HASIL UJI KEKERASAN MICROVICKERS
M.A. BUQI RIZKY DWI PUTRA (NIM 1811015)
INSTITUT TEKNOLOGI NASIONAL MALANG

No	Kode Spesimen	Kekerasan (HV)	Keterangan
1	A	199.6	
2		229.9	TENGAH
3		176.7	
4	B	194.3	
5		233.2	TENGAH
6		176.2	
7	C	261.1	
8		178.4	TENGAH
9		255.7	
10	D	273.3	
11		187.3	TENGAH
12		261.3	

force : 300 gram
dwell : 10 detik

Malang, 17 November 2022
Kepala Lab. Teknik Mesin U

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN UNIVERSITAS NEGERI MALANG LABORATORIUM TEKNIK MESIN

Drs. IMAM SUDJONO, MT
NIP 19600327 198601 1002

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS NEGERI MALANG (UM)
FAKULTAS TEKNIK
Jl Semarang 5 Malang 65145
Telepon: 0341-565307
Laman: www.um.ac.id

SURAT KETERANGAN

Yang bertanda tangan di bawah ini :

Nama	: Drs. Imam Sudjono, MT
NIP	: 196003271986011002
Jabatan	: Kepala Laboratorium Teknik Mesin FT UM

Menerangkan bahwa :

Nama	: M A Buqi Rizky Dwi Putra
NIM	: 1811 015
Asal	: Mahasiswa Prodi Teknik Mesin Institut Teknologi Nasional Malang

Telah melaksanakan penelitian (heat treatment, pengujian kekerasan dan pengujian tarik) di Laboratorium Teknik Mesin Fakultas Teknik Universitas Negeri Malang untuk keperluan penyusunan skripsi.

Demikian Surat Keterangan ini dibuat dengan sebenarnya.

Malang, 18 November 2022
Kepala Lab. Teknik Mesin

DRS. IMAM SUDJONO, M.T.
NIP. 196003271986011002

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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SURAT KETERANGAN

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Nama	: Drs. Imam Sudjono, MT
NIP	: 196003271986011002
Jabatan	: Kepala Laboratorium Teknik Mesin FT UM

Menerangkan bahwa :

Nama	: M A Buqi Rizky Dwi Putra
NIM	: 1811 015
Asal	: Mahasiswa Prodi Teknik Mesin Institut Teknologi Nasional Malang

Telah melaksanakan penelitian (pengujian SEM) di Laboratorium Teknik Mesin Fakultas Teknik Universitas Negeri Malang untuk keperluan penyusunan skripsi.

Demikian Surat Keterangan ini dibuat dengan sebenarnya.

Malang, 29 November 2022
Kepala Lab. Teknik Mesin

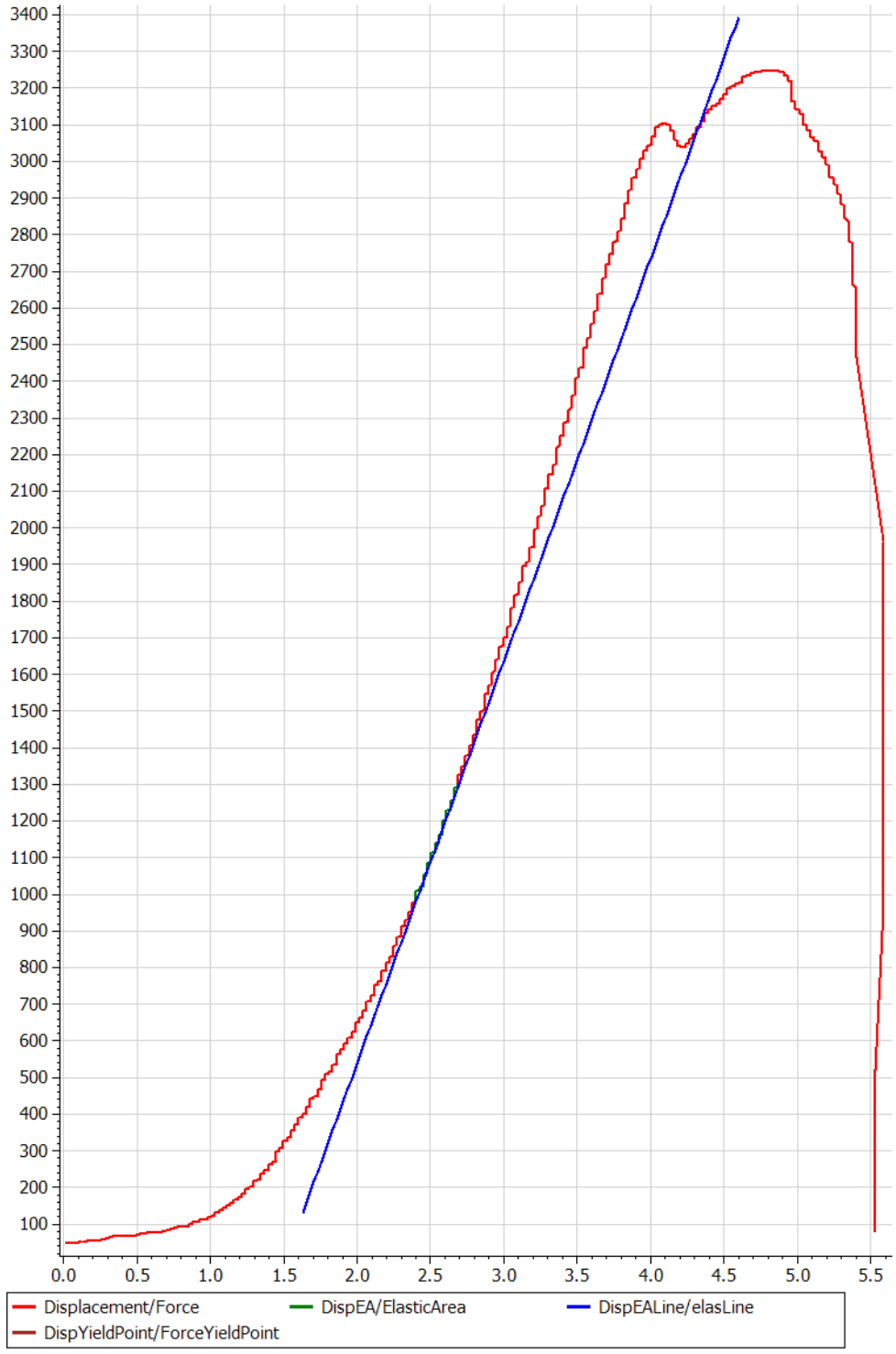
DRS. IMAM SUDJONO, M.T.
NIP. 196003271986011002

LABORATORIUM TEKNIK MESIN

Test Report

Force

Displacement



Open Testing

Analysis

Save

Export

Force Ultimate	Elongation @Ultimate
3247.9 kgf	4.83 mm

Yield Force	Disp@Yield
3198.3 kgf	4.55 mm

LABORATORIUM
TEKNIK MESIN

Test Report

Stress

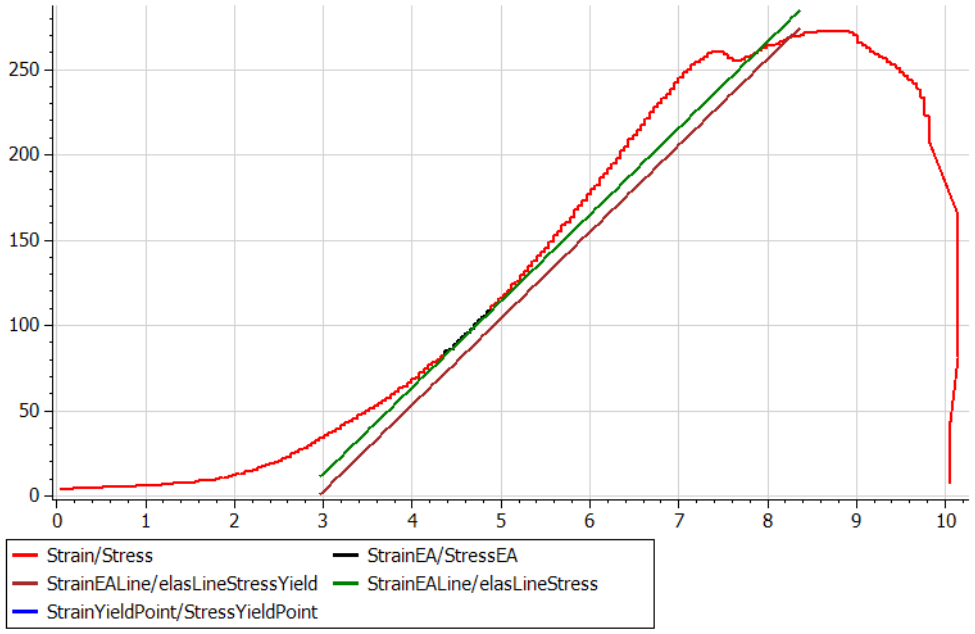
Strain

Open Testing

Analysis

Save

Export



Stress Ultimate	Strain @Ultimate	Yield Stress	Strain@Yield
272.6 MPa	8.79 %	268.4 MPa	8.27 %

LABORATORIUM
TEKNIK MESIN

Test Report

Nomor Pengujian	Jenis Pengujian	Kode Benda Uji

Name Shape	Name	Type
Round		

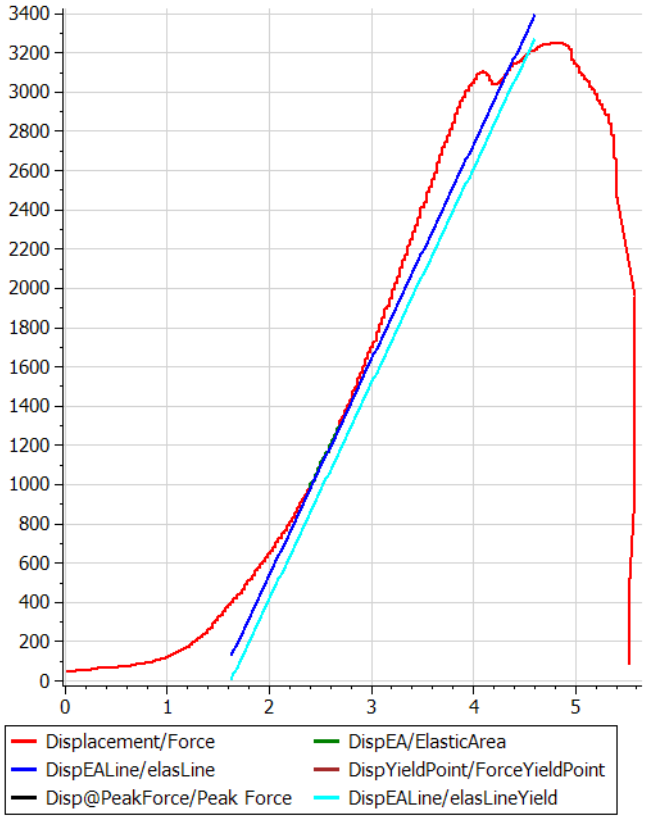
Standard	Remark	Area

Init Length	Yield Point	Modulus Elasticity
55.00 mm	0.20 %	1097.9 MPa

Force Ultimate	Elongation @Ultimate	Stress Ultimate
3247.9 kgf	4.83 mm	272.6 MPa

Strain @Ultimate	Yield Force	Disp@Yield
8.79 %	3198.3 kgf	4.55 mm

Yield Stress	Strain@Yield
268.4 MPa	8.27 %



LABORATORIUM TEKNIK MESIN

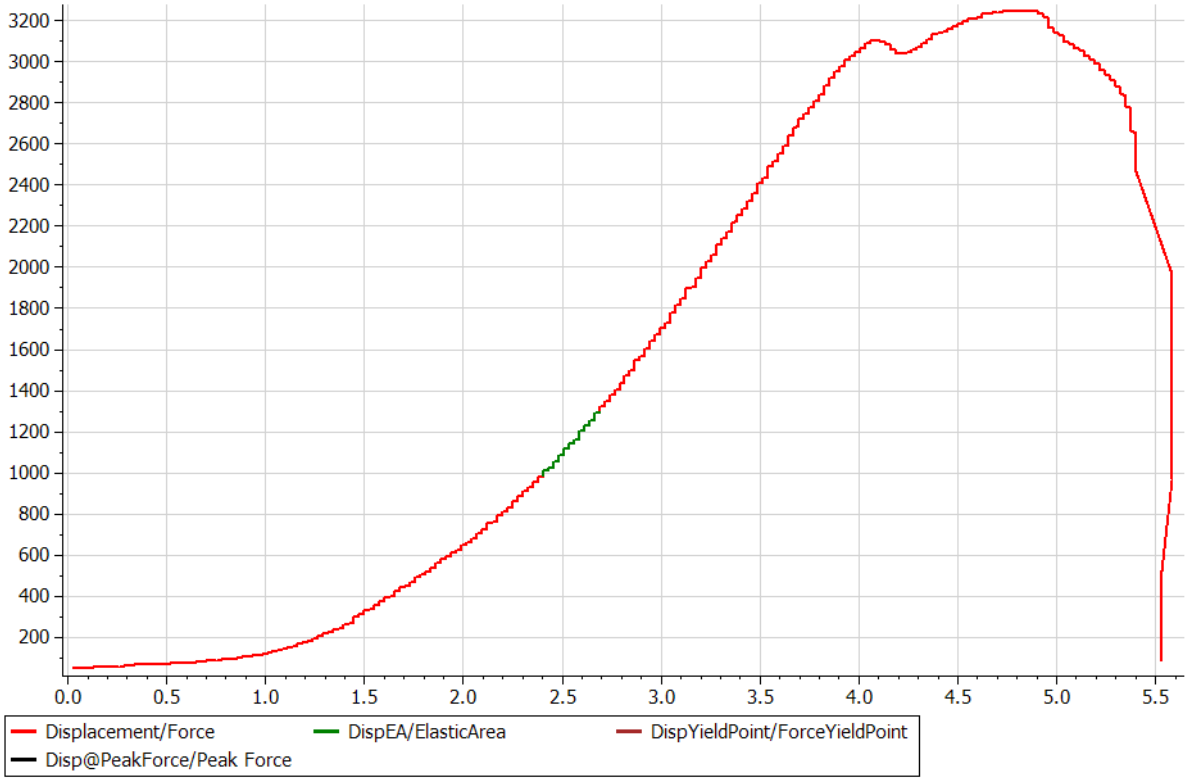
Test Report

Thursday, 17-Nov-2022 3:06:09 PM

Tensile With Yield

No. Pengujian	:	T-34
Kode Benda Uji	:	BUQI3
Nama	:	M A BUQI RIZKY DWI PUTRA
Type	:	AISI1045
Standard	:	ASTM
Remark	:	A

