helps you determine the scaling potential of the water by using the Ryznar Stability Index

Give the values of your water analysis. You have to fill all the boxes with \*.

If you do not have a water analysis you can use the values in table 2. Click on a button at the bottom of table 2

**Table 1: Input table**

pH	<input type="text"/>	*	
Conductivity in TDS	<input type="text"/>	*	mg/l <input type="button" value="v"/>
[Ca <sup>2+</sup> ]	<input type="text"/>	*	mg/L <input type="button" value="v"/>
[HCO <sub>3</sub> <sup>-</sup> ]	<input type="text"/>	*	mg/l <input type="button" value="v"/>
Water temperature	<input type="text"/>	*	degree C <input type="button" value="v"/>

**Table 2: Additional data**

pH =	7.7	8	8.6	
TDS =	20	34483	273	mg/l
[Ca <sup>2+</sup> ] =	5	400	49	mg/l
[HCO <sub>3</sub> <sup>-</sup> ] =	10	140	121	mg/l
T =	20	20	20	degree C
	<input type="button" value="Example"/>	<input type="button" value="Seawater"/>	<input type="button" value="Tap water"/>	

**Table 3: Results Ryznar Stability Index**

pH <sub>s</sub>	<input type="text"/>
RI	<input type="text"/>
Indication base on Ryznar (1942)	<input type="text"/>
Indication based on improved Ryznar index by Carrier 1965	<input type="text"/>

The Ryznar Stability Index formula is:

$$RI = 2 \cdot pH_s - pH$$

For an explanation of the formula click [here](#).

The criteria used to give an indication are as shown in table 4 and 5

**Table 4**

**Table 5**

## Lampiran 3. Hasil Uji Komposisi Sampel

**COMPOSITION TEST REPORT**

Hal 1 dari 1

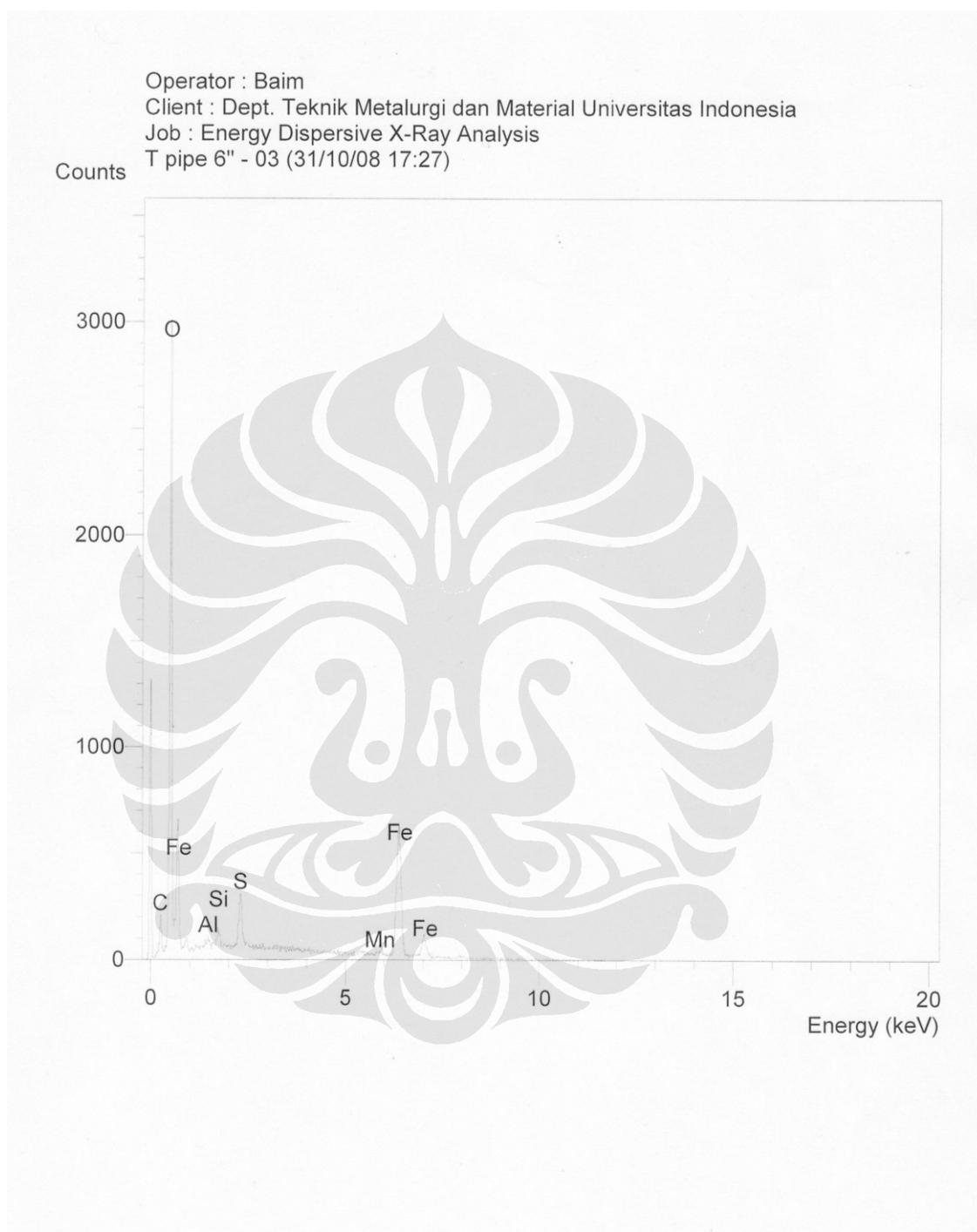
<b>No Laporan</b>	1000	<b>Bahan</b>	Baja
<i>Report Nr</i>		<i>Material</i>	
<b>Pemakai Jasa</b>	Wirda Safitri	<b>Identitas Bahan</b>	Tee
<i>Customer</i>		<i>Material Identity</i>	
<b>Alamat</b>	-	<b>Tanggal Terima</b>	4 November 2008
<i>Address</i>		<i>Receiving Date</i>	
<b>No Kontrak</b>	1000/PT.02/FT04/P/2008	<b>Standar</b>	ASTM A751
<i>Contract Nr.</i>		<i>Standard</i>	
<b>Tanggal Uji</b>	5 November 2008	<b>Mesin Uji</b>	Optical Emission Spectrometer
<i>Date of Test</i>		<i>Testing machine</i>	

