

DAFTAR PUSTAKA

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Lampiran 1. Uji SEM



KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS BRAWIJAYA
LABORATORIUM SENTRAL ILMU HAYATI (LSIH)
Jl. Veteran, Malang 65145, Indonesia
Telp./Fax. +62 341 559054
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Lembar Permohonan Pengambilan Gambar FESEM *(FESEM Image Acquisition Request Sheet)*

Informasi Pemohon / Applicant Information

Nama / Name : Muhammad Ali Chandra
No. Telp. / Phone number : 085235809787
Alamat email / Email address : muhammadalichandra@gmail.com
Posisi / Position : Mahasiswa S-2 (Postgraduate)
NIM/NIP/ID lain : 3505112801910002
(student/employee/other ID)
Jurusan–Instansi / Department–
Institution : teknik mesin - universitas hasanudin
Pembimbing/Promotor /
Supervisor : Prof. Dr. Ir. Onny Sutresman, MT
Estimasi tanggal akuisisi /
Acquisition date estimation : **25 & 26 Agustus 2021 08:30 - 15:00**

Informasi Spesimen / Specimen Information

Jumlah spesimen / Number of
specimen : 7
Wujud spesimen / specimen form : Padatan (Bulk)
Konduktivitas spesimen / Specimen
conductivity : Non-konduktif (Non-conductive)
Klasifikasi biologi / Biological
classification : Non-biologis (Non-biological)
Identitas spesimen / Specimen
identity : plastik LDPE var suhu 160; 170; dst

Informasi Khusus yang Dibutuhkan / Specific Request Information

Mode operasi FESEM / FESEM :
mode
Perbesaran / Magnification : 40-100
Akuisisi gambar / Image
acquisition : 1 spot @ 4 macam perbesaran (1 spot @ 4 magnification)
EDS : Ya / Yes
Pengukuran dimensi / Dimension
measurement : Ya / Yes
Catatan khusus / Notes : struktur plastik LDPE dengan perbedaan suhu
Turut Proses Akuisisi / Present : Ya / Yes
during acquisition

Dengan ini pemohon menyatakan menyetujui untuk menuliskan "fasilitas FESEM (FEI Quanta FEG 650) di Laboratorium Sentral Ilmu Hayati - Universitas Brawijaya (LSIH-UB) atau FESEM facility (FEI Quanta FEG 650) at Central Laboratory of Life Science - Brawijaya University (LSIH-UB)" dalam setiap bentuk publikasi pemohon (skripsi, tesis, disertasi, laporan penelitian, artikel ilmiah di jurnal/prosiding/forum ilmiah lainnya) yang menampilkan data hasil akuisisi dengan peralatan FESEM LSIH UB, serta bersedia mengirimkan link publikasi kepada LSIH UB melalui email high-res@ub.ac.id.

Pemohon / Applicant

Ttd./Signed

Muhammad Ali Chandra



KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS BRAWIJAYA
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Daftar Rincian Tagihan Pengukuran FESEM

FESEM Measurement Billing List

Nama / Name * : Muhammad Ali Chandra / Prof. Dr. Ir. Onny Sutresman, MT
Jurusan–Instansi / Department– : teknik mesin - universitas hasanudin
Institution

No. (No.)	Uraian (Description)	Jumlah (Amount)	Satuan (Unit)	Harga Satuan (Unit Price)	Total (Total)
1	FESEM Hivac		sampel		
2	FESEM Hivac + EDS	7	sampel	Rp 600.000,-	Rp 4.200.000,-
3	FESEM Lovac		sampel		
4	FESEM Lovac + EDS		sampel		
5	ESEM		sampel		
6	wetSTEM		sampel		
7	Extra EDS	1	spot	Rp 100.000,-	Rp 100.000,-
8	Extra Gambar		gambar		
Total Tagihan (Total bill)					Rp 4.300.000,-

Ket./notes: Pembayaran melalui Bank BNI a/n RPL 032 UTK LSIH No. Rek. 888136666

Payment via Bank BNI p.p. RPL 032 UTK LSIH account number 888136666

Untuk uang yang telah ditransfer tidak dapat ditarik kembali/The transfered money, can not be withdrawn

*coret yang tidak perlu

Malang, 30 Agustus 2021
Di periksa oleh / Verified by
Operator FESEM / FESEM operator

Nike F. Khusnah

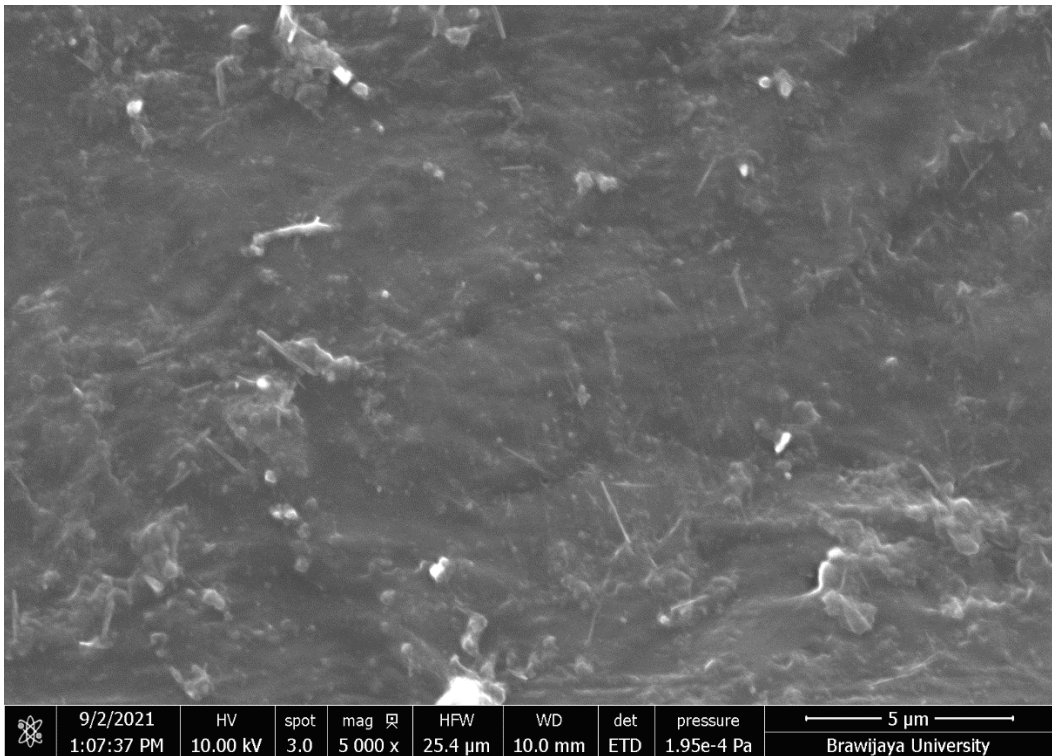
Tembusan / copy:

1. Bagian keuangan / Financial department
2. Arsip Lab / Lab archive

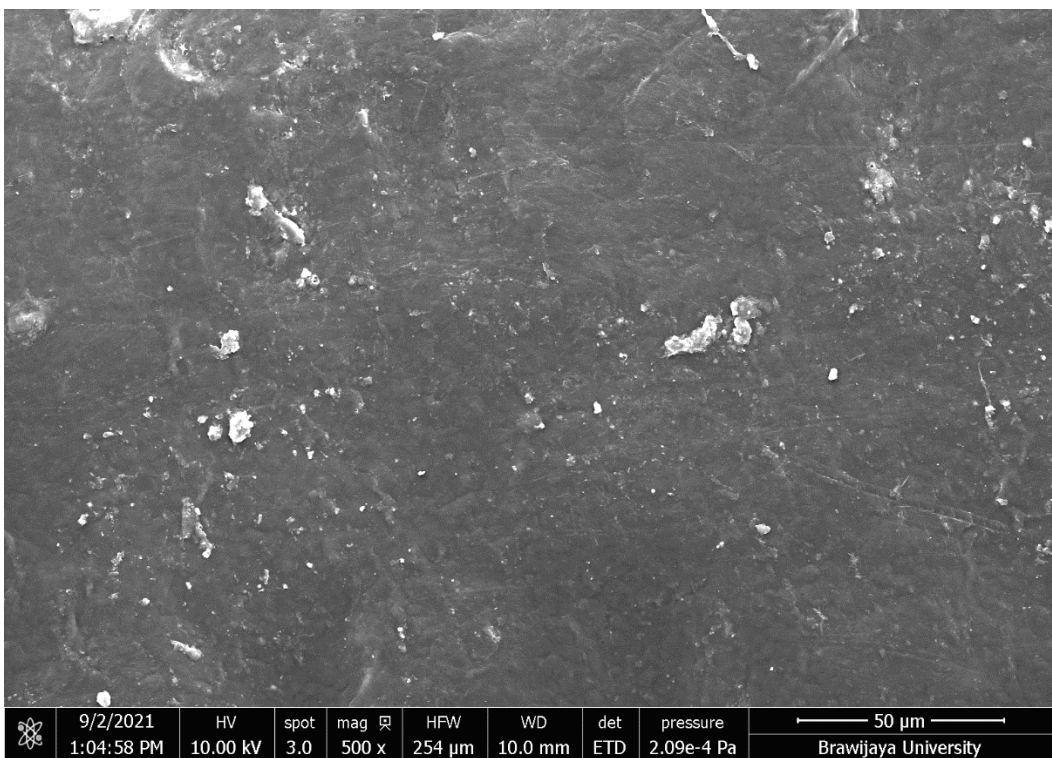
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30 Agustus 2021--> harga proses sputter coating masih dicharge sebagai extra EDS