Shape	Area (mm²)	initial length (mm)	Yield Point (%)
Round	116.84	55.00	0.20



Ultimate			
Force Ultimate (kgf)	Elongation @Ultimate (mm)	Stress Ultimate (MPa)	Strain @Ultimate (%)
3247.9	4.83	272.6	8.79

Yield			
Yield Force (kgf)	Elongation @Yield (mm)	Yield Stress (MPa)	Strain @Yield (%)
3198.3	4.55	268.4	8.27

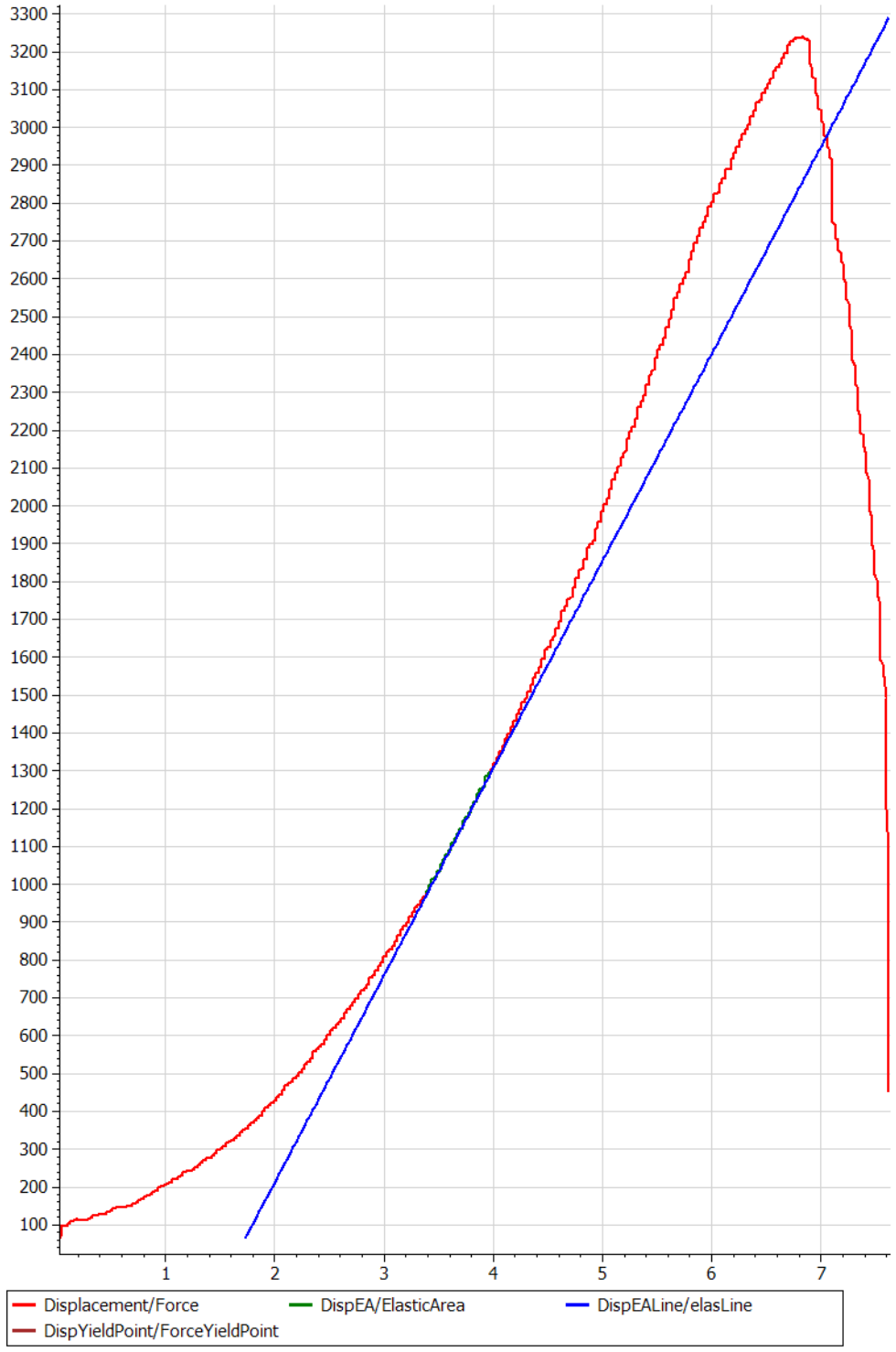
Modulus Elasticity (MPa)
1097.9

LABORATORIUM
TEKNIK MESIN

Test Report

Force

Displacement



Open Testing

Analysis

Save

Export

Force Ultimate	Elongation @Ultimate
3238.1 kgf	6.80 mm

Yield Force	Disp@Yield
2931.9 kgf	7.08 mm

Test Report

Stress

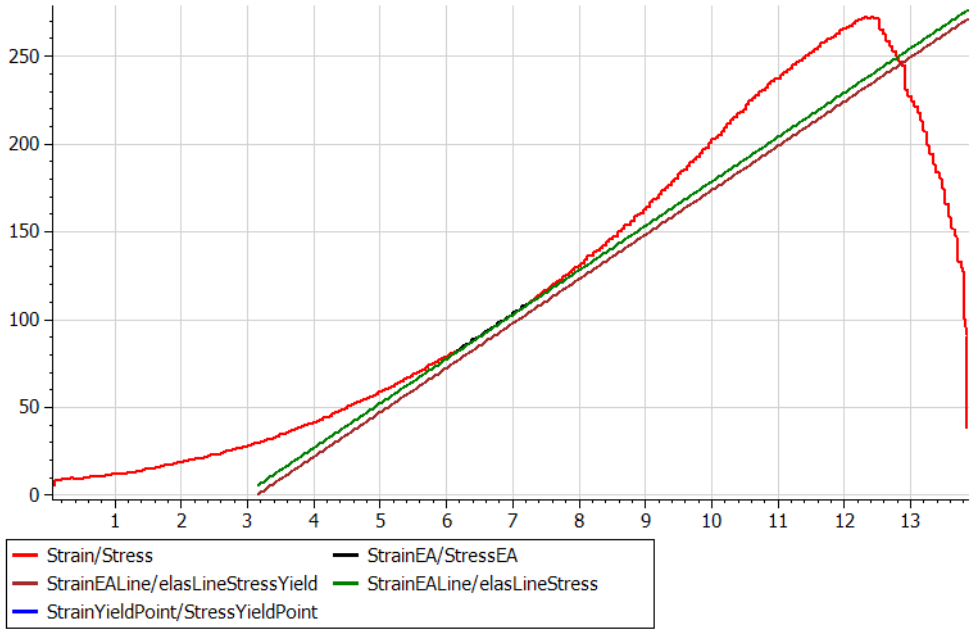
Strain

Open Testing

Analysis

Save

Export



Stress Ultimate	Strain @Ultimate	Yield Stress	Strain@Yield
271.8 MPa	12.36 %	246.1 MPa	12.88 %

LABORATORIUM
TEKNIK MESIN

Test Report

Nomor Pengujian	Jenis Pengujian	Kode Benda Uji

Name Shape	Name	Type
Round		

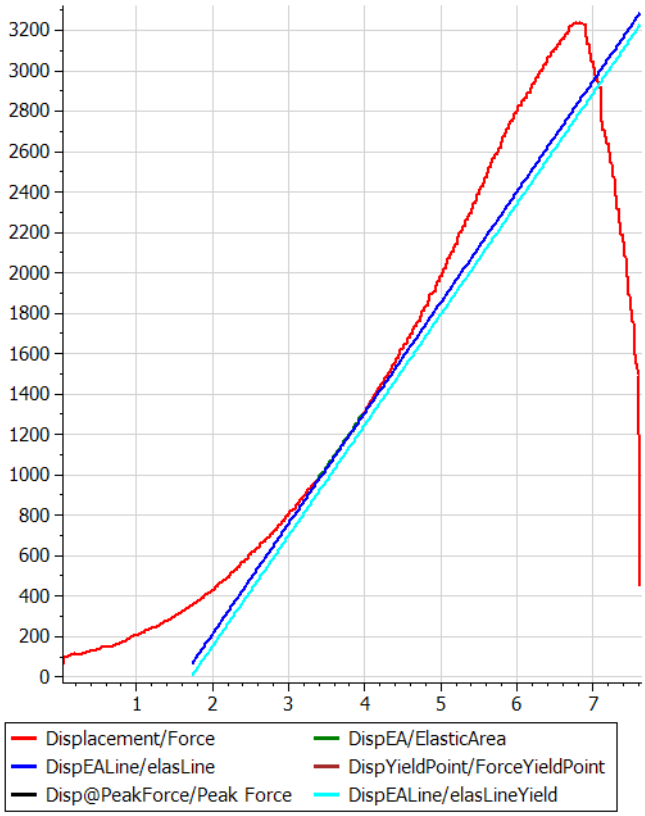
Standard	Remark	Area

Init Length	Yield Point	Modulus Elasticity
55.00 mm	0.20 %	547.4 MPa

Force Ultimate	Elongation @Ultimate	Stress Ultimate
3238.1 kgf	6.80 mm	271.8 MPa

Strain @Ultimate	Yield Force	Disp@Yield
12.36 %	2931.9 kgf	7.08 mm

Yield Stress	Strain@Yield
246.1 MPa	12.88 %



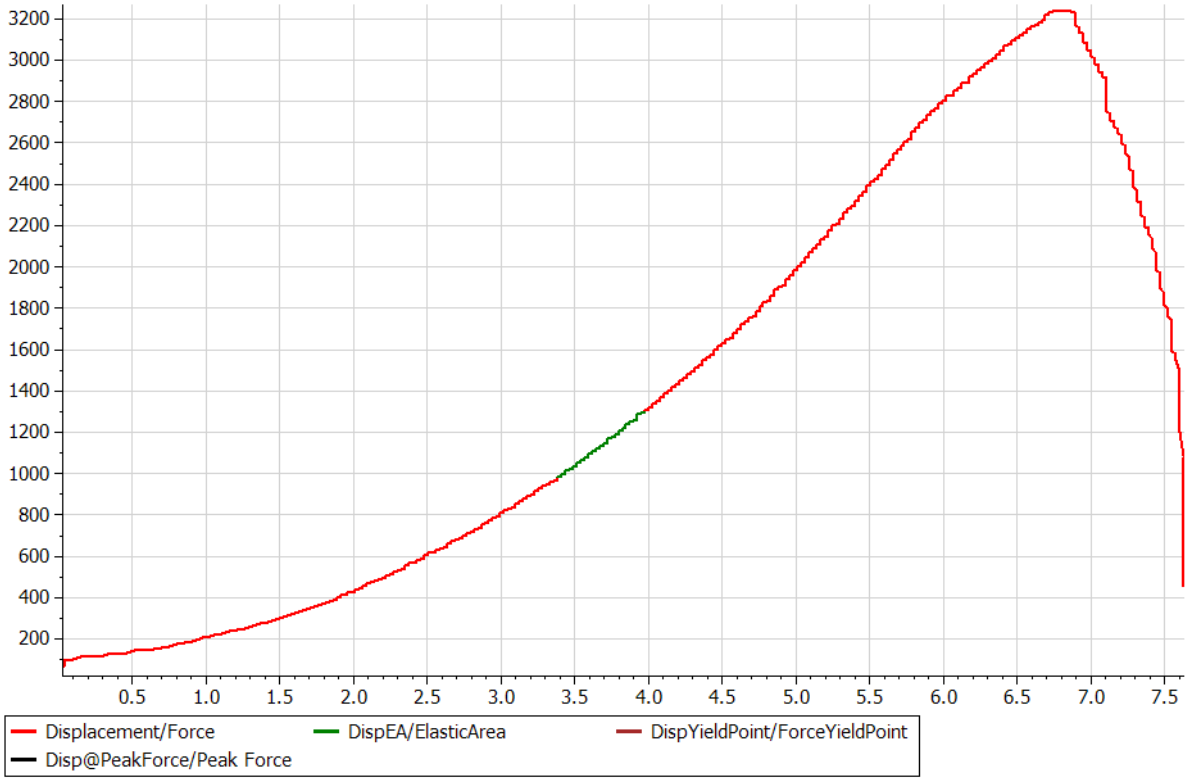
Test Report

Thursday, 17-Nov-2022 3:15:19 PM

Tensile With Yield

No. Pengujian	:	T-34
Kode Benda Uji	:	BUQI 4
Nama	:	M A BUQI RIZKY DWI PUTRA
Type	:	AISI1045
Standard	:	ASTM
Remark	:	B