<b>Kode Sampel</b> <i>Sample Code</i>	<b>C</b> (%)	<b>Si</b> (%)	<b>S</b> (%)	<b>P</b> (%)	<b>Mn</b> (%)	<b>Ni</b> (%)	<b>Cr</b> (%)
Tee	0.187	0.225	0.013	0.031	0.509	<0.005	0.012
	<b>Mo</b> (%)	<b>Ti</b> (%)	<b>Cu</b> (%)	<b>Nb</b> (%)	<b>V</b> (%)	<b>Al</b> (%)	<b>Fe</b> (%)
	<0.005	0.006	0.007	<0.002	0.007	<0.001	98.736

Depok, 6 November 2008  
**LABORATORIUM UJI MATERIAL**  
 Manajer Teknis,

(Ahmad Ivan Karayan, ST, M.Eng)

## Lampiran 4. Hasil Pengujian EDX Arah Jam Enam Pertama



## Lampiran 4. Hasil Pengujian EDX Arah Jam Enam Pertama (lanjutan)

SEMQuant results. Listed at 17:29:45 on 31/10/08  
 Operator: Baim  
 Client: Dept. Teknik Metalurgi dan Material Universitas Indonesia  
 Job: Energy Dispersive X-Ray Analysis  
 Spectrum label: T pipe 6" - 03

System resolution = 62 eV

Quantitative method: ZAF ( 3 iterations).  
 Analysed all elements and normalised results.