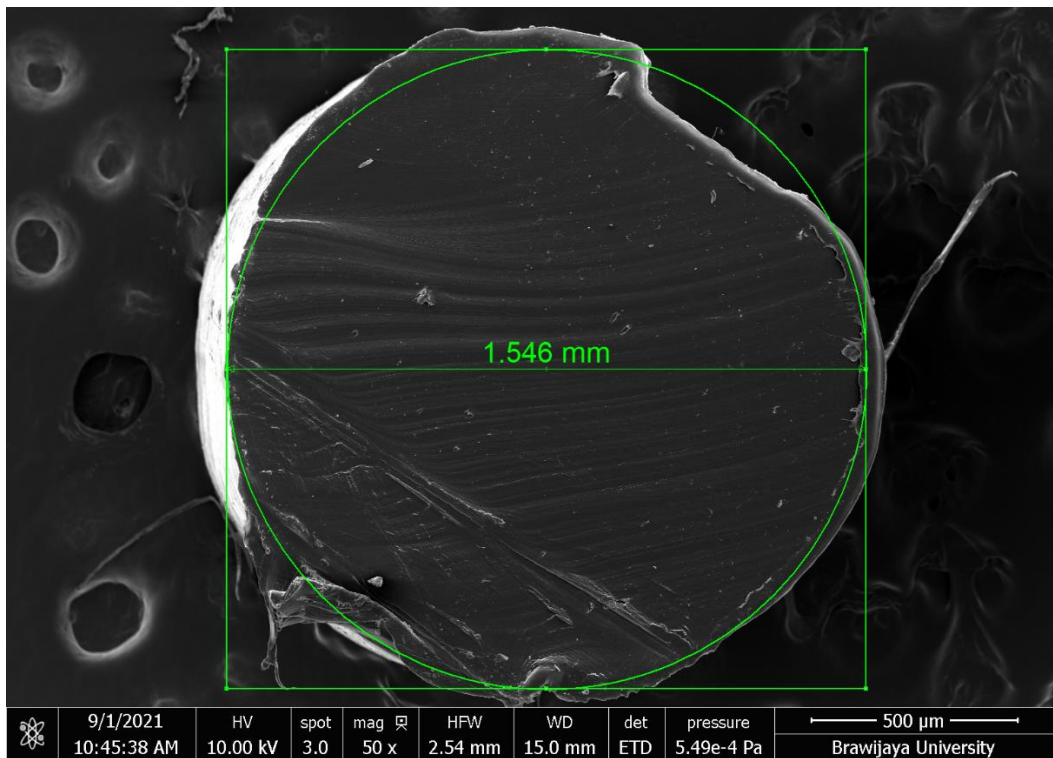
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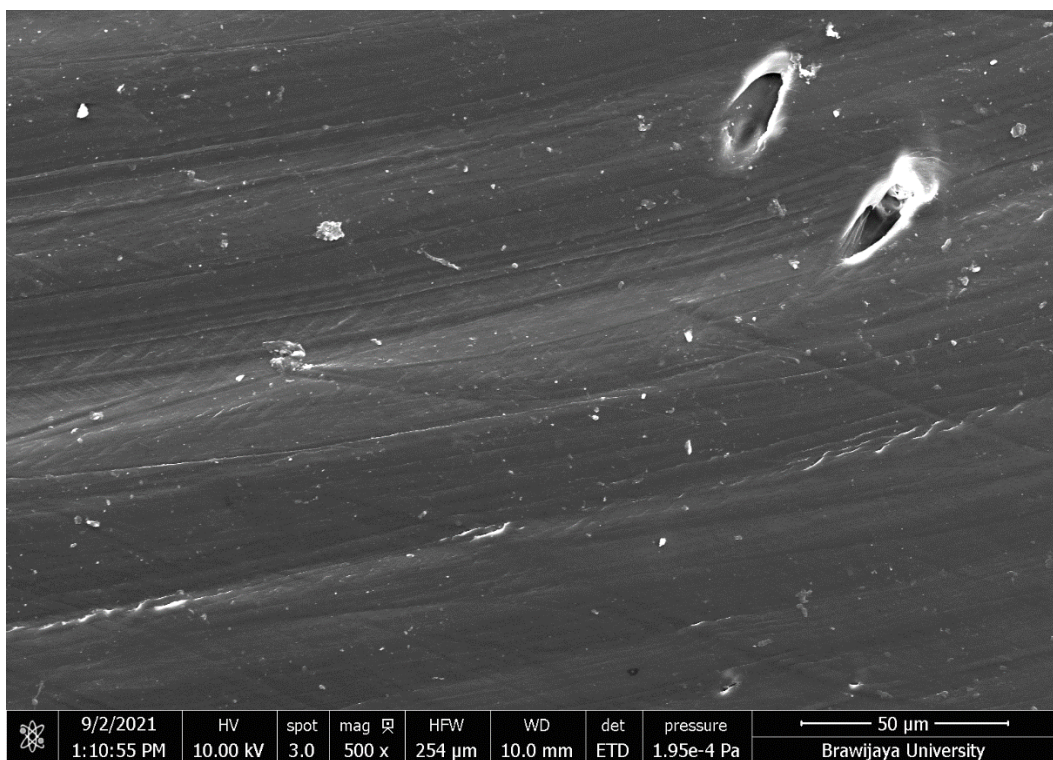
Plastik LDPE variasi suhu 170-5kX