Shape	Area (mm²)	initial length (mm)	Yield Point (%)
Round	116.84	55.00	0.20



Ultimate			
Force Ultimate (kgf)	Elongation @Ultimate (mm)	Stress Ultimate (MPa)	Strain @Ultimate (%)
3238.1	6.80	271.8	12.36

Yield			
Yield Force (kgf)	Elongation @Yield (mm)	Yield Stress (MPa)	Strain @Yield (%)
2931.9	7.08	246.1	12.88

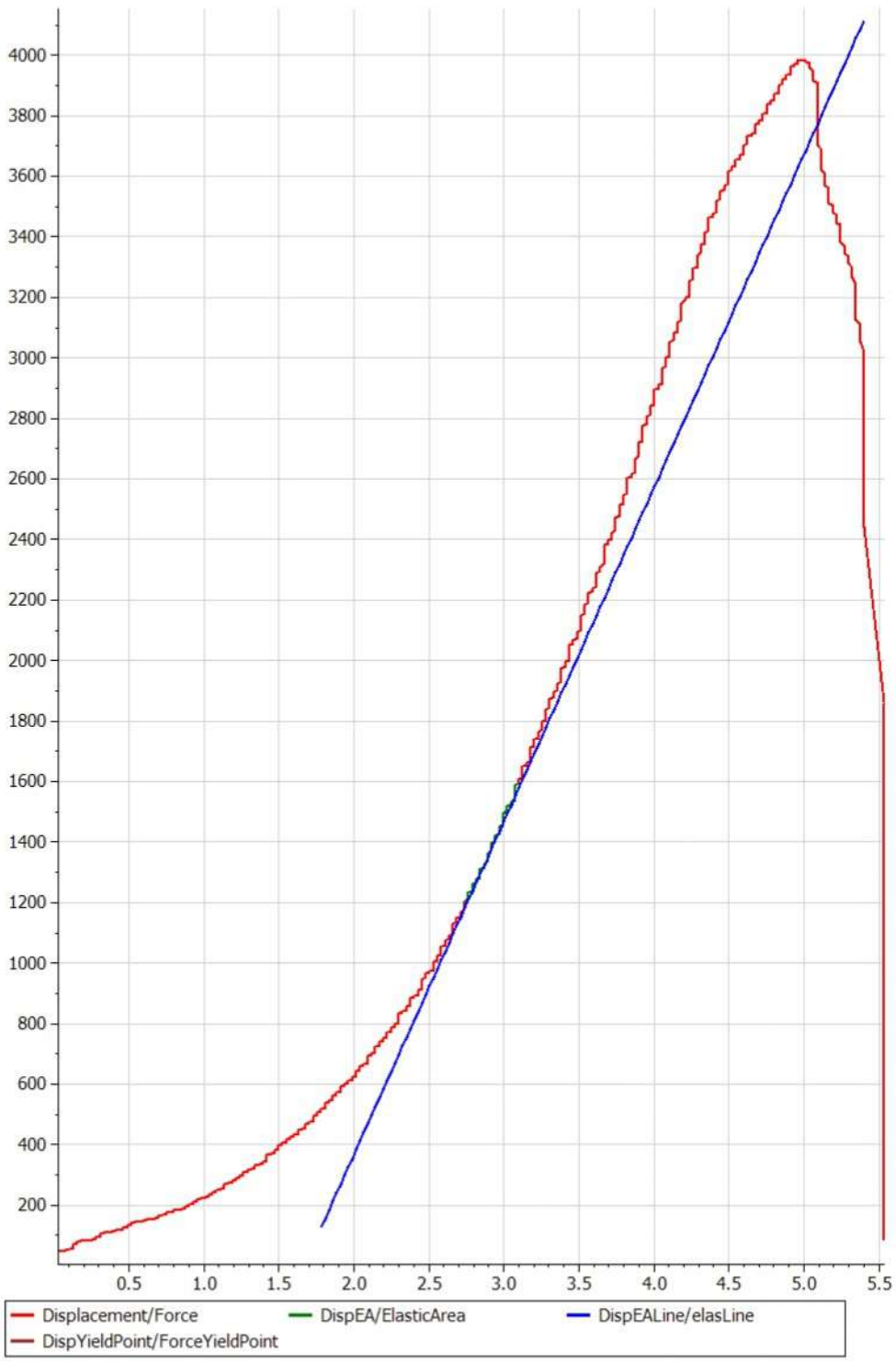
Modulus Elasticity (MPa)
547.4

LABORATORIUM TEKNIK MESIN

Test Report

Force

Displacement



Open Testing

Analysis

Save

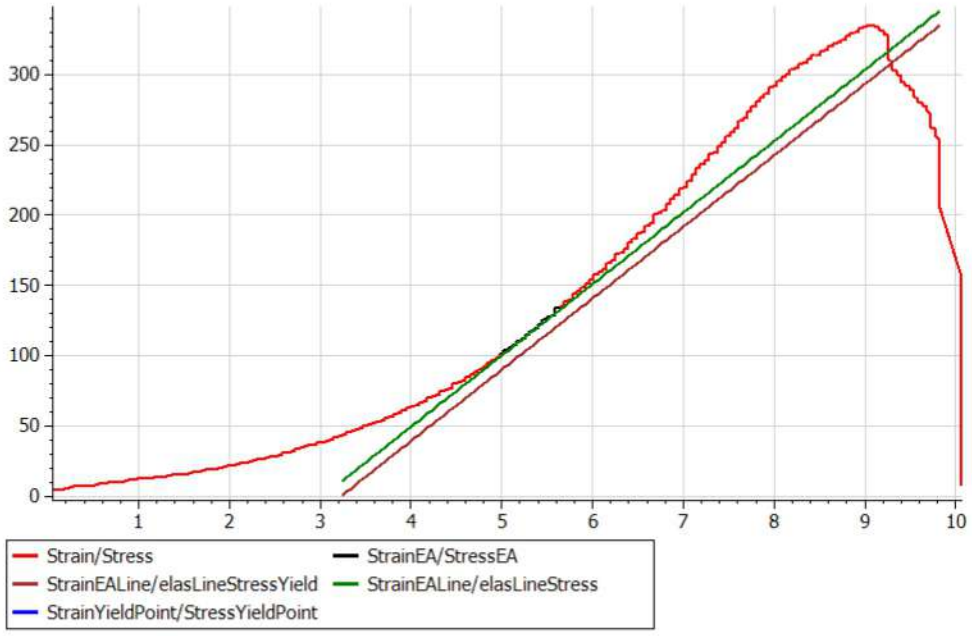
Export

Force Ultimate	Elongation @Ultimate
3983.8 kgf	4.69 mm
Yield Force	**Disp@Yield**
3666.9 kgf	5.12 mm

Test Report

Stress

Strain



Open Testing

Analysis

Save

Export

Stress Ultimate	Strain @Ultimate	Yield Stress	Strain@Yield
334.4 MPa	9.02 %	307.8 MPa	9.30 %

LABORATORIUM TEKNIK MESIN

Test Report

Nomor Pengujian	Jenis Pengujian	Kode Benda Uji

Name Shape	Name	Type
Round		

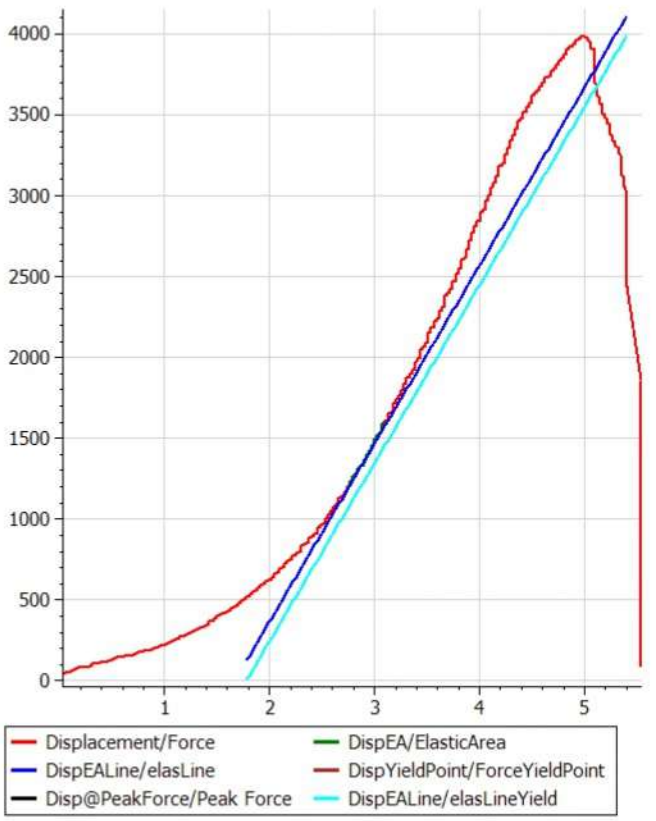
Standard	Remark	Area

Init Length	Yield Point	Modulus Elasticity
55.00 mm	0.20 %	1101.6 MPa

Force Ultimate	Elongation @Ultimate	Stress Ultimate
3983.8 kgf	4.69 mm	334.4 MPa

Strain @Ultimate	Yield Force	Disp@Yield
9.02 %	3666.9 kgf	5.12 mm

Yield Stress	Strain@Yield
307.8 MPa	9.30 %



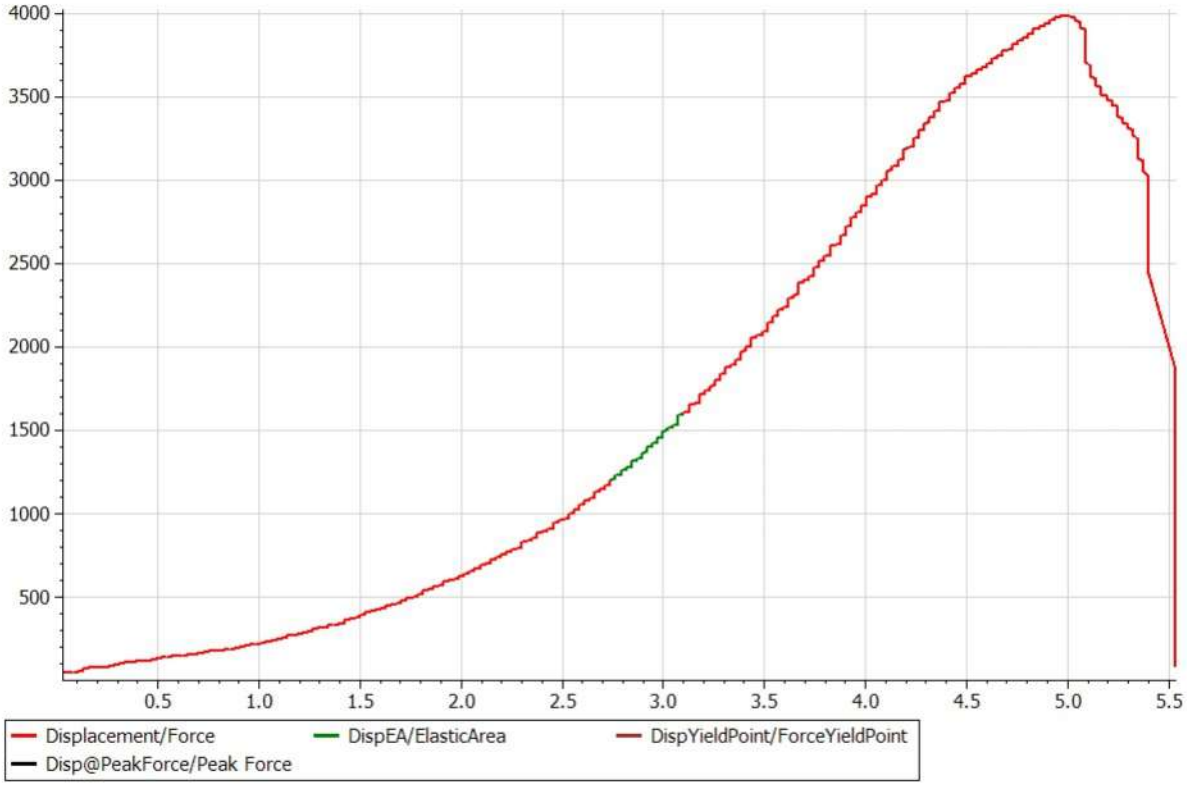
Test Report

Thursday, 17-Nov-2022 11:54:03 AM

Tensile With Yield

No. Pengujian	:	T-34
Kode Benda Uji	:	BUQI1
Nama	:	M A BUQI RIZKY DWI PUTRA
Type	:	AISI1045
Standard	:	ASTM
Remark	:	C