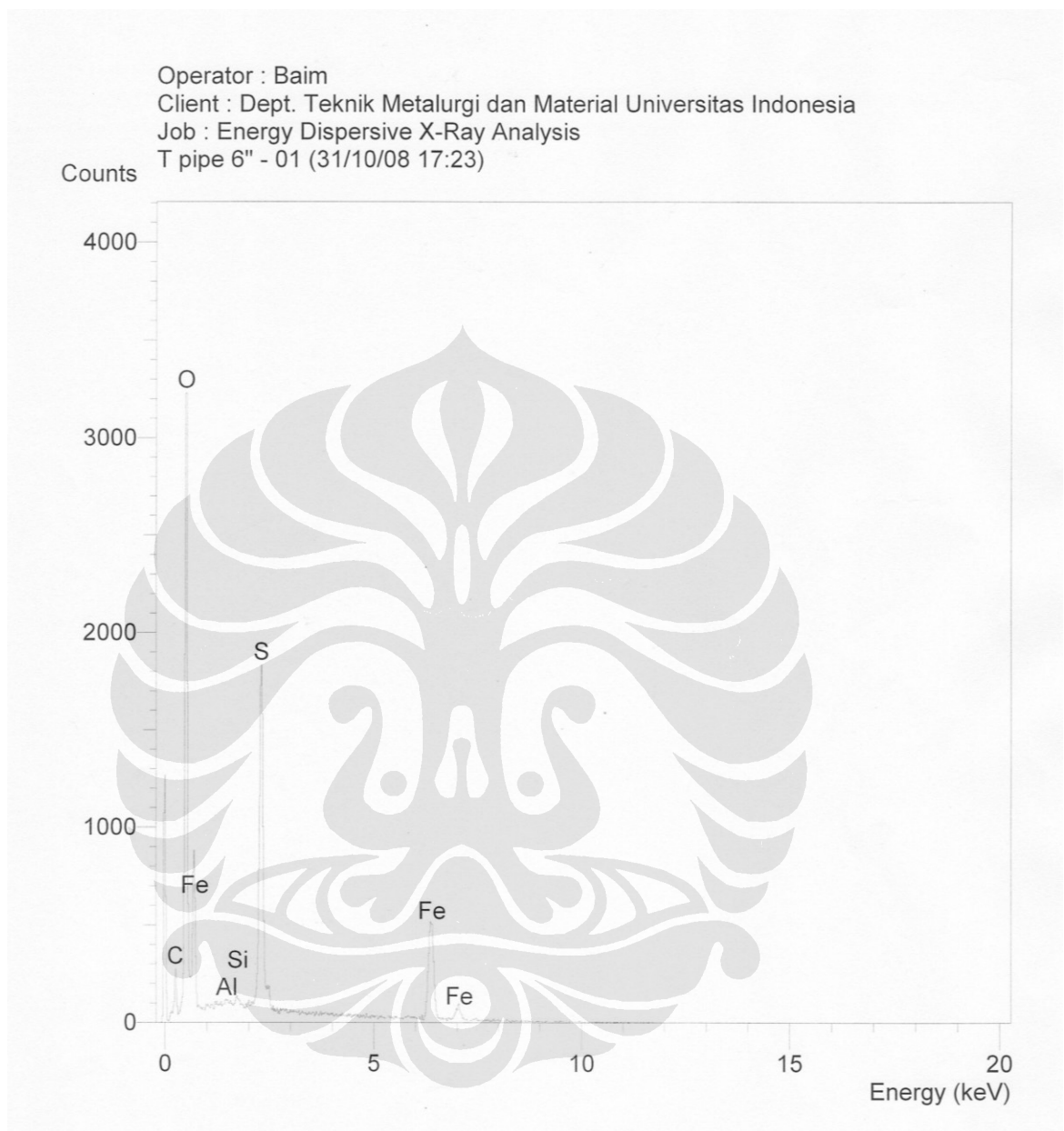
Standards :

C K Carbon Low 13/09/06  
 O K AL2O3 22/03/06  
 Al K CeAl2 03/03/07  
 Si K Low Carbon Steel 13/09/06  
 S K FeS2 22/03/06  
 Mn K Mangan 02 13/09/06  
 Fe K FeS2 22/03/06

Elmt	Spect.	Element	Atomic
	Type	%	%
C K	ED	0.54	1.48
O K	ED	25.85	53.32
Al K	ED	0.25	0.31
Si K	ED	0.37	0.43
S K	ED	3.00	3.08
Mn K	ED	1.42	0.86
Fe K	ED	68.56	40.51
Total		100.00	100.00

\* = <2 Sigma

## Lampiran 5. Hasil Pengujian EDX Arah Jam Enam Kedua



## Lampiran 5. Hasil Pengujian EDX Arah Jam Enam Kedua (lanjutan)

SEMQuant results. Listed at 17:25:33 on 31/10/08  
 Operator: Baim  
 Client: Dept. Teknik Metalurgi dan Material Universitas  
 Job: Energy Dispersive X-Ray Analysis  
 Spectrum label: T pipe 6" - 01

System resolution = 61 eV

Quantitative method: ZAF ( 3 iterations).  
 Analysed all elements and normalised results.

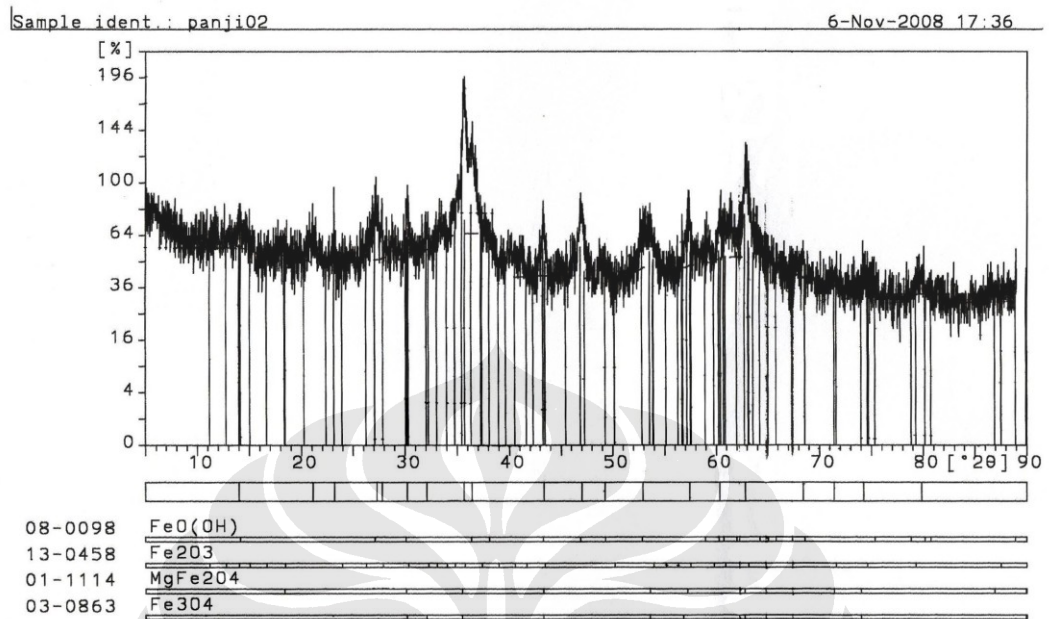
Standards :