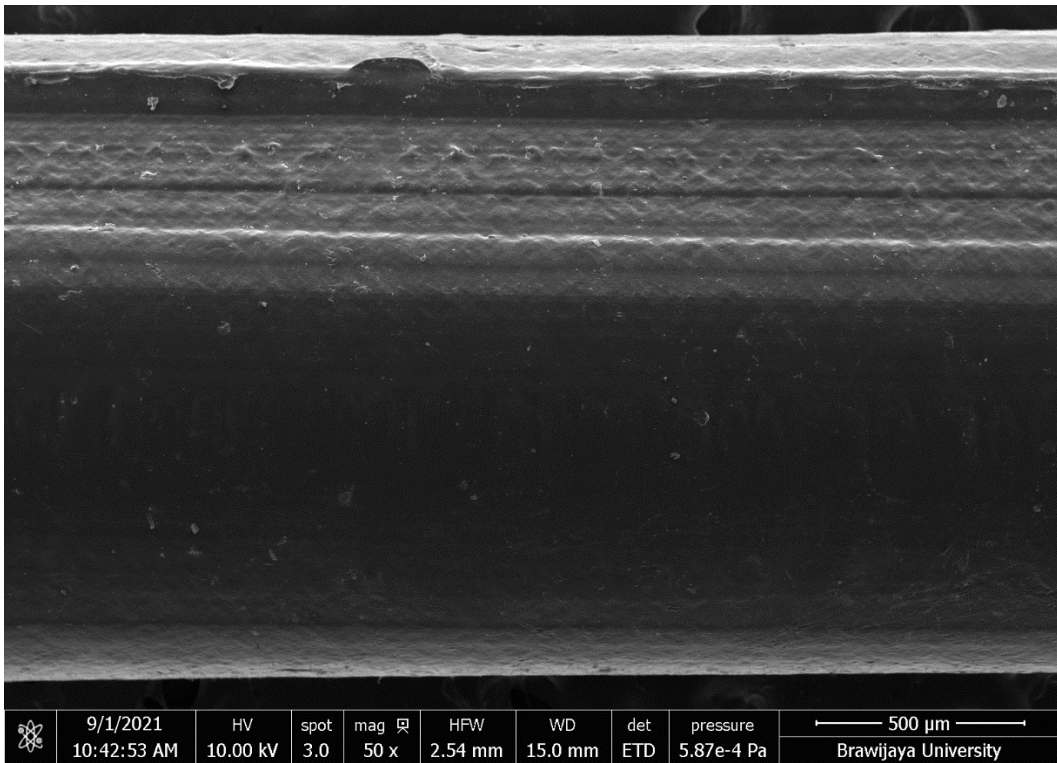
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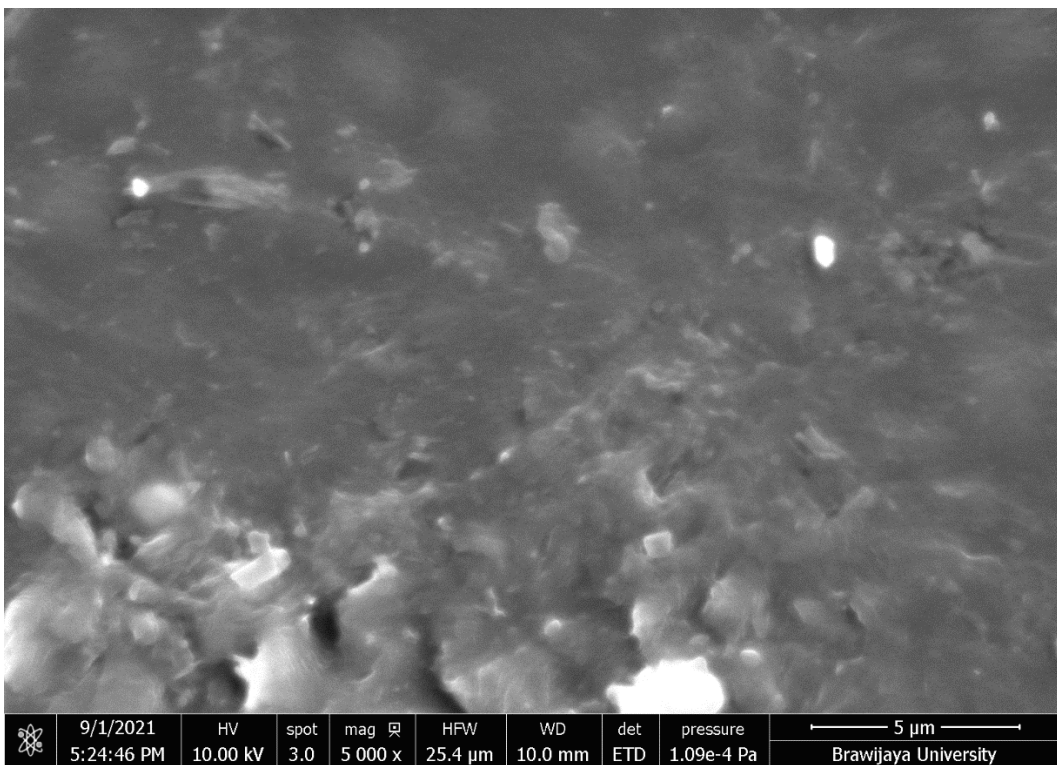
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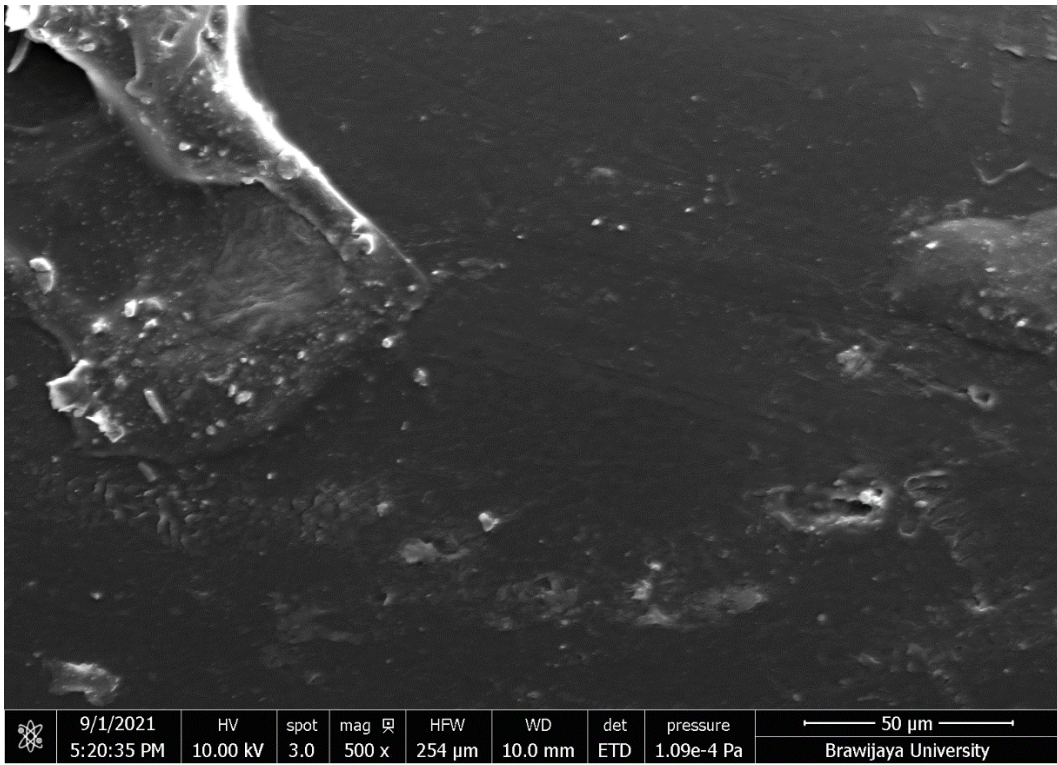
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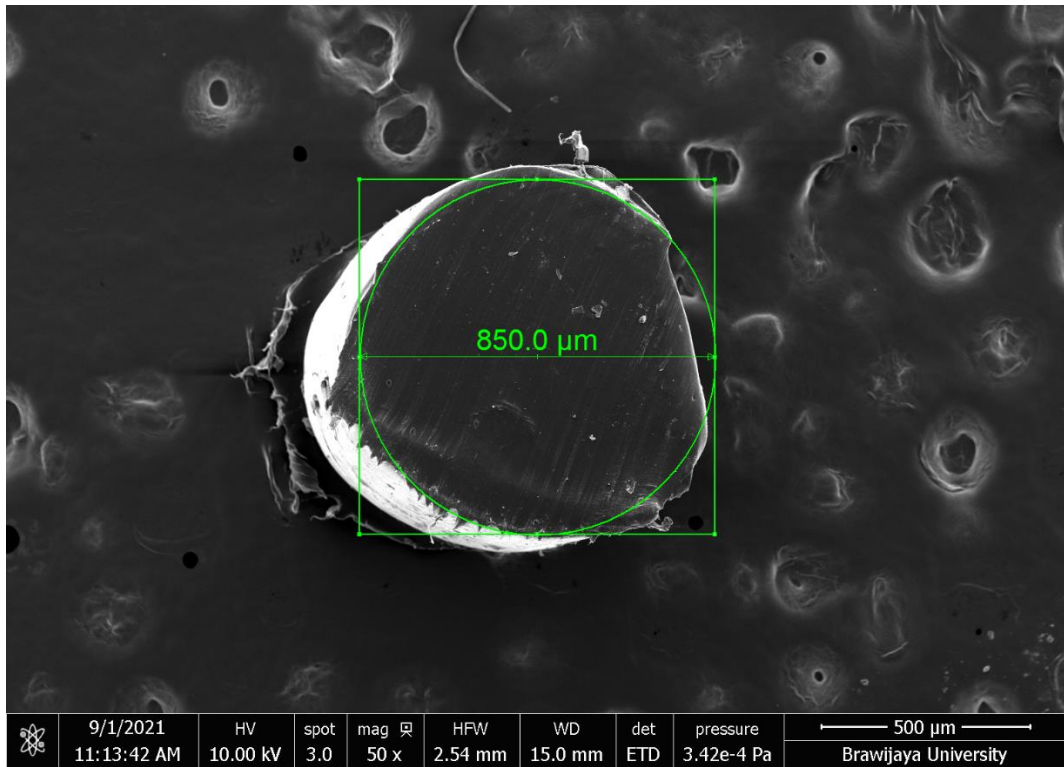
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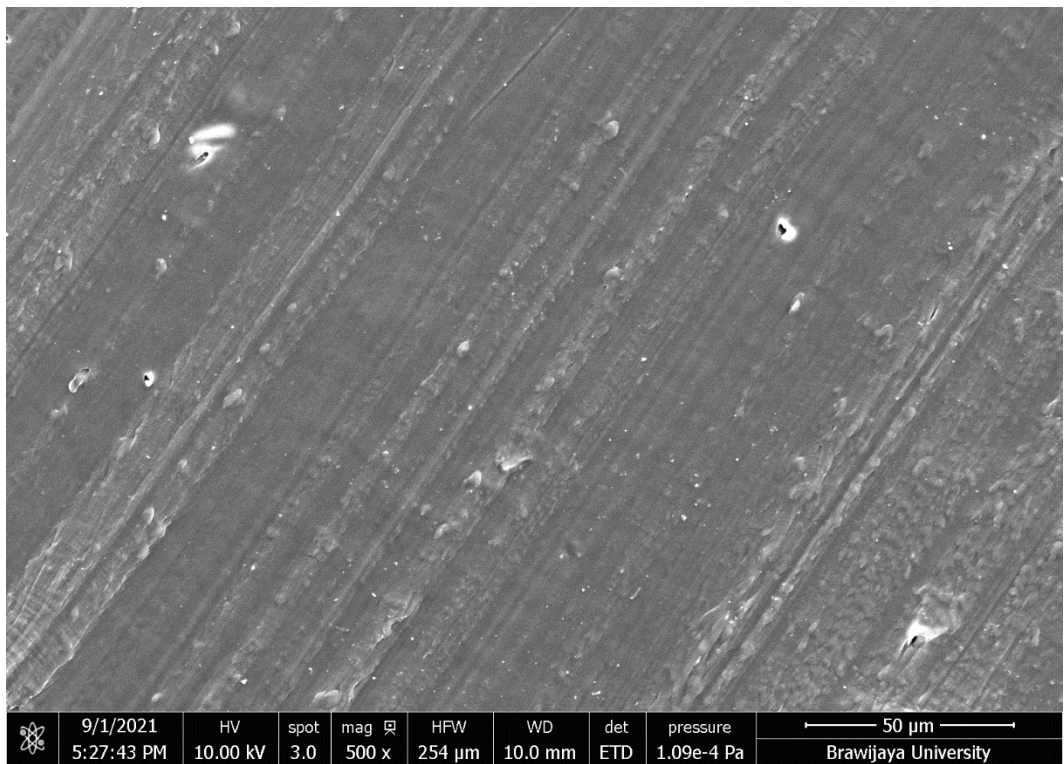
Plastik LDPE var suhu 180-5kX