Shape	Area (mm²)	initial length (mm)	Yield Point (%)
Round	116.84	55.00	0.20



Ultimate			
Force Ultimate (kgf)	Elongation @Ultimate (mm)	Stress Ultimate (MPa)	Strain @Ultimate (%)
3983.8	4.69	334.4	9.02

Yield			
Yield Force (kgf)	Elongation @Yield (mm)	Yield Stress (MPa)	Strain @Yield (%)
3666.9	5.12	307.8	9.30

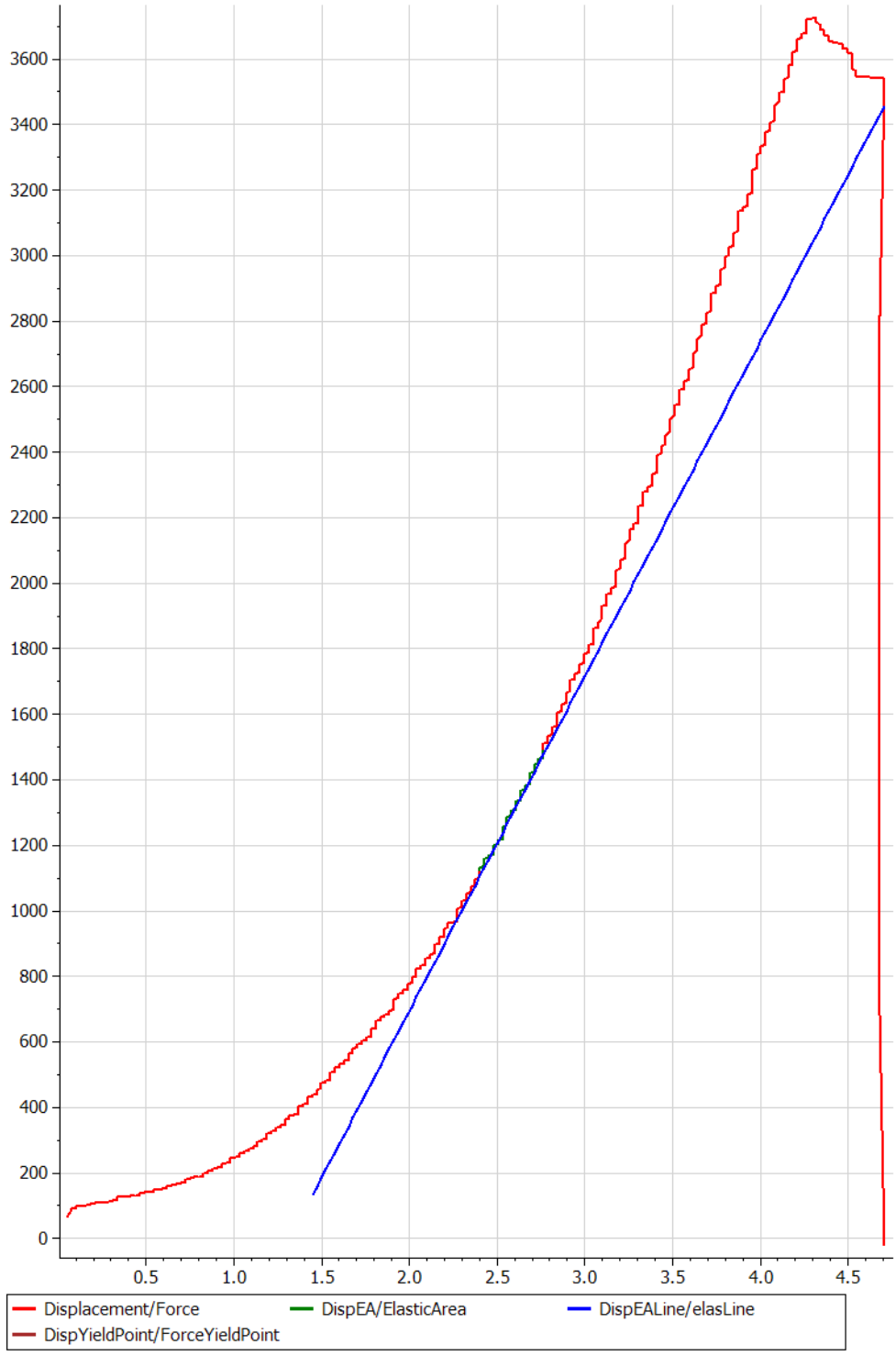
Modulus Elasticity (MPa)
1101.6

LABORATORIUM
TEKNIK MESIN

Test Report

Force

Displacement



Open Testing

Analysis

Save

Export

Force Ultimate	Elongation @Ultimate
3727.9 kgf	4.32 mm

Yield Force	Disp@Yield
2817.0 kgf	4.68 mm

LABORATORIUM
TEKNIK MESIN

Test Report

Stress

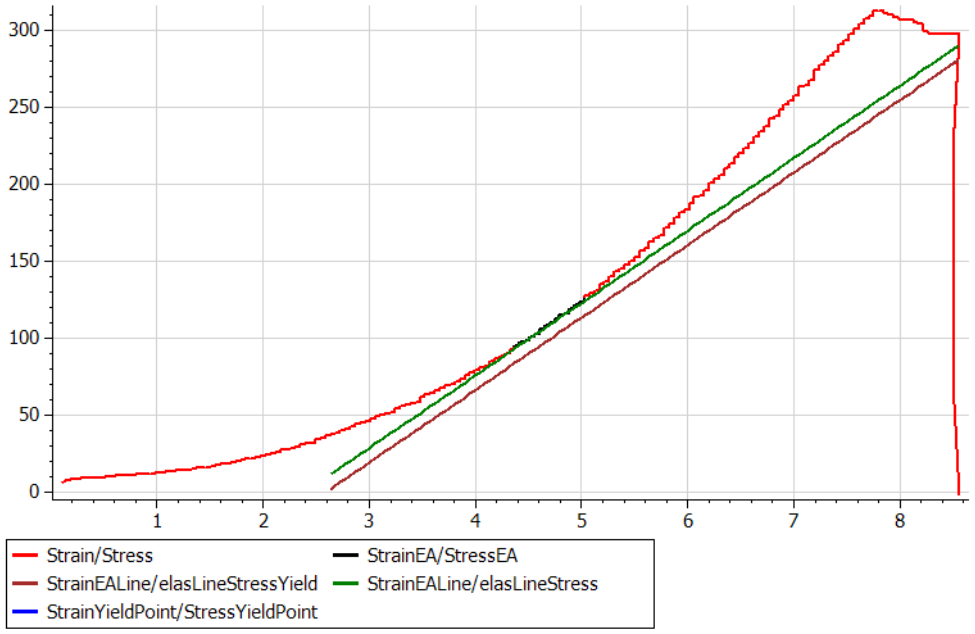
Strain

Open Testing

Analysis

Save

Export



Stress Ultimate	Strain @Ultimate	Yield Stress	Strain@Yield
312.9 MPa	7.85 %	236.4 MPa	8.51 %

LABORATORIUM
TEKNIK MESIN

Test Report

Nomor Pengujian	Jenis Pengujian	Kode Benda Uji

Name Shape	Name	Type
Round		

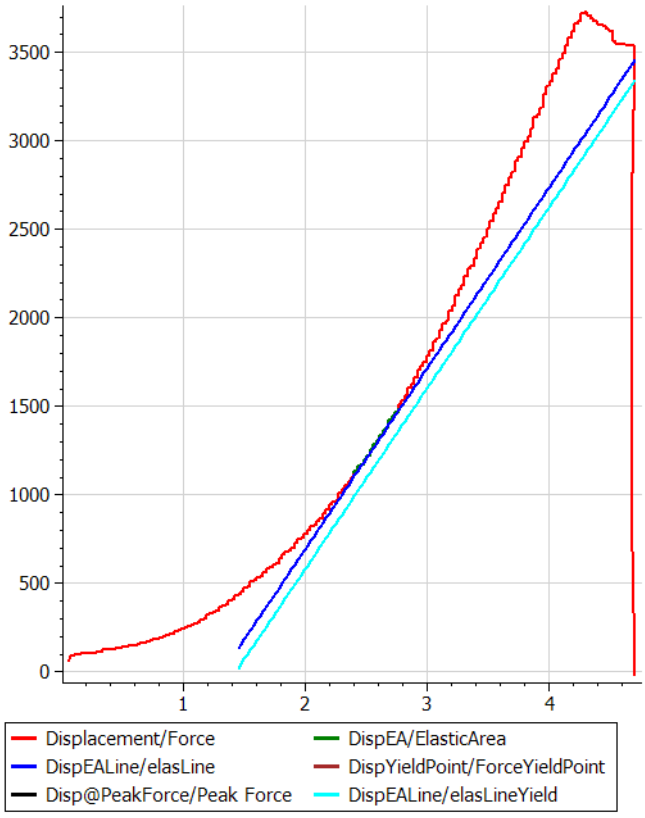
Standard	Remark	Area

Init Length	Yield Point	Modulus Elasticity
55.00 mm	0.20 %	1020.5 MPa

Force Ultimate	Elongation @Ultimate	Stress Ultimate
3727.9 kgf	4.32 mm	312.9 MPa

Strain @Ultimate	Yield Force	Disp@Yield
7.85 %	2817.0 kgf	4.68 mm

Yield Stress	Strain@Yield
236.4 MPa	8.51 %



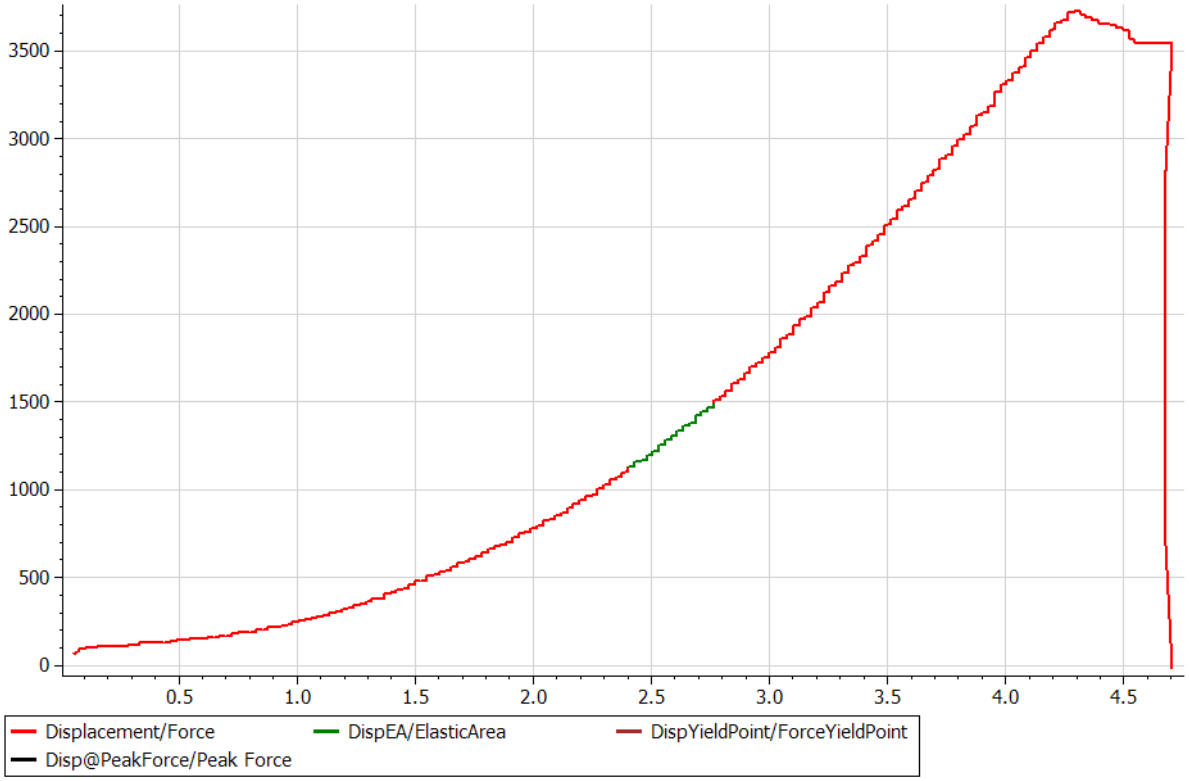
Test Report

Thursday, 17-Nov-2022 12:01:35 PM

Tensile With Yield

No. Pengujian	:	T-34
Kode Benda Uji	:	BUQI2
Nama	:	M A BUQI RIZKY DWI PUTRA
Type	:	AISI1045
Standard	:	ASTM
Remark	:	D

Shape	Area (mm²)	initial length (mm)	Yield Point (%)
Round	116.84	55.00	0.20



Ultimate			
Force Ultimate (kgf)	Elongation @Ultimate (mm)	Stress Ultimate (MPa)	Strain @Ultimate (%)
3727.9	4.32	312.9	7.85