C K Carbon Low 13/09/06  
 O K AL2O3 22/03/06  
 Al K CeAl2 03/03/07  
 Si K Low Carbon Steel 13/09/06  
 S K FeS2 22/03/06  
 Fe K FeS2 22/03/06

Elmt	Spect.	Element	Atomic
	Type	%	%
C K	ED	0.90	2.18
O K	ED	29.78	54.33
Al K	ED	0.20	0.22
Si K	ED	0.21	0.22
S K	ED	18.17	16.54
Fe K	ED	50.74	26.52
Total		100.00	100.00

\* = <2 Sigma

## Lampiran 6. Hasil Pengujian XRD Arah Jam Enam





## Lampiran 6. Hasil Pengujian XRD Arah Jam Enam (Lanjutan)

: PANJI02.DI 5-Nov-2008 14:43  
 =====  
 Philips Analytical X-Ray B.V. Department of Metallurgy UI

Sample identification: panji02  
 Data measured at: 5-Nov-2008 13:33:00

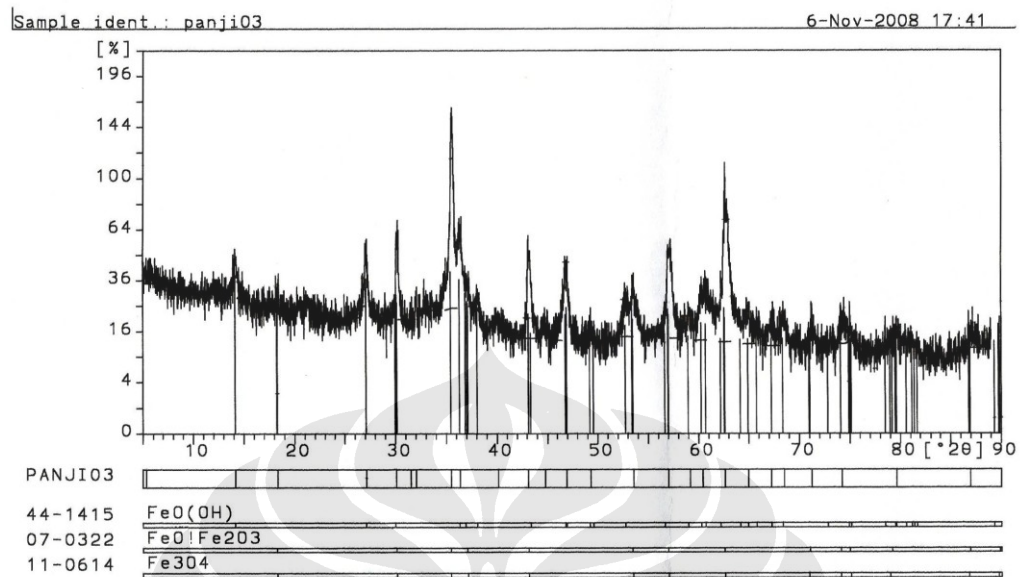
Diffraction type: PW1710 BASED  
 Tube anode: Cu  
 Generator tension [kV]: 40  
 Generator current [mA]: 30  
 Wavelength Alpha1 [Å]: 1.54056  
 Wavelength Alpha2 [Å]: 1.54439  
 Intensity ratio (alpha2/alpha1): 0.500  
 Divergence slit: AUTOMATIC  
 Irradiated length [mm]: 12  
 Receiving slit: 0.2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

Start angle [°2θ]: 5.000  
 End angle [°2θ]: 89.000  
 Step size [°2θ]: 0.020  
 Maximum intensity: 98.0100  
 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: 20