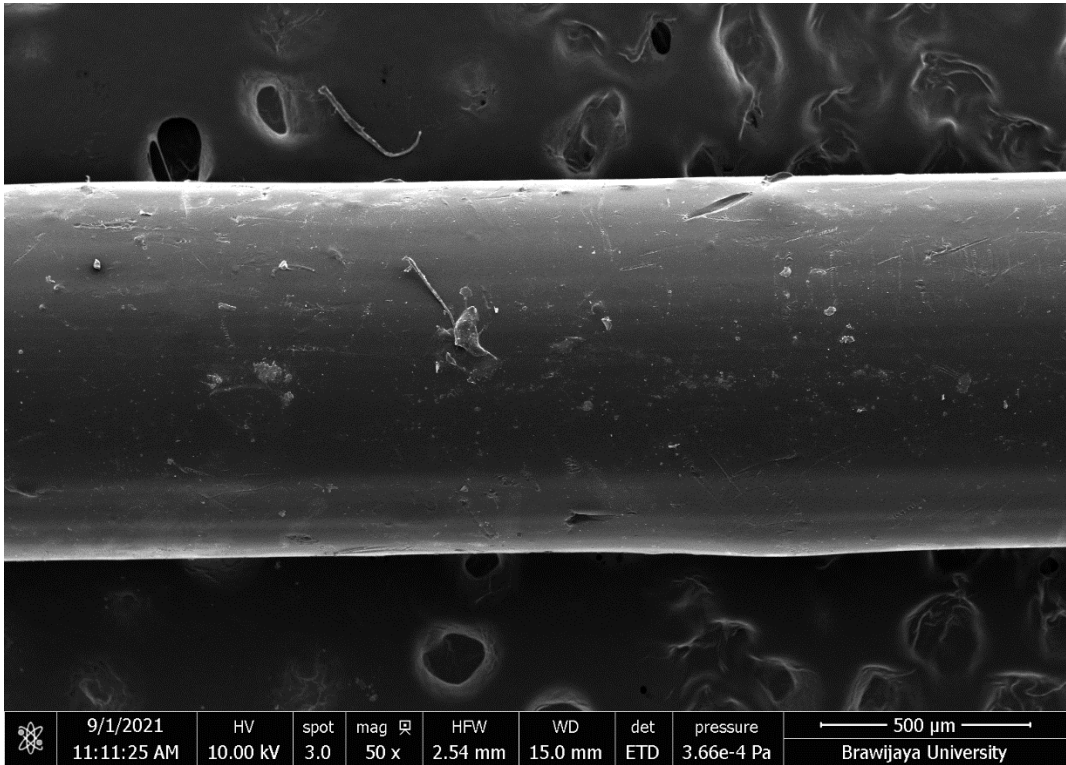
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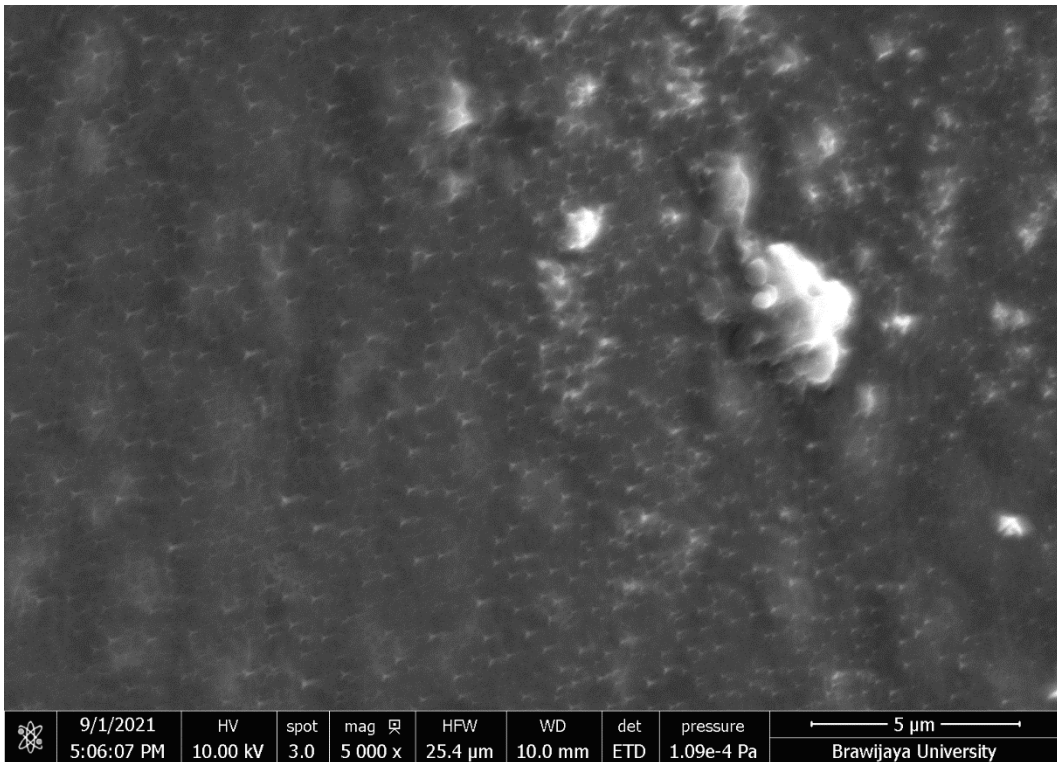
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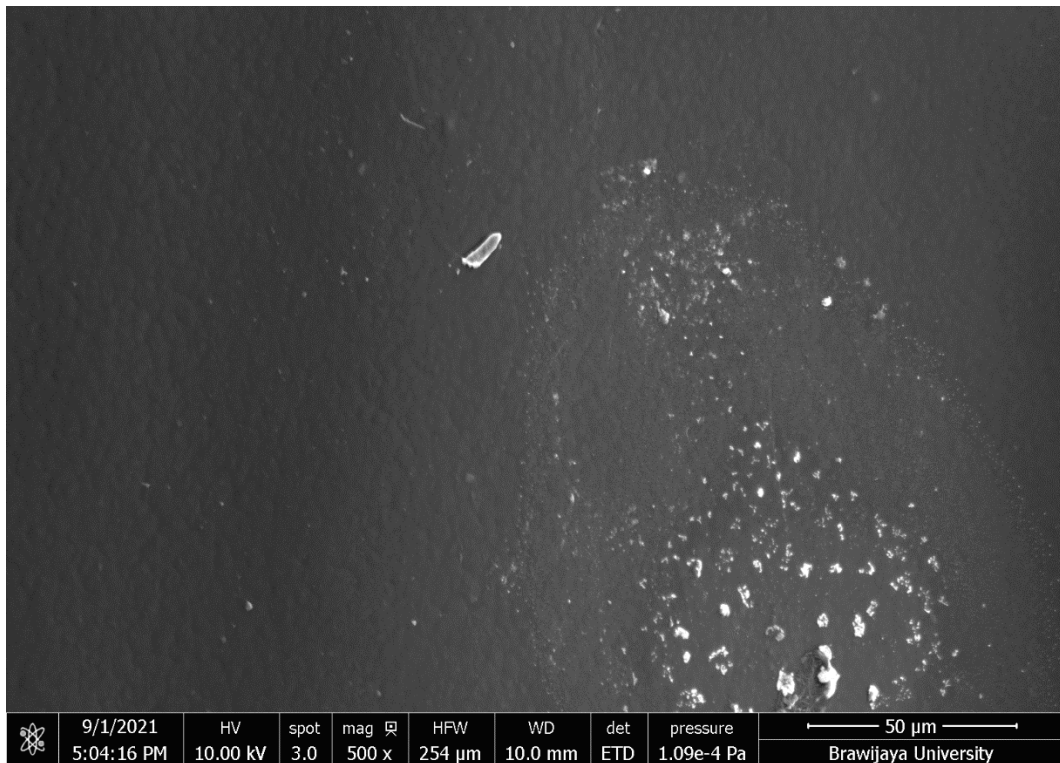
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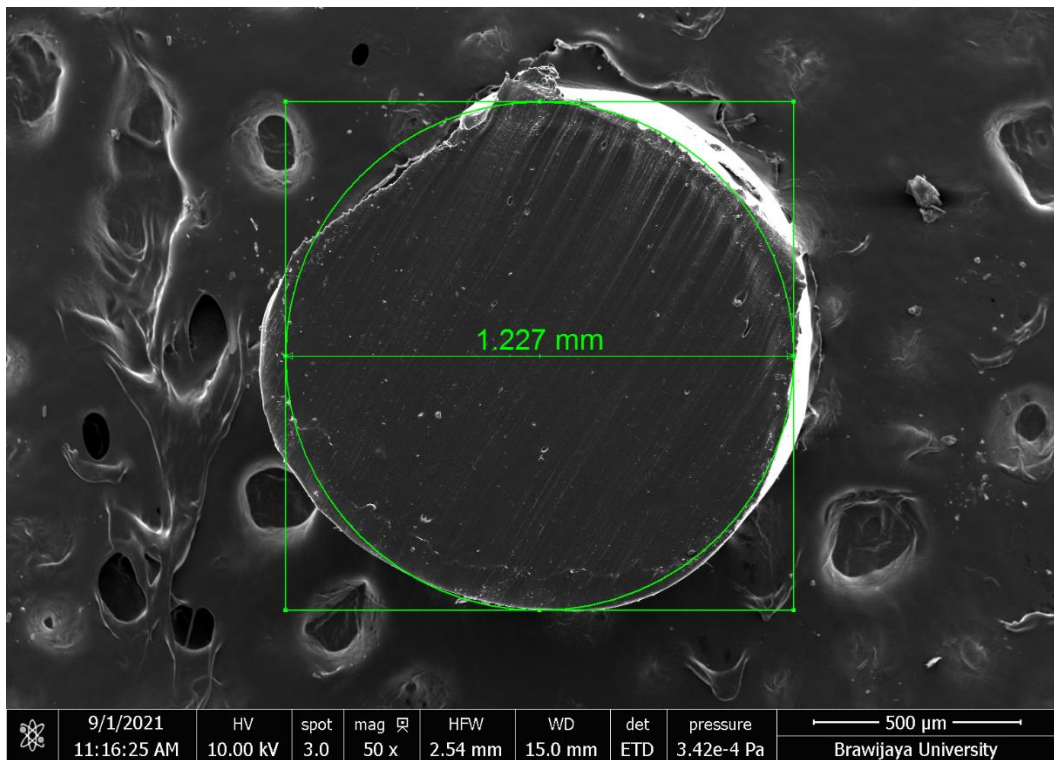