Yield			
Yield Force (kgf)	Elongation @Yield (mm)	Yield Stress (MPa)	Strain @Yield (%)
2817.0	4.68	236.4	8.51

Modulus Elasticity (MPa)
1020.5

Application Note

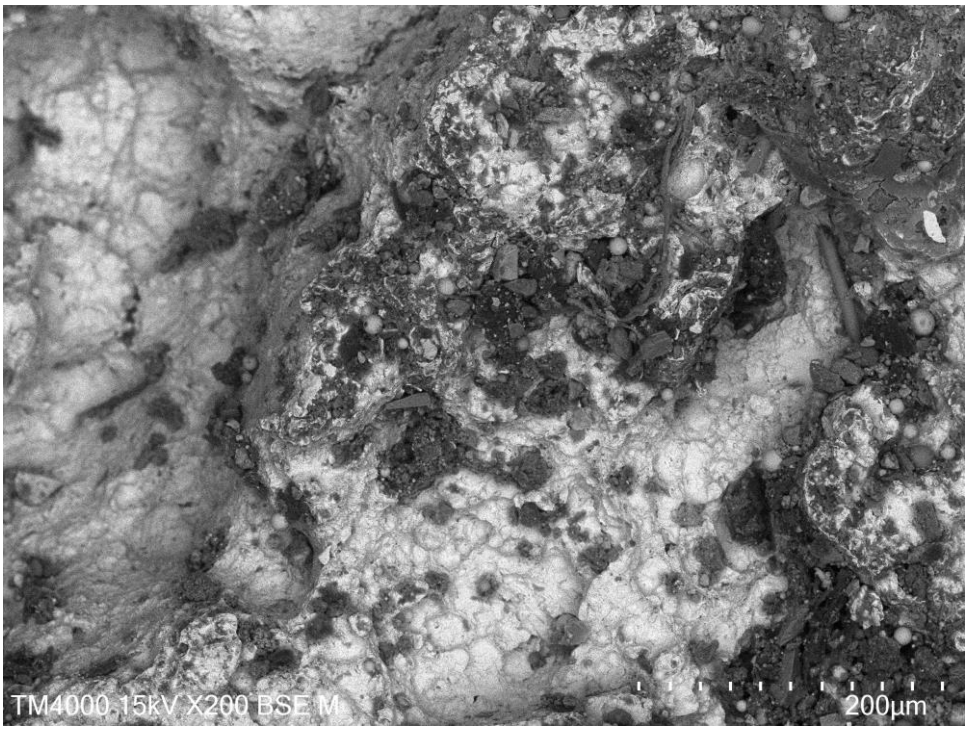
Company / Department

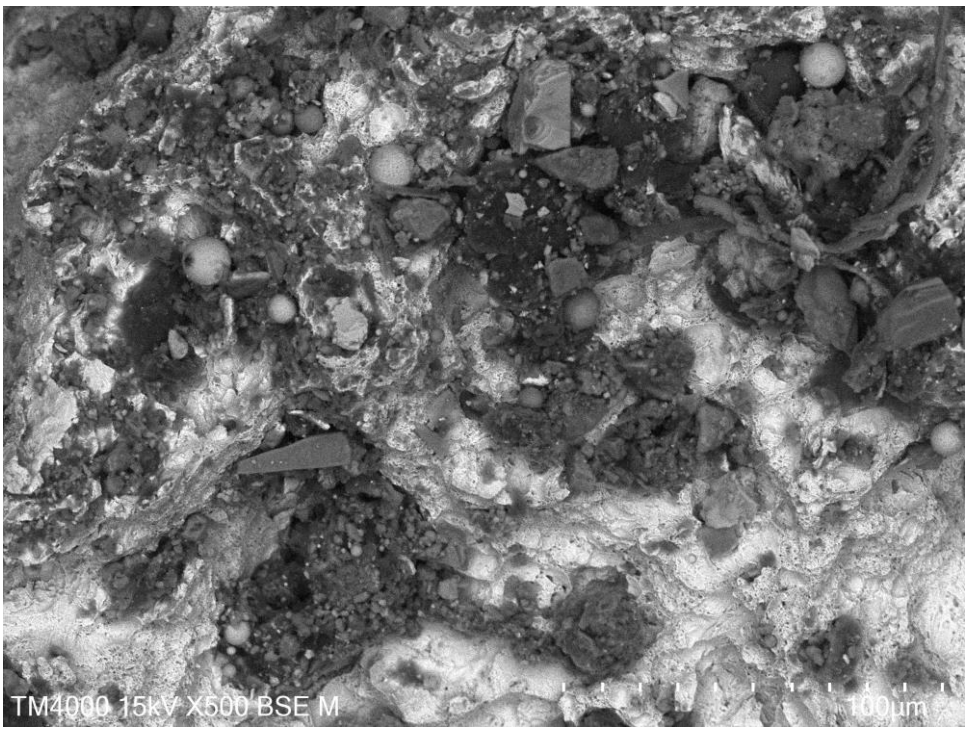
Nama : M A Buqi Rizky Dwi Putra (1811015)

Type : AISI1045

Sampel : Standart 379

Spesimen : Remark (A)





Application Note

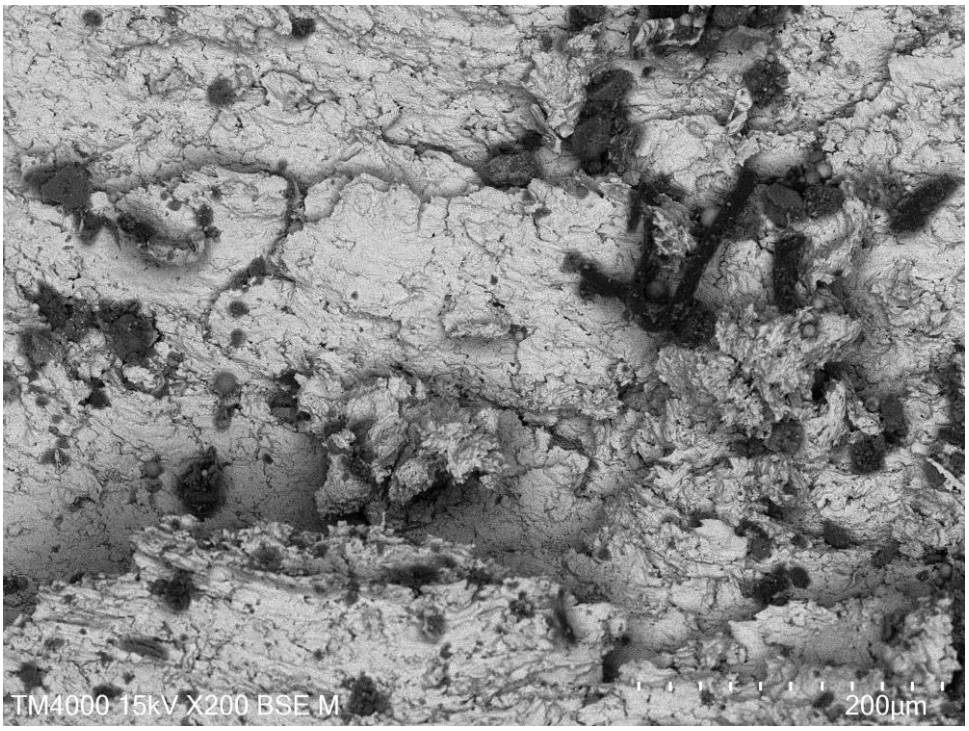
Company / Department

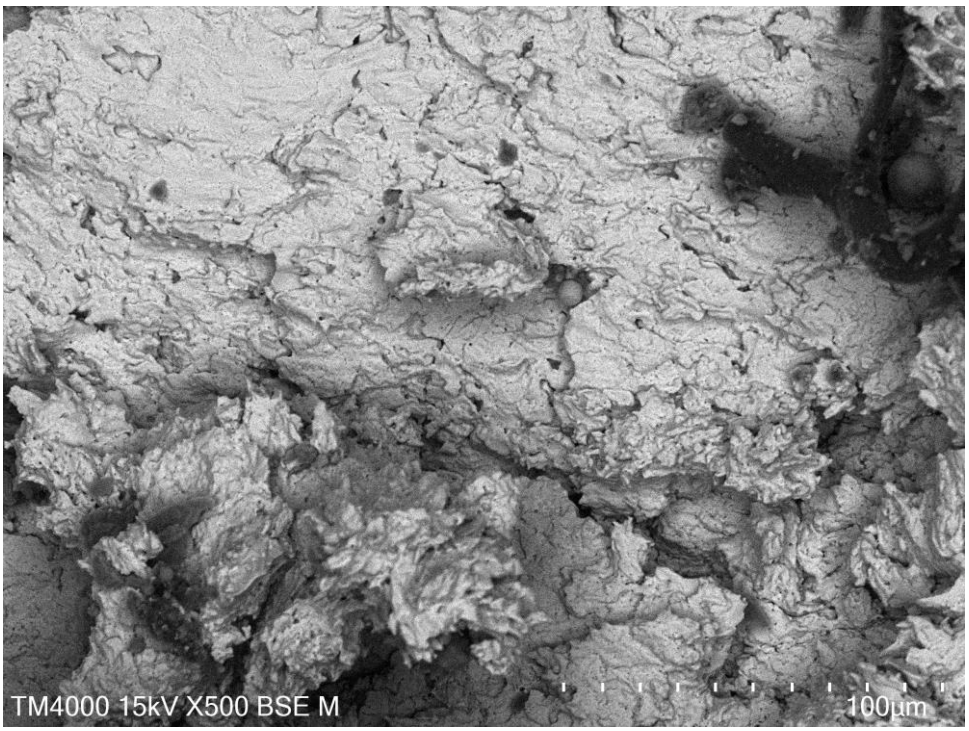
Nama : M A Buqi Rizky Dwi Putra (1811015)

Type : AISI1045

Sampel : Standart 379

Spesimen : Remark (B)





Application Note

Company / Department

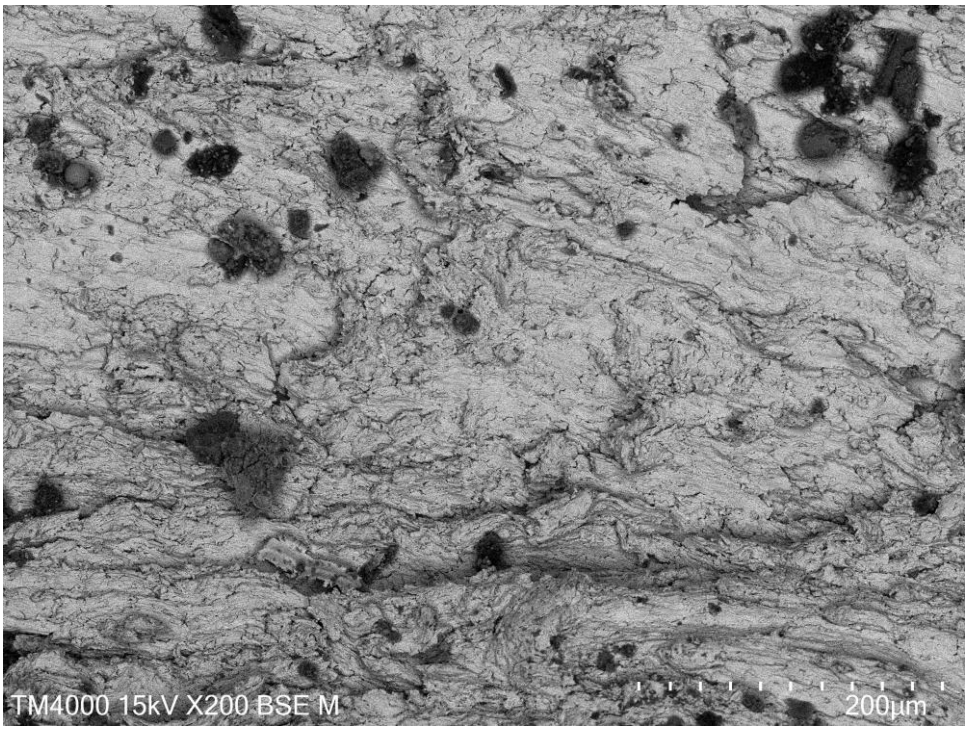
LABORATORIUM TEKNIK MESIN

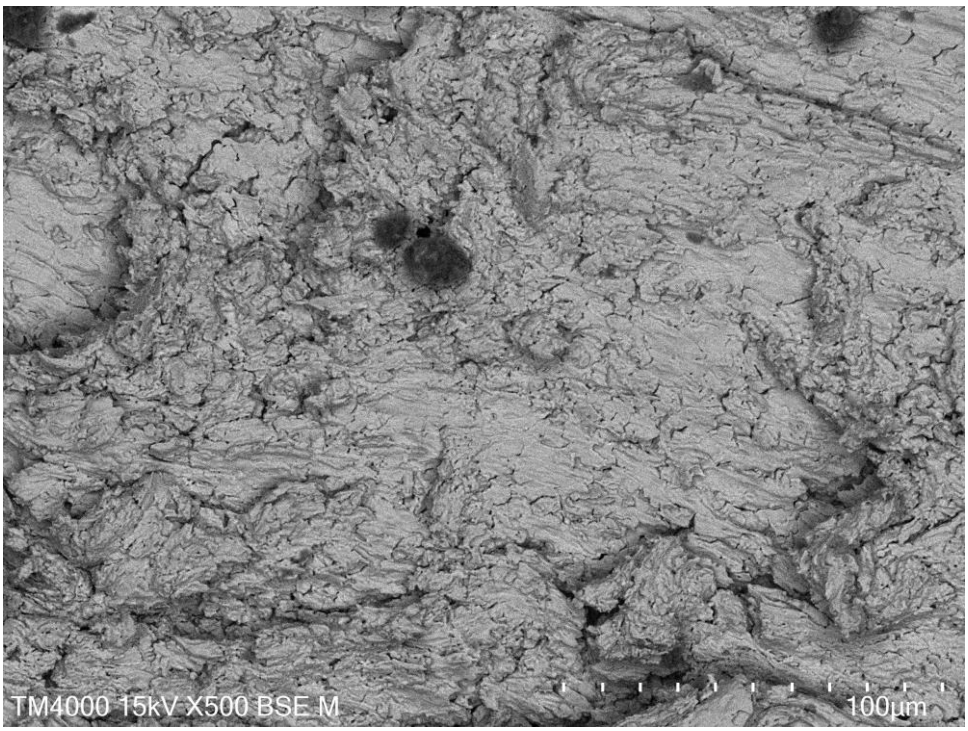
Nama : M A Buqi Rizky Dwi Putra (1811015)