Angle [°2θ]	d-value a1 [Å]	d-value a2 [Å]	Peak width [°2θ]	Peak int [counts]	Back. int [counts]	Rel. int [%]	Signif.
14.010	6.3161	6.3318	0.480	30	117	30.9	1.04
21.085	4.2100	4.2205	0.640	18	66	18.0	0.95
23.170	3.8357	3.8452	0.100	35	59	35.5	0.95
27.250	3.2699	3.2780	0.400	30	52	30.9	1.38
27.795	3.2070	3.2150	0.120	30	52	30.9	0.82
30.180	2.9588	2.9661	0.240	23	50	23.5	1.56
32.065	2.7890	2.7960	0.240	12	50	12.5	0.79
35.630	2.5177	2.5240	0.200	98	53	100.0	1.37
36.420	2.4649	2.4710	0.320	53	52	54.4	0.79
43.325	2.0867	2.0919	0.280	17	28	17.2	1.57
47.000	1.9317	1.9365	0.400	23	25	23.5	1.83
49.225	1.8495	1.8541	0.640	4	23	4.5	1.05
52.885	1.7298	1.7341	0.640	12	25	12.5	0.91
57.405	1.6039	1.6079	0.240	16	24	16.3	1.24
60.345	1.5326	1.5364	0.320	12	25	11.8	0.77
62.830	1.4778	1.4815	0.240	29	25	29.8	1.39
68.440	1.3697	1.3731	0.160	5	18	5.4	0.87
71.390	1.3202	1.3235	0.800	2	15	2.3	0.78
74.230	1.2765	1.2797	0.400	3	14	2.9	0.94
79.835	1.2004	1.2034	0.800	4	13	3.7	1.13

## Lampiran 7. Hasil Pengujian XDR Arah Jam Sembilan



## Lampiran 7. Hasil Pengujian XRD Arah Jam Sembilan (Lanjutan)

: PANJI03.DI

6-Nov-2008 15:08

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Philips Analytical X-Ray B.V.

Department of Metallurgy UI

Sample identification: panji03

Data measured at: 6-Nov-2008 13:58:00

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 [ $^{\circ}2\theta$ ]: 5.000End angle [ $^{\circ}2\theta$ ]: 89.000Step size [ $^{\circ}2\theta$ ]: 0.020

Maximum intensity: 179.5600

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: 26

Angle [ $^{\circ}2\theta$ ]	d-value $\alpha_1$ [Å]	d-value $\alpha_2$ [Å]	Peak width [ $^{\circ}2\theta$ ]	Peak int [counts]	Back. int [counts]	Rel. int [%]	Signif.
5.350	16.5046	16.5456	0.800	42	335	23.5	1.12
14.155	6.2517	6.2672	0.320	66	102	36.5	1.17
18.310	4.8413	4.8533	0.240	14	69	8.0	0.83
27.100	3.2877	3.2958	0.120	66	40	36.5	0.80
30.095	2.9670	2.9743	0.060	69	35	38.4	0.85
31.530	2.8351	2.8422	0.240	2	34	0.9	0.93
32.040	2.7911	2.7981	0.160	10	34	5.7	0.75
35.485	2.5277	2.5340	0.100	180	36	100.0	1.53
36.365	2.4685	2.4746	0.320	55	35	30.5	1.64
40.150	2.2441	2.2497	0.960	4	20	2.5	0.88
43.100	2.0971	2.1023	0.160	42	17	23.5	1.00
44.790	2.0218	2.0268	0.480	6	17	3.2	1.13
46.900	1.9356	1.9404	0.400	31	14	17.5	3.01
49.325	1.8460	1.8506	0.480	6	13	3.2	1.49
53.550	1.7099	1.7141	0.240	19	14	10.8	1.39
57.005	1.6142	1.6182	0.120	35	13	19.4	0.76
59.160	1.5604	1.5643	0.480	7	13	3.8	0.76
60.425	1.5307	1.5345	0.960	15	12	8.5	3.21
62.625	1.4821	1.4858	0.060	85	11	47.1	0.80
64.935	1.4349	1.4385	0.480	8	10	4.7	1.31
67.215	1.3917	1.3951	0.320	6	10	3.2	1.75
68.510	1.3685	1.3719	0.480	7	10	4.1	3.10

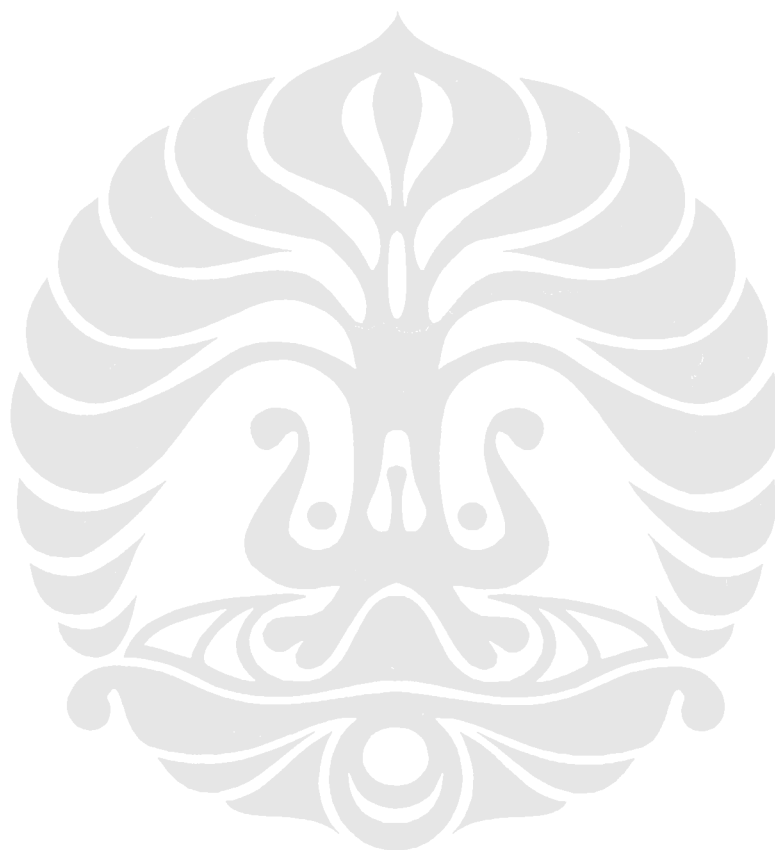
## Lampiran 7. Hasil Pengujian XRD Arah Jam Sembilan (Lanjutan)