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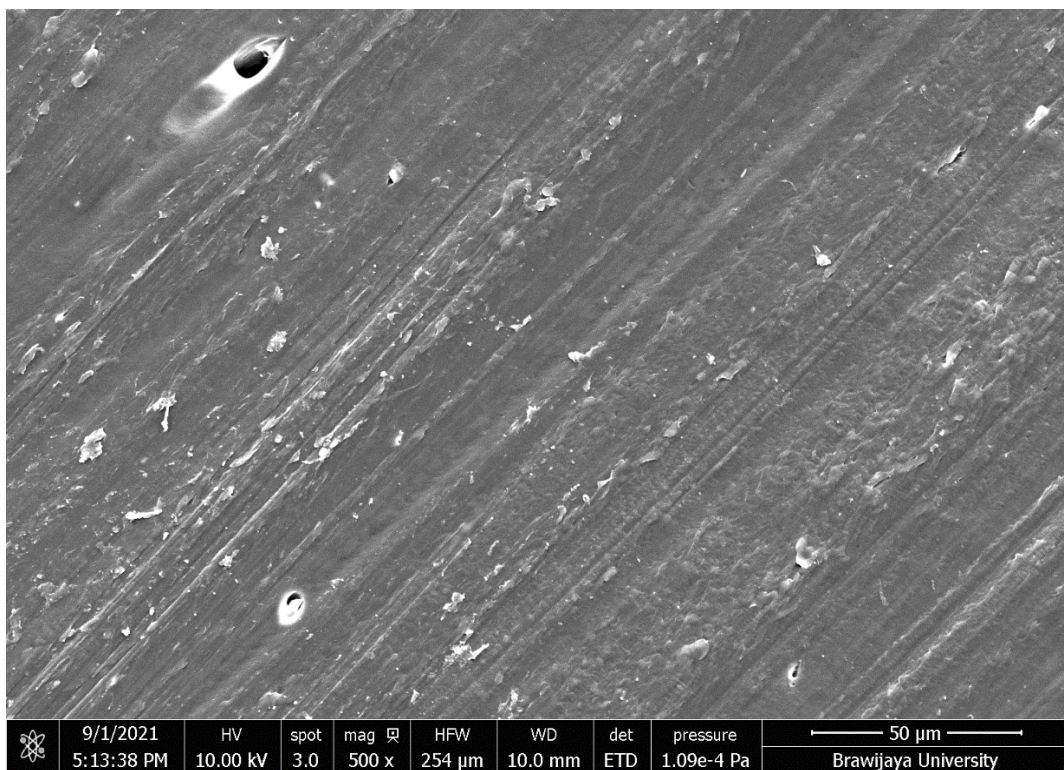
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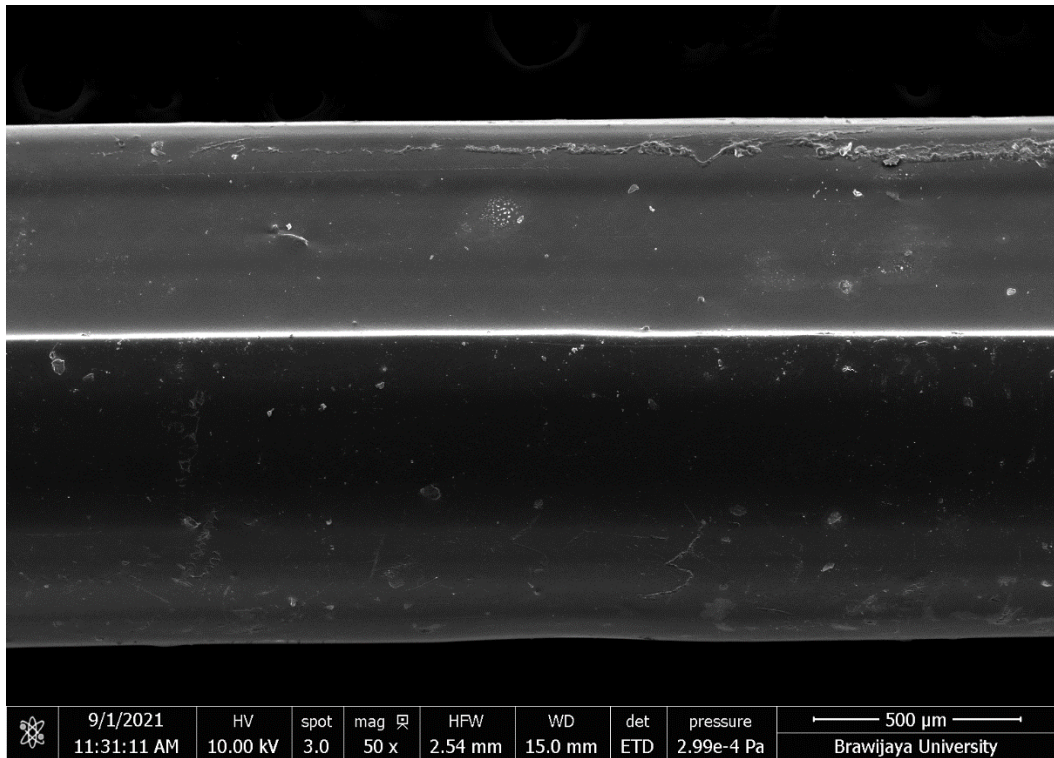
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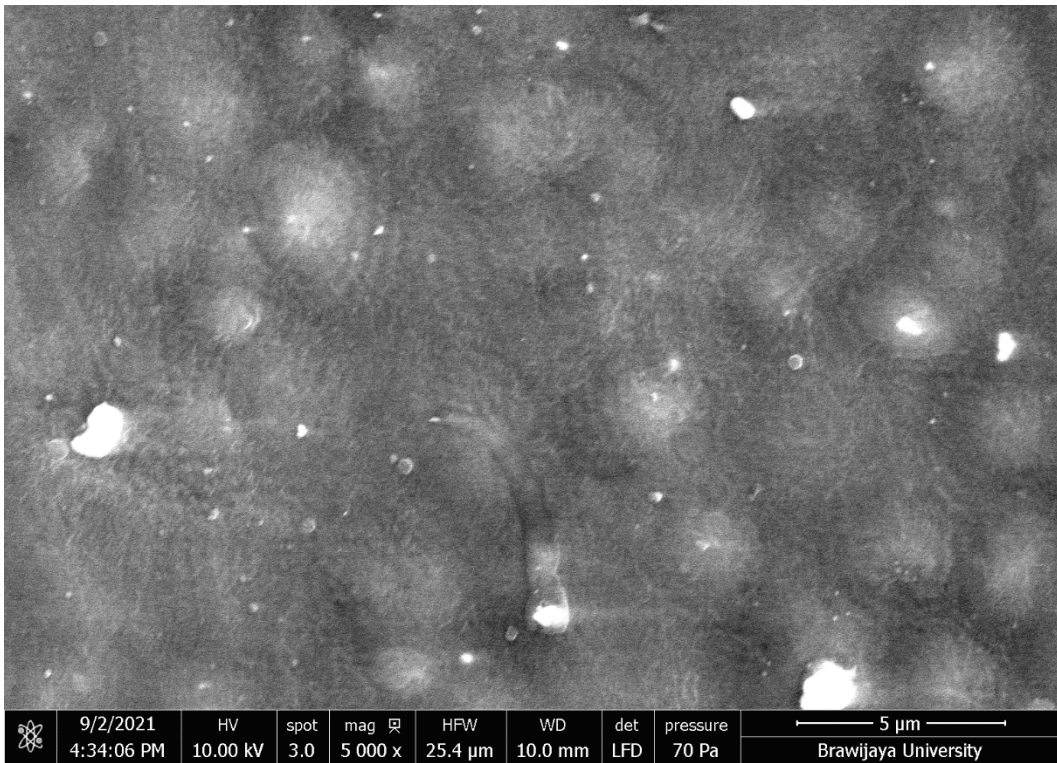