Type : AISI1045

Sampel : Standart 379

Spesimen : Remark (C)





Application Note

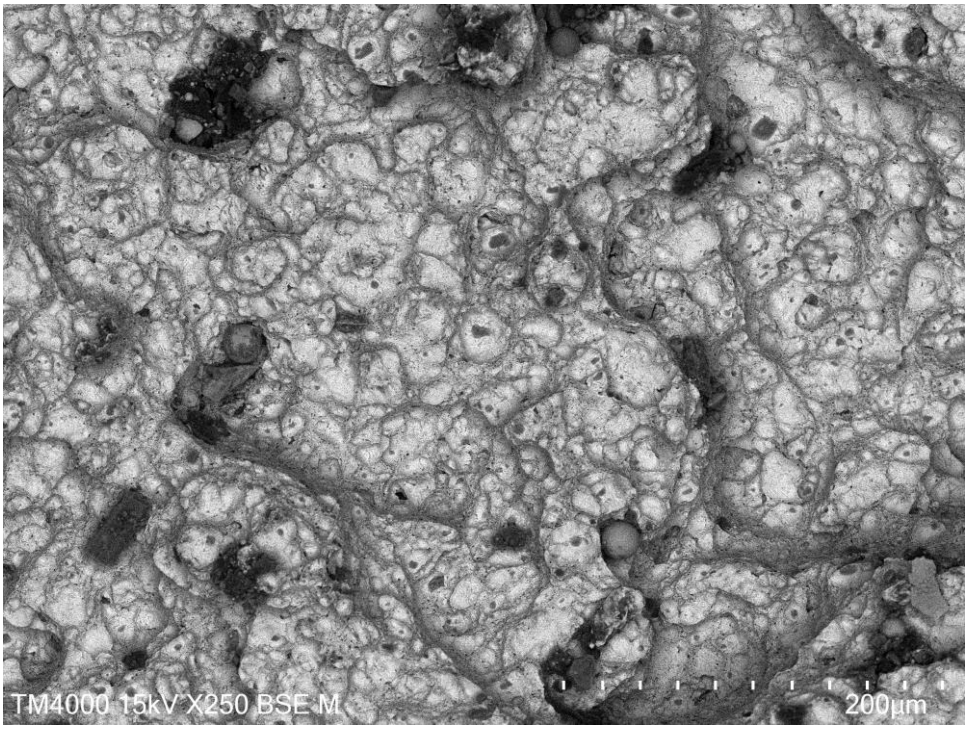
Company / Department

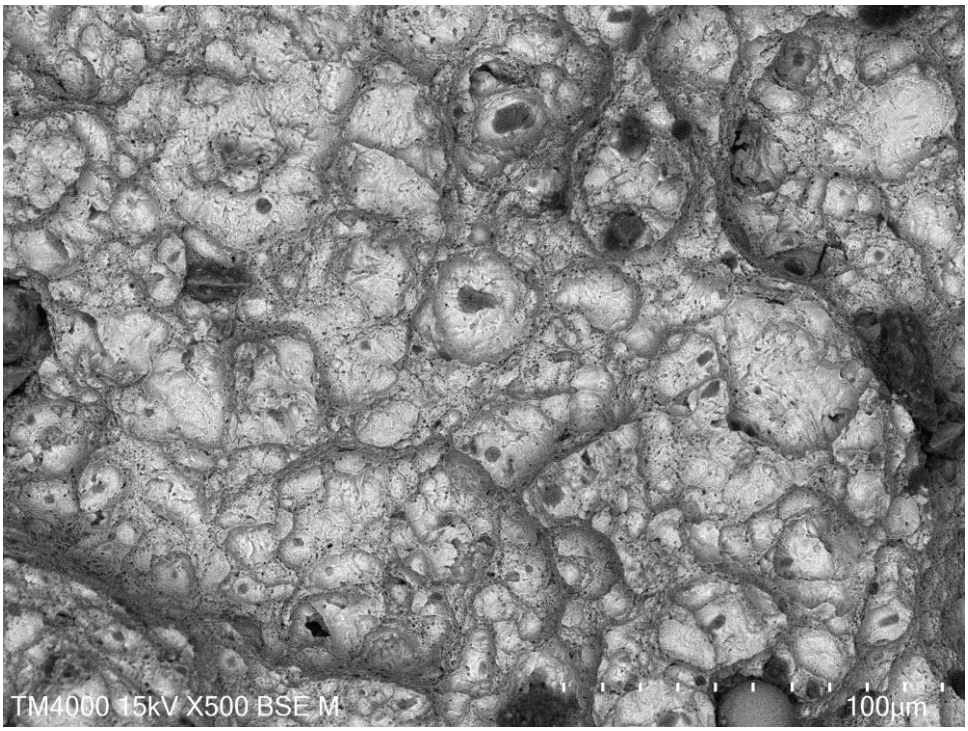
Nama : M A Buqi Rizky Dwi Putra (1811015)

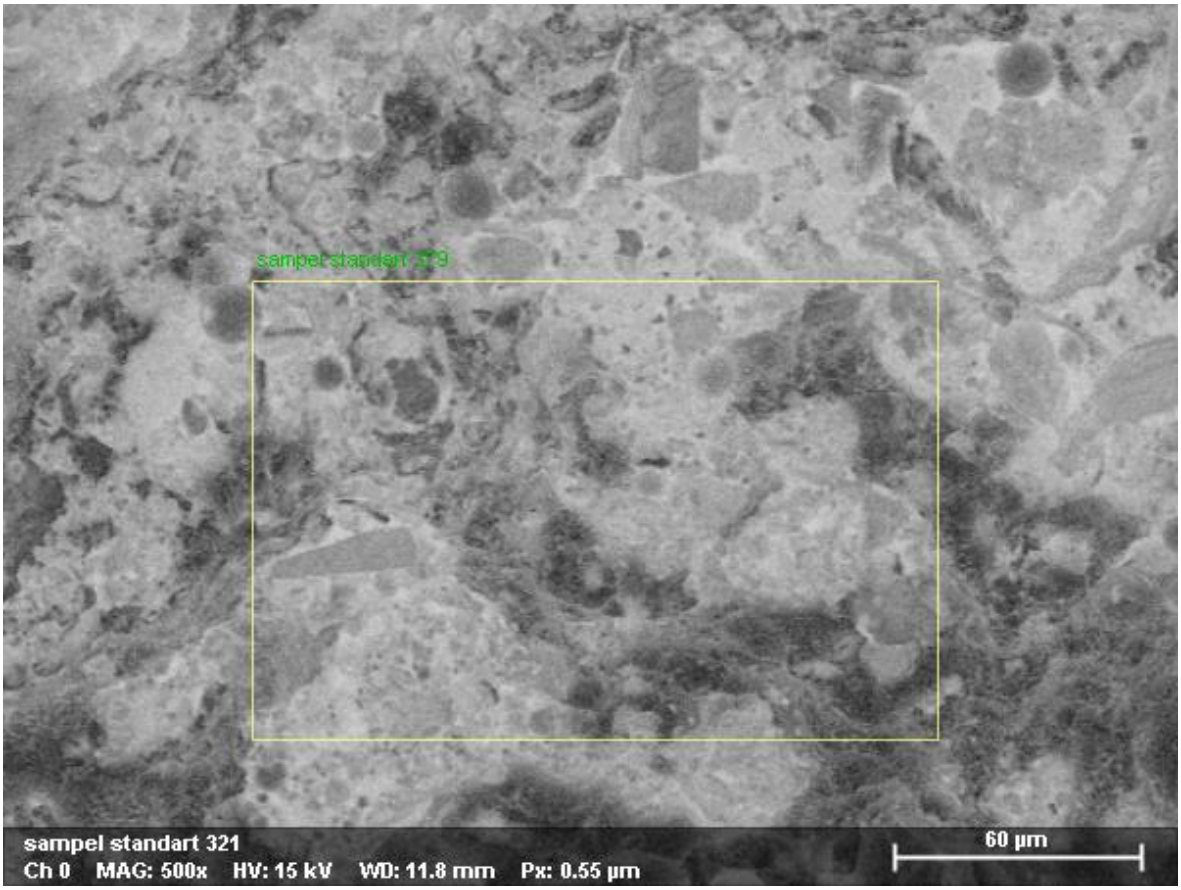
Type : AISI1045

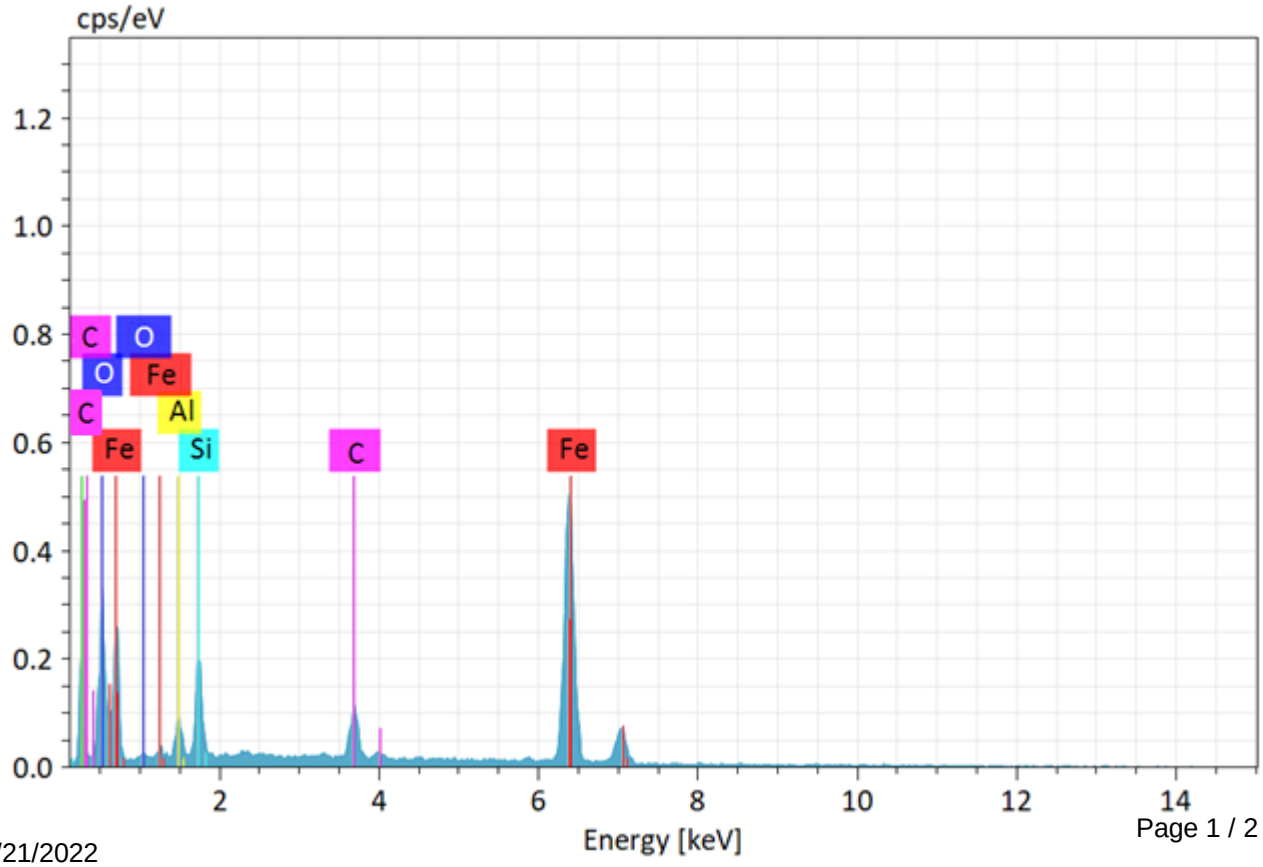
Sampel : Standart 379

Spesimen : Remark (D)