File: PANJI03.DI 6-Nov-2008 15:08

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Philips Analytical X-Ray B.V. Department of Metallurgy UI

Angle [ $^{\circ}2\theta$ ]	d-value $\alpha_1$ [Å]	d-value $\alpha_2$ [Å]	Peak width [ $^{\circ}2\theta$ ]	Peak int [counts]	Back. int [counts]	Rel. int [%]	Signif.
71.245	1.3225	1.3258	0.640	3	9	1.8	1.25
74.205	1.2769	1.2801	0.480	5	9	2.9	0.75
79.660	1.2026	1.2056	0.640	3	8	1.8	0.94
86.965	1.1194	1.1222	0.800	4	7	2.0	1.39



## Lampiran 8. Kalkulator Online Bilangan Reynold

**Calculator**

This calculator computes the Reynolds Number given the flow characteristics asked for below. It outputs the flow type you can expect (**laminar**, **transitional**, or **turbulent**) based on the Reynolds Number result.

Think of the *Characteristic Distance* as the distance from the leading edge (where the fluid first makes contact) for flow over a plate, or as the pipe diameter for flow inside a pipe.

**Inputs**

Free-stream fluid velocity, $V$ :	236	mph	▾
Characteristic distance (or pipe diameter), $D$ :	16	cm	▾
Fluid density, $\rho$ :	1	kg/l	▾
Fluid viscosity (dynamic), $\mu$ :	0.00065	Pa-s	▾