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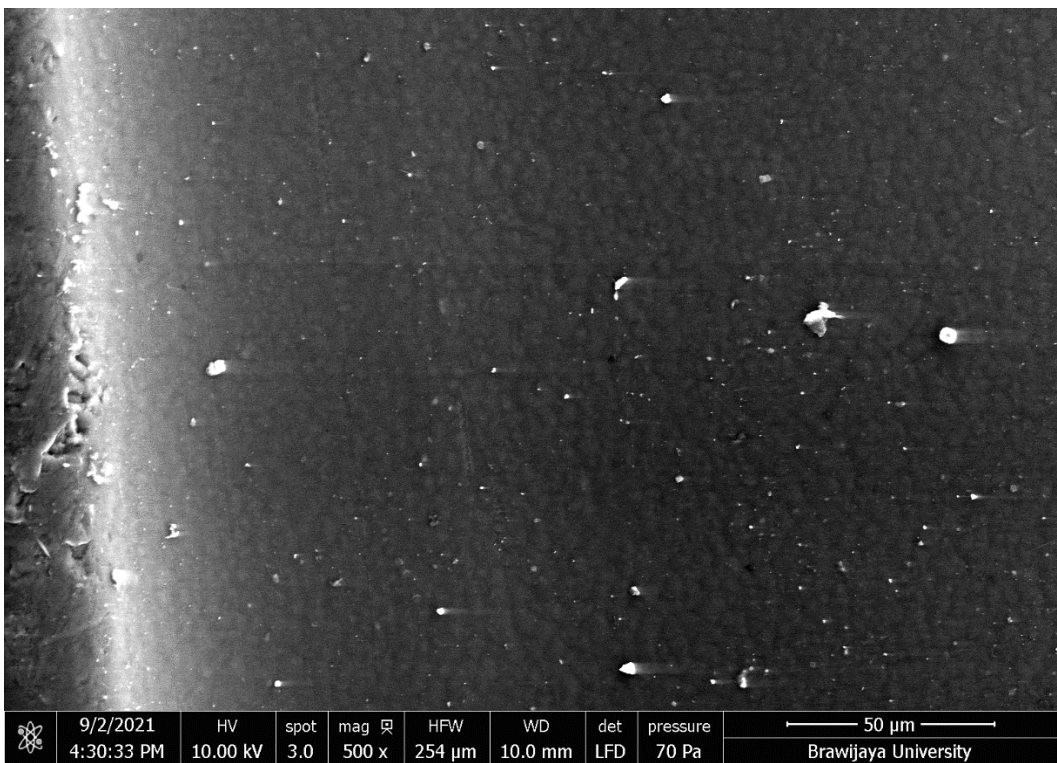
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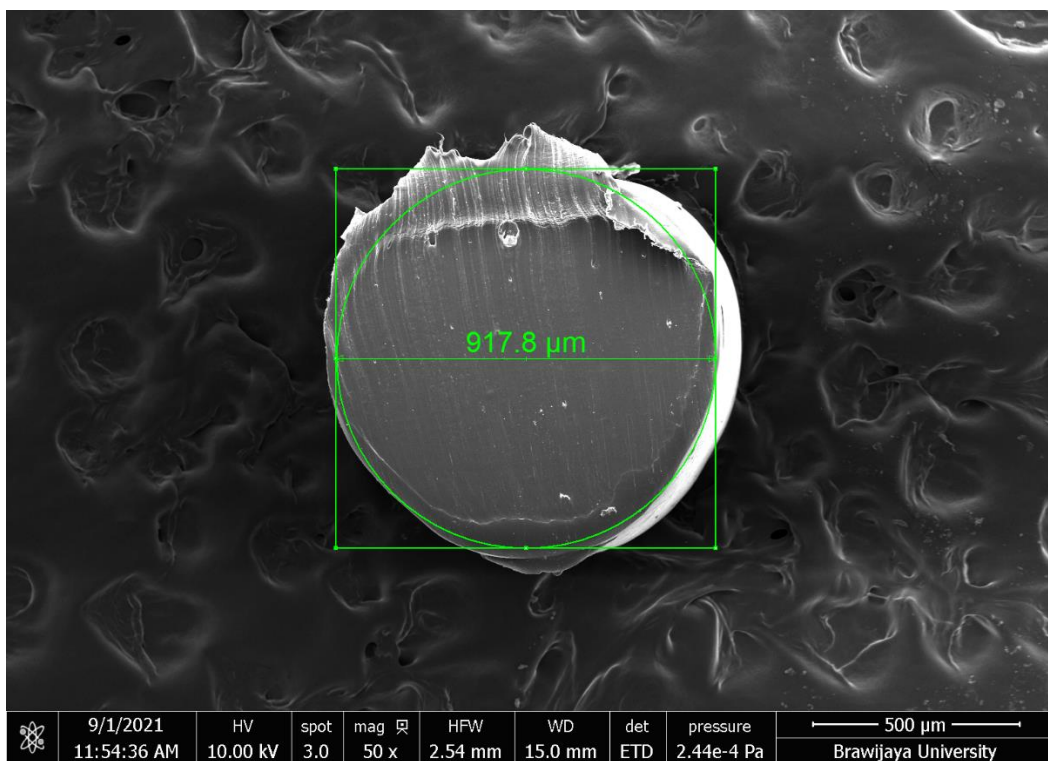
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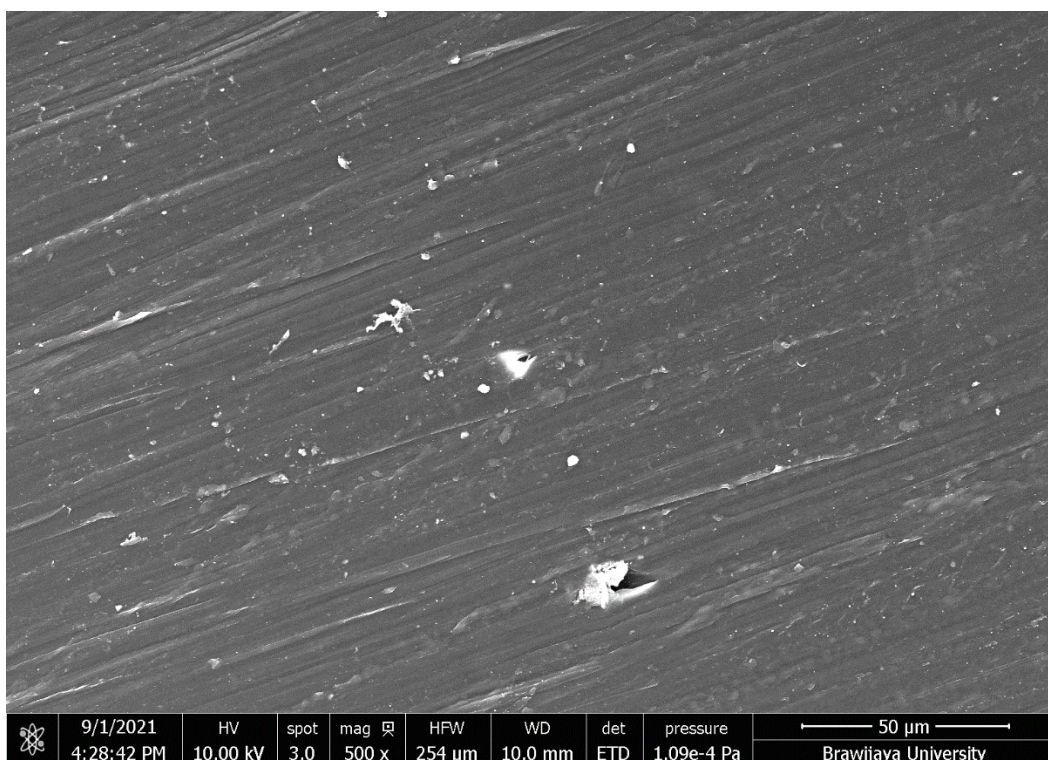