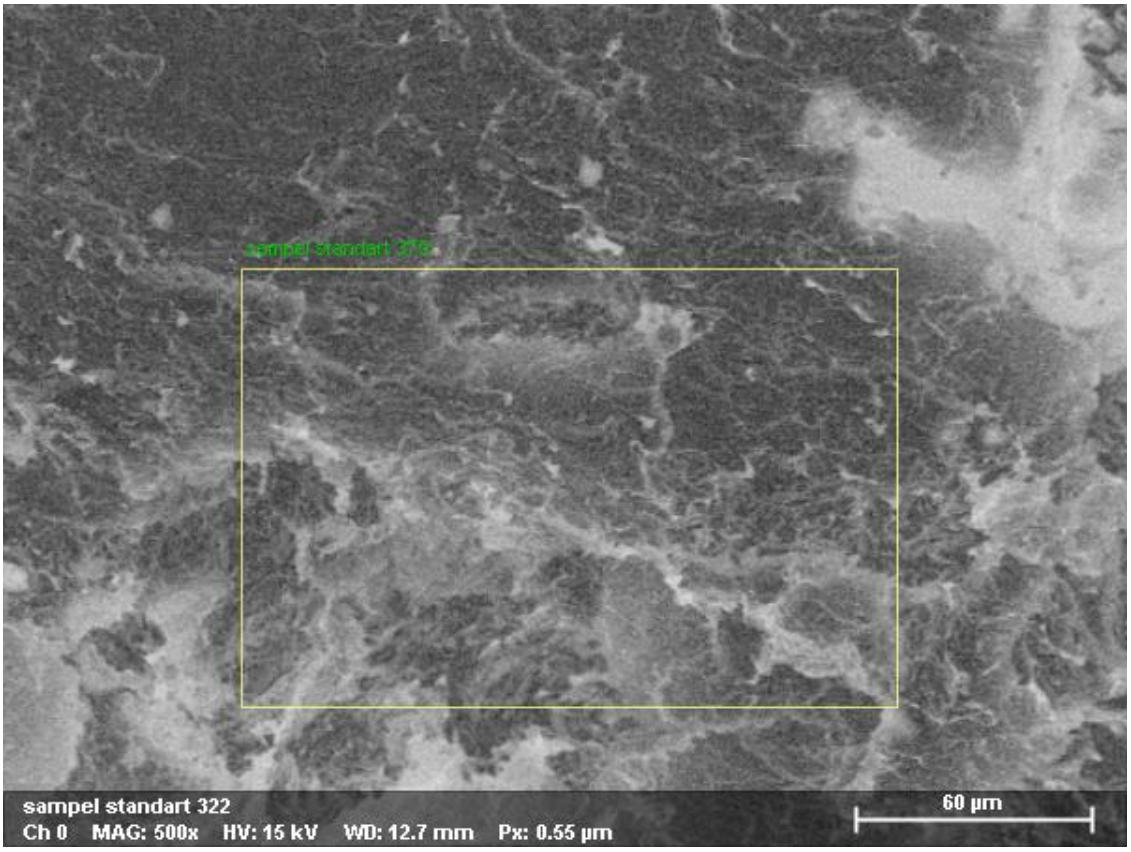


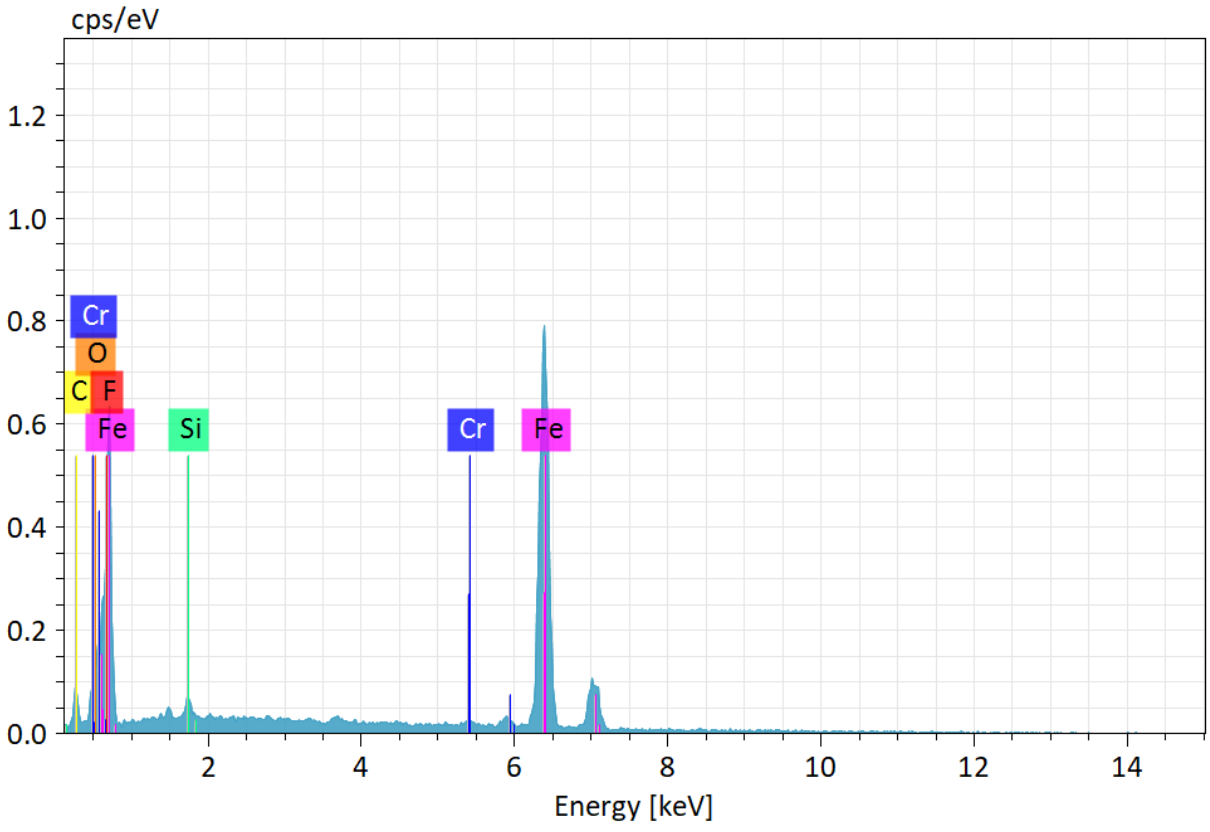

sampel standart 321
Ch 0 MAG: 500x HV: 15 kV WD: 11.8 mm Px: 0.55 µm
60 µm


cps/eV
1.2
1.0
0.8
0.6
0.4
0.2
0.0
C
O
O
Fe
C
Al
Fe
Si
C
Fe
2
4
6
8
10
12
14
Energy [keV]

sampel standart 379

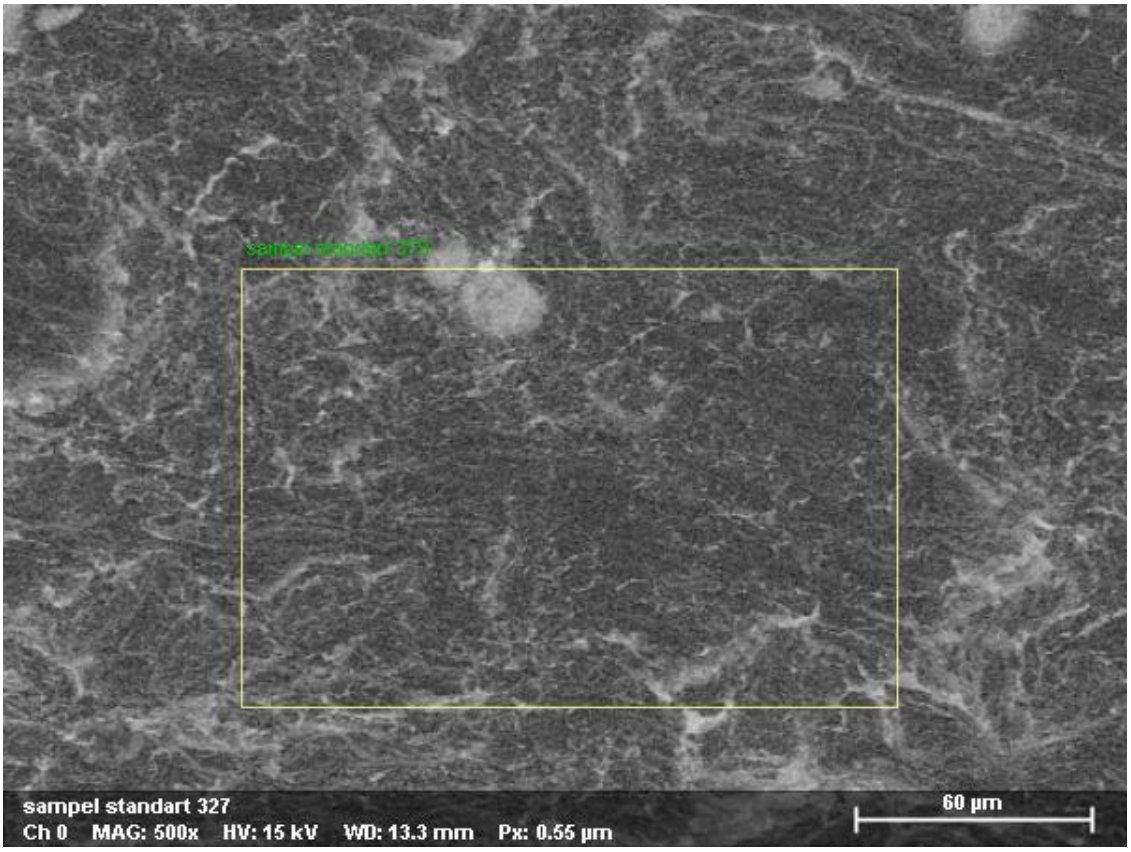
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Fe	26	12636	58.18	51.16	22.17	1.83	3.15
C	6	2477	25.60	22.51	45.36	4.64	18.14
O	8	3648	18.20	16.00	24.21	3.05	16.76
Si	14	2613	4.71	4.14	3.57	0.26	5.47
Al	13	1019	2.15	1.89	1.70	0.16	7.50
		Sum	**113.73**	**100.00**	**100.00**		

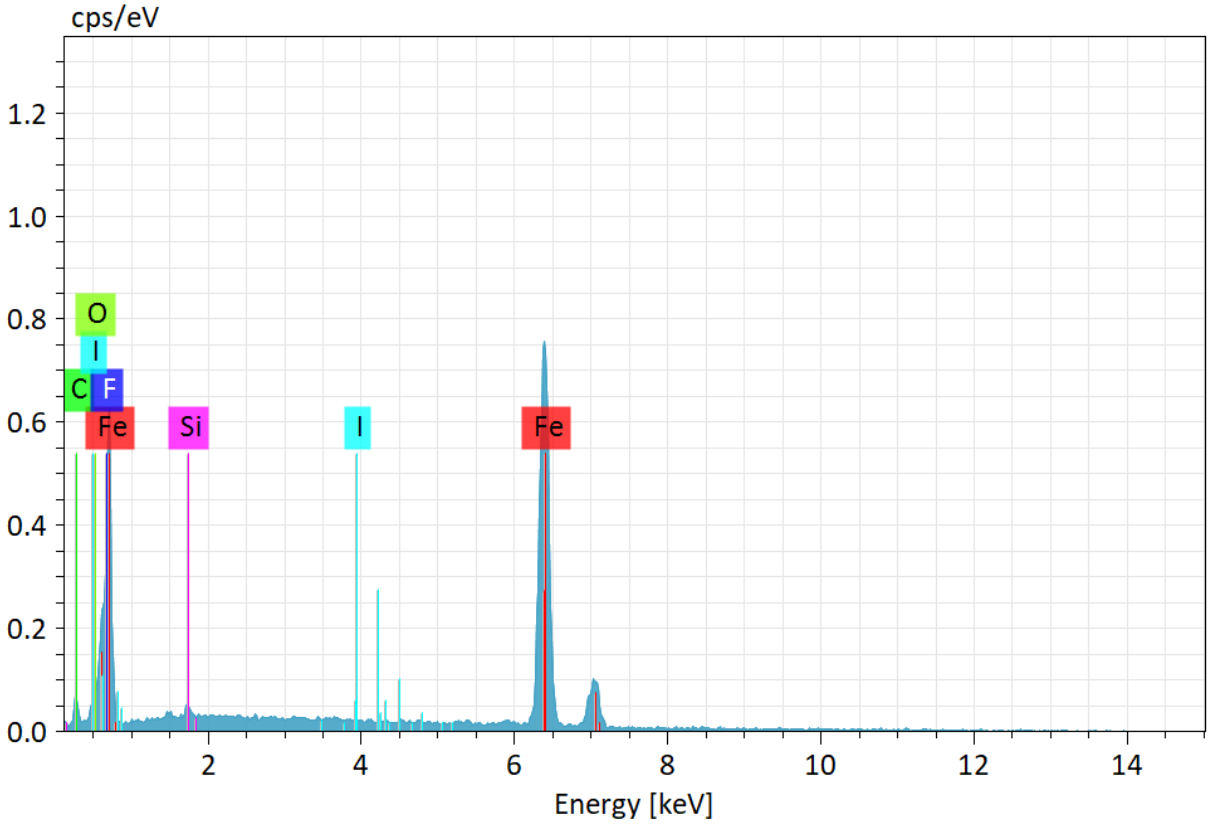

sampel standart 322
Ch 0 MAG: 500x HV: 15 kV WD: 12.7 mm Px: 0.55 µm
60 µm


cps/eV
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Cr
O
C
F
Fe
Si
Cr
Fe
2
4
6
8
10
12
14
Energy [keV]