**Answers**

Reynolds Number,  $R$ :  $2.58 \times 10^7$

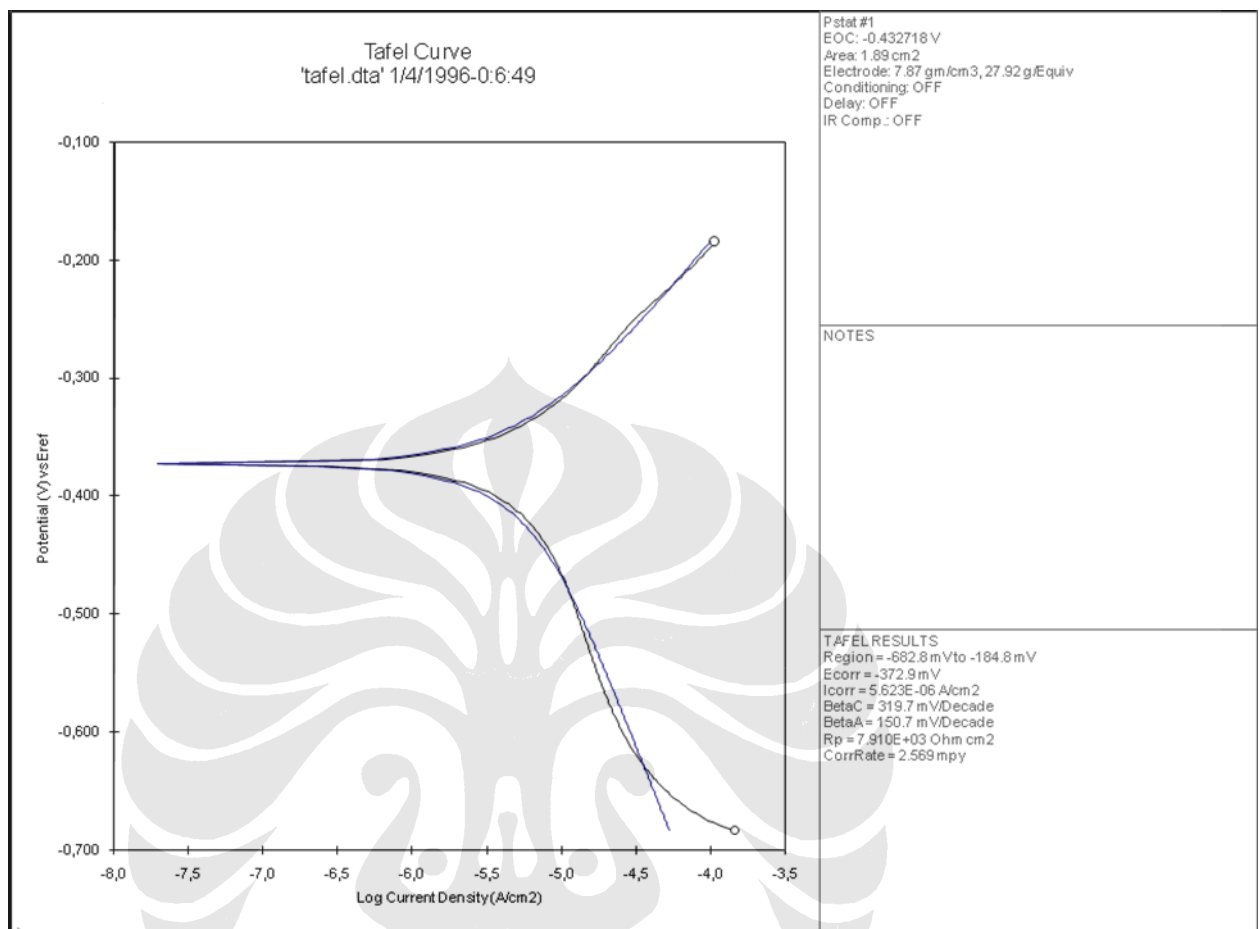
Calculate Again

Default Values

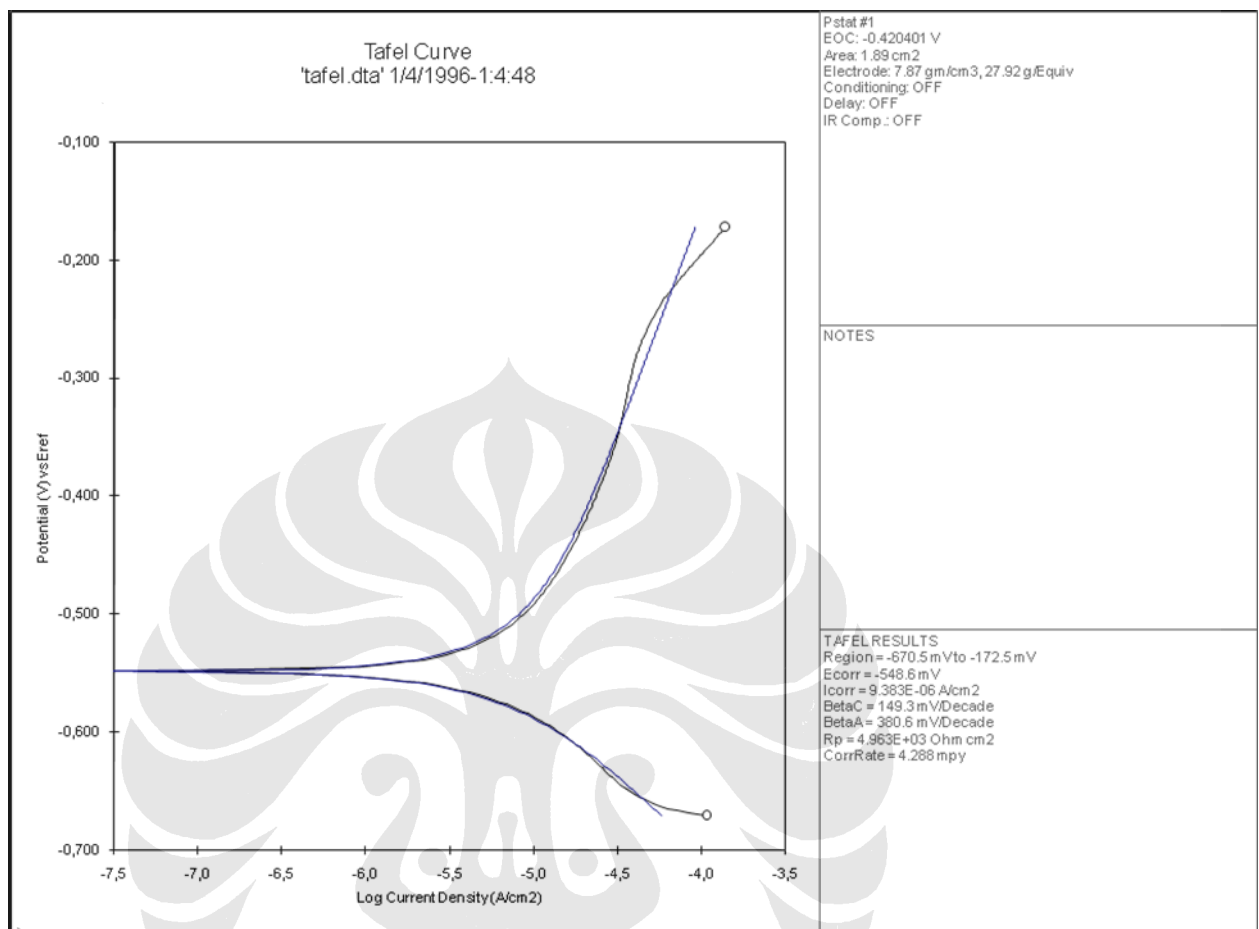
**Plate flow is fully turbulent at a distance  $D$  from the leading edge.**