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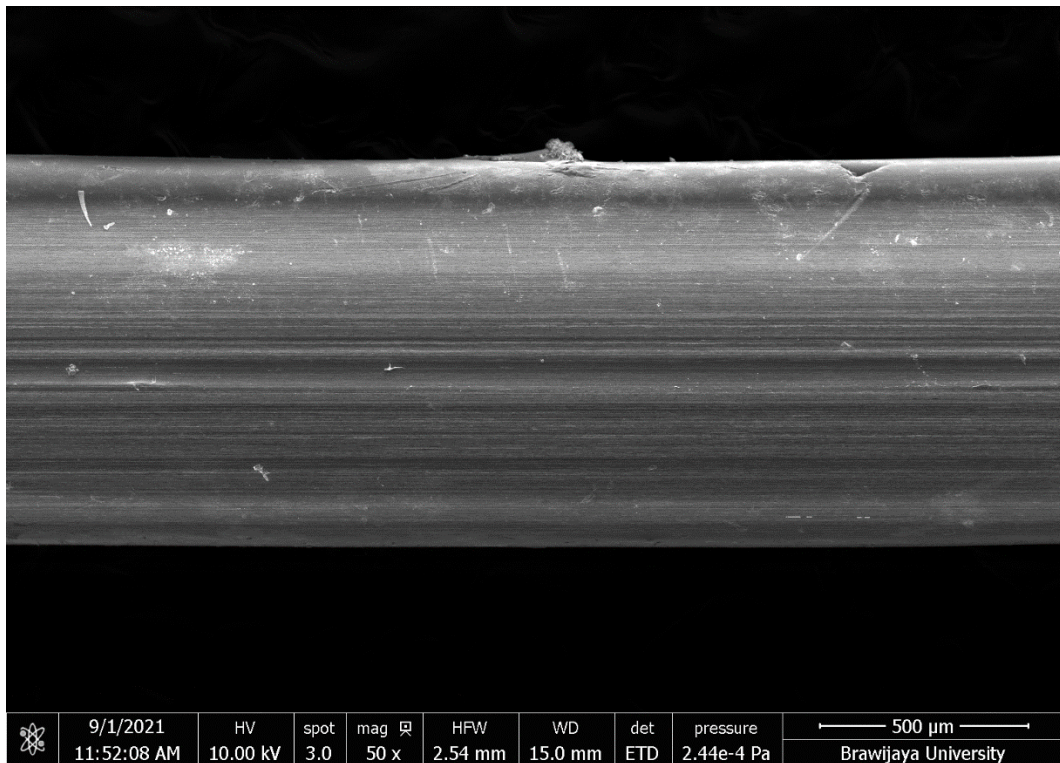
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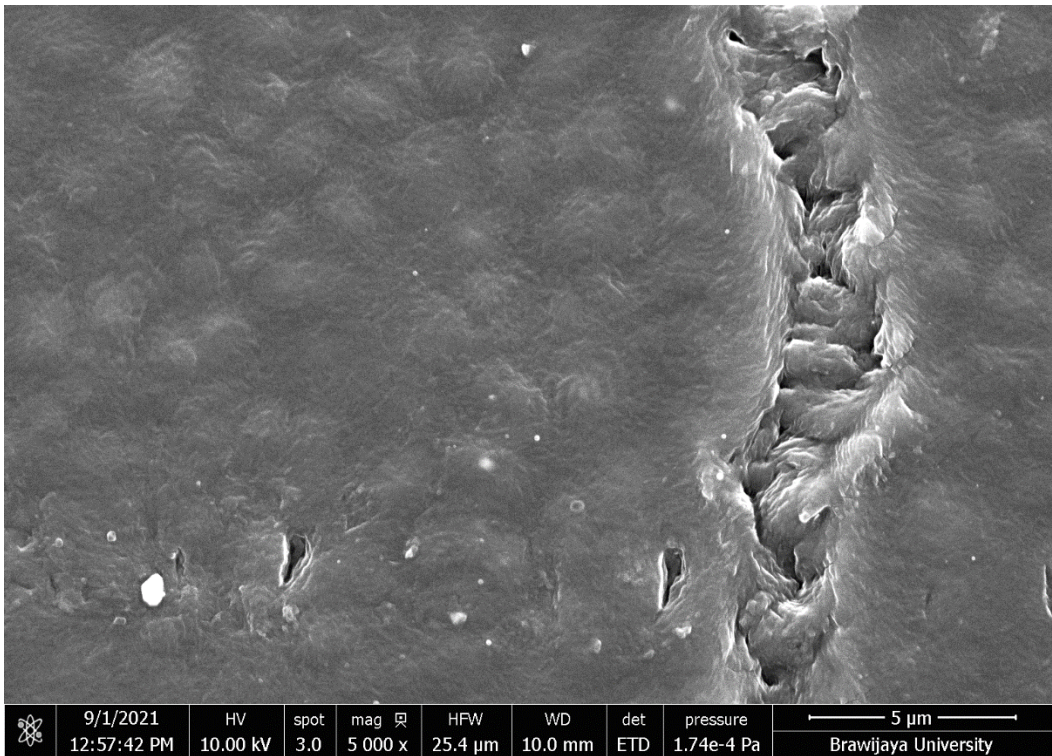
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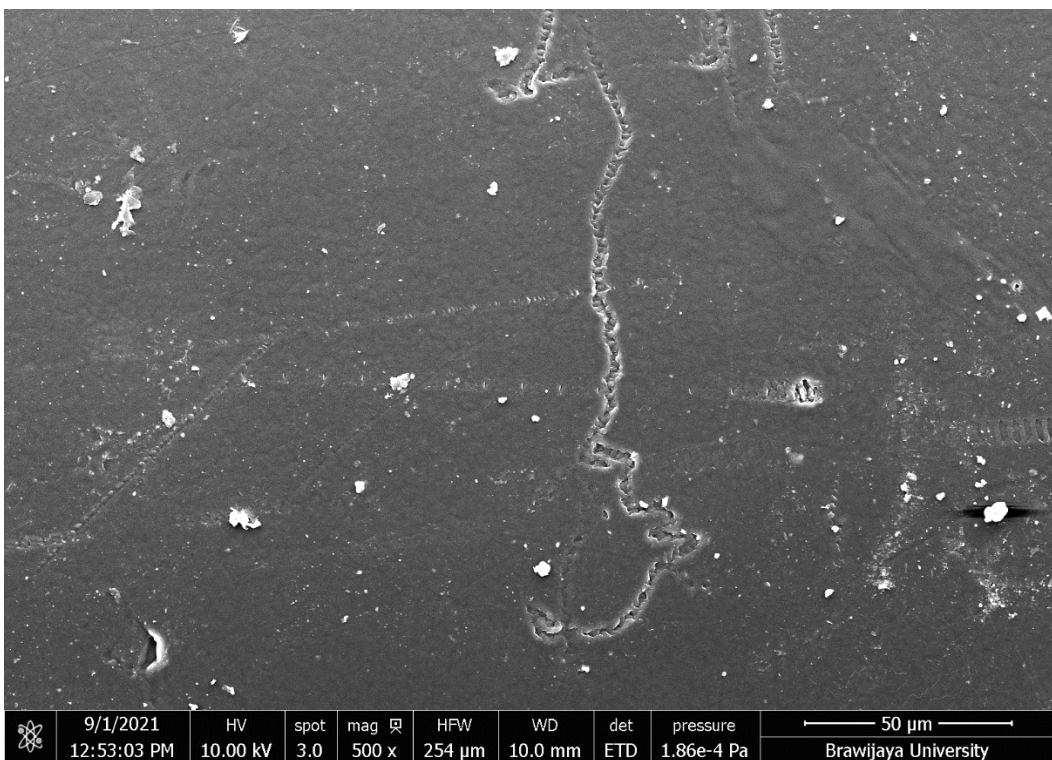