sampel standart 379

Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Fe	26	15609	86.96	74.03	56.95	3.00	3.10
C	6	715	20.91	19.46	29.80	2.75	25.19
O	8	873	4.32	3.74	8.86	1.04	24.12
F	9	517	1.75	1.51	3.01	0.51	29.03
Si	14	456	0.86	0.75	1.00	0.09	10.15
Cr	24	195	0.59	0.51	0.37	0.07	12.52
		Sum	**115.39**	**100.00**	**100.00**		


sampel standart 327
Ch 0 MAG: 500x HV: 15 kV WD: 13.3 mm Px: 0.55 µm
60 µm

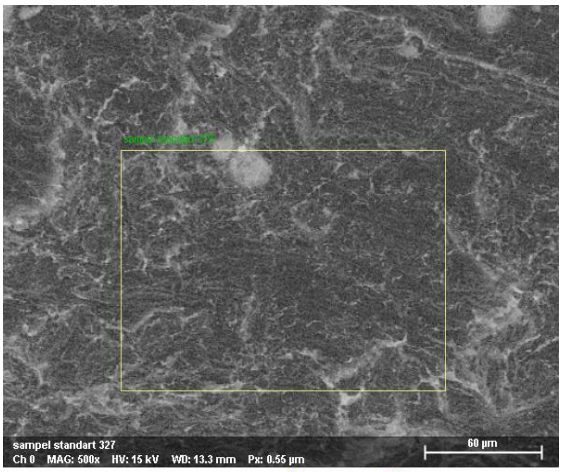

cps/eV
1.2
1.0
0.8
0.6
0.4
0.2
0.0
O
I
C
F
Fe
Si
I
Fe
2
4
6
8
10
12
14
Energy [keV]

sampel standart 379

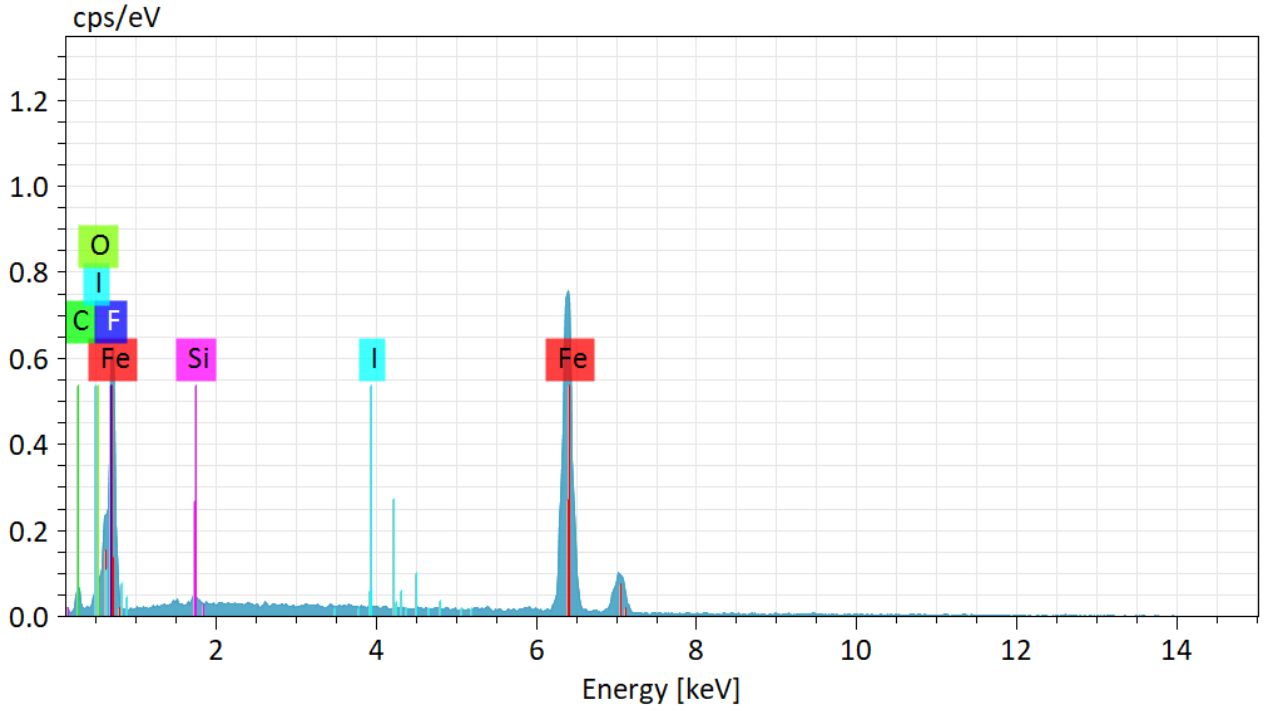
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Fe	26	16508	104.16	88.47	65.10	3.21	3.09
C	6	556	8.79	7.47	25.56	2.40	27.25
O	8	615	3.01	2.56	6.57	0.81	26.96
F	9	353	1.13	0.96	2.08	0.38	33.51
Si	14	251	0.53	0.45	0.65	0.07	13.51
I	53	31	0.11	0.09	0.03	0.05	42.22
		Sum	**117.73**	**100.00**	**100.00**		

Application Note

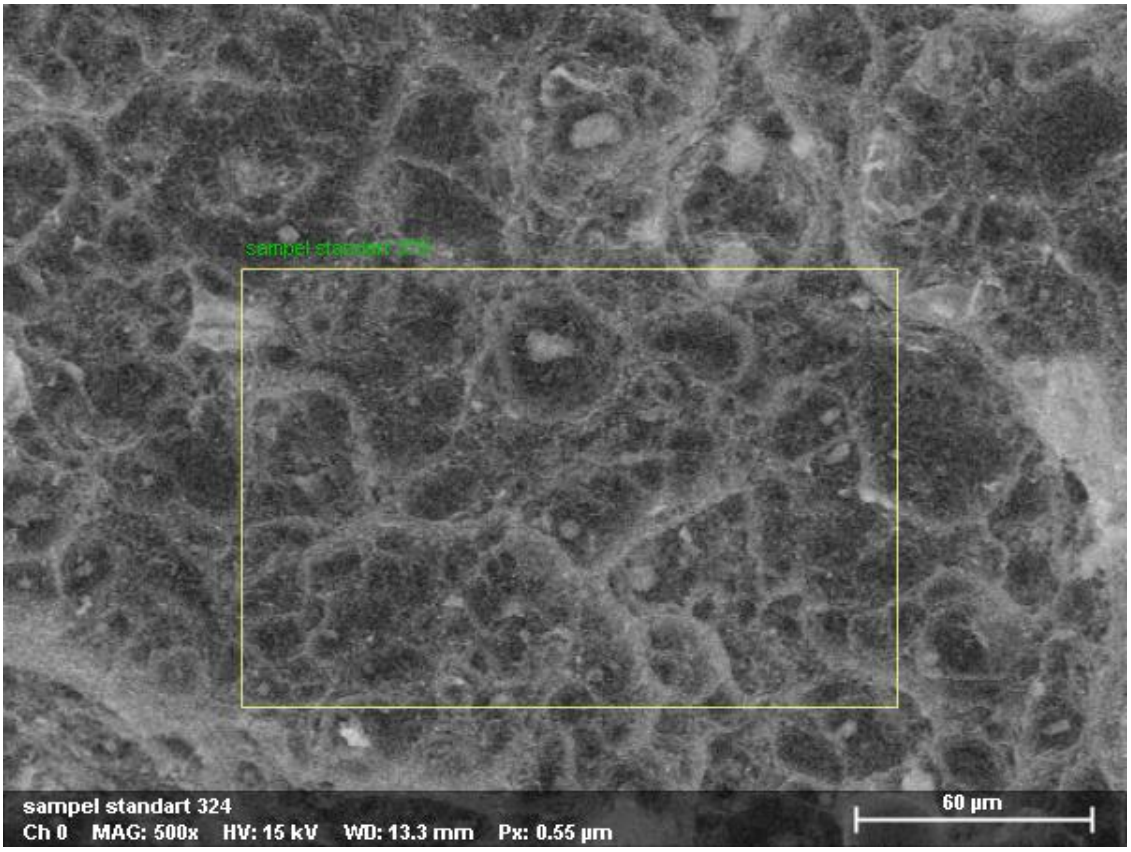
Company / Department

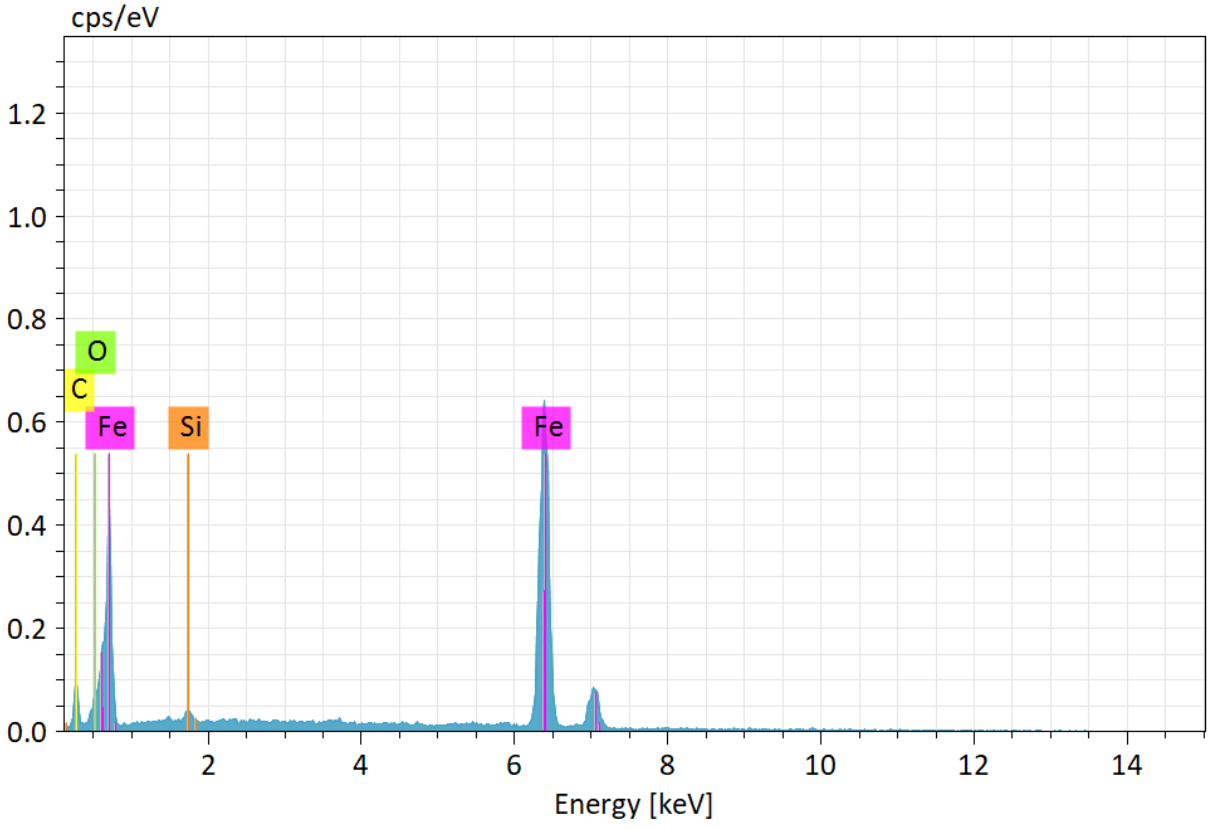


Name	Date	Time	HV [kV]	Mag	WD [mm]
sampel standart 327	11/21/2022	11:56:03 PM	15.0 keV	500x	13.3 mm



Spectrum	C	O	F	Si	Fe	I
sampel standart 379	7.47	2.56	0.96	0.45	88.47	0.09


sampel standart 324
Ch 0 MAG: 500x HV: 15 kV WD: 13.3 mm Px: 0.55 µm
60 µm


cps/eV
1.2
1.0
0.8
0.6
0.4
0.2
0.0
O
C
Fe
Si
Fe
2
4
6
8
10
12
14
Energy [keV]

sampel standart 379

Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Fe	26	17277	85.83	83.55	54.21	2.65	3.08
C	6	1065	12.77	12.43	37.50	2.87	22.45
O	8	781	3.28	3.20	7.24	0.82	25.07
Si	14	395	0.84	0.82	1.05	0.09	10.54
		Sum	**102.73**	**100.00**	**100.00**		