**Pipe flow is fully turbulent in a pipe of diameter  $D$ .**

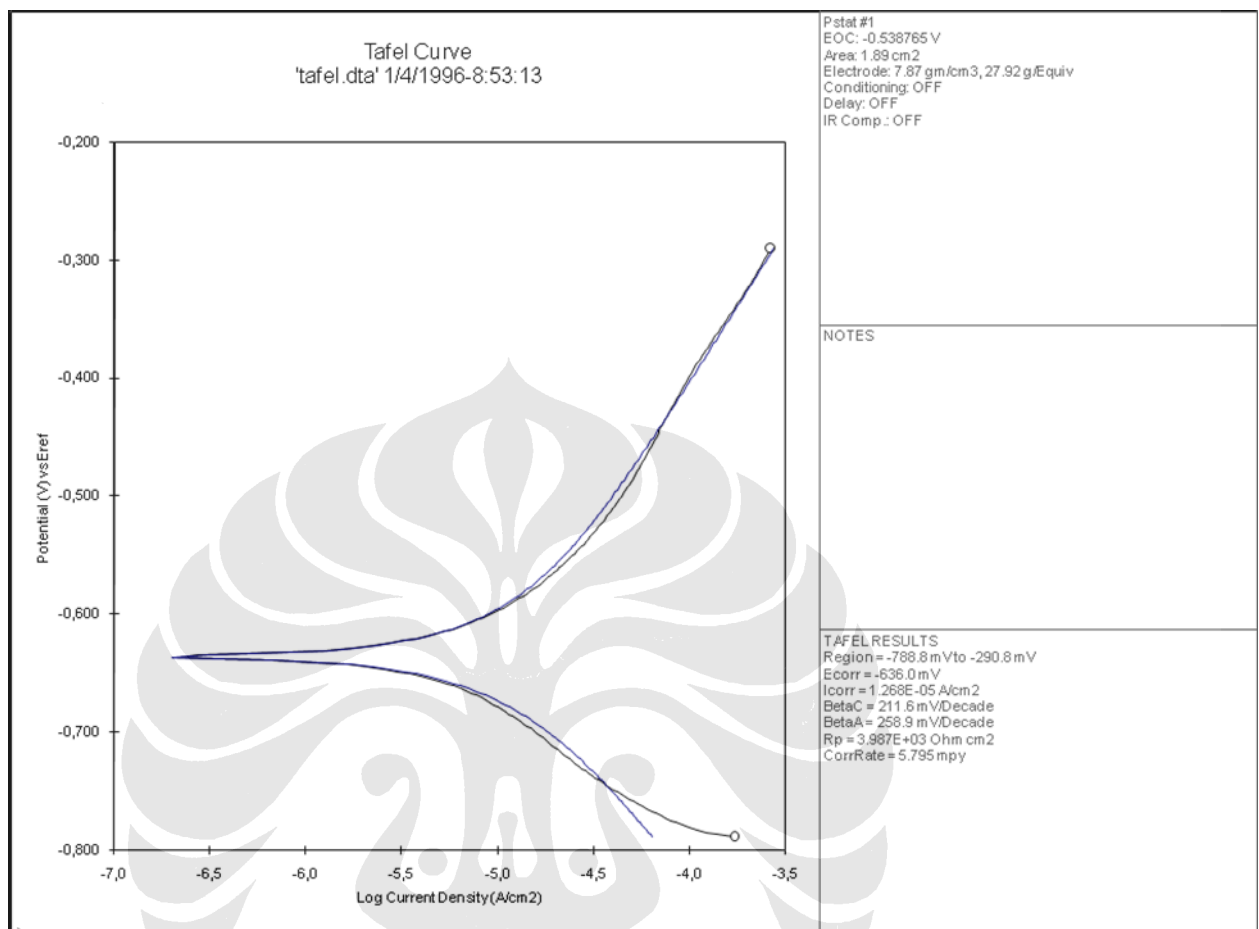
## Lampiran 9. Hasil Pengujian Polarisasi CT01



## Lampiran 10. Hasil Pengujian Polarisasi CT02



## Lampiran 11. Hasil Pengujian Polarisasi CT03





## Lampiran 12. Hasil Pengujian Polarisasi DS