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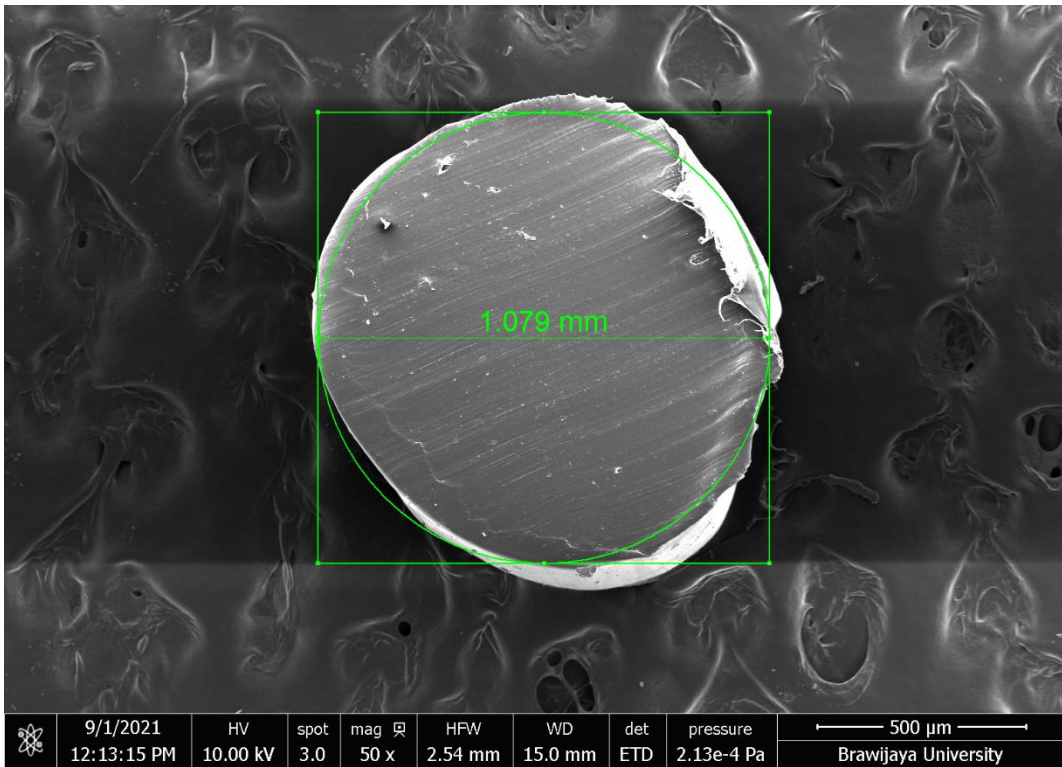
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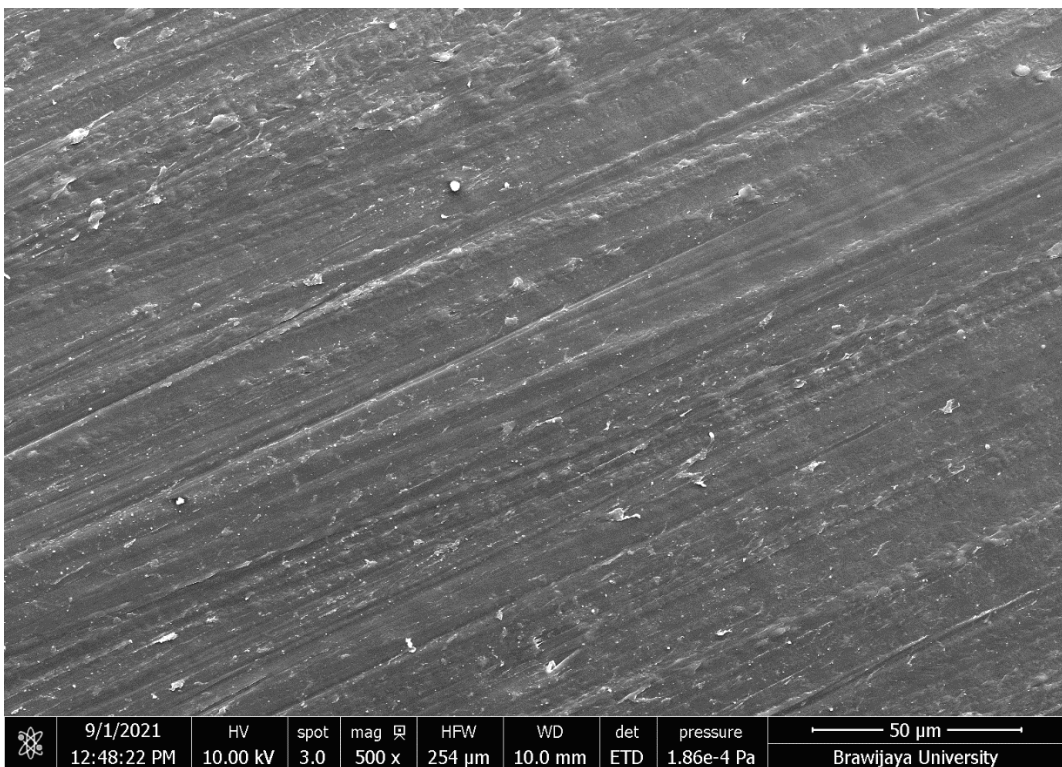
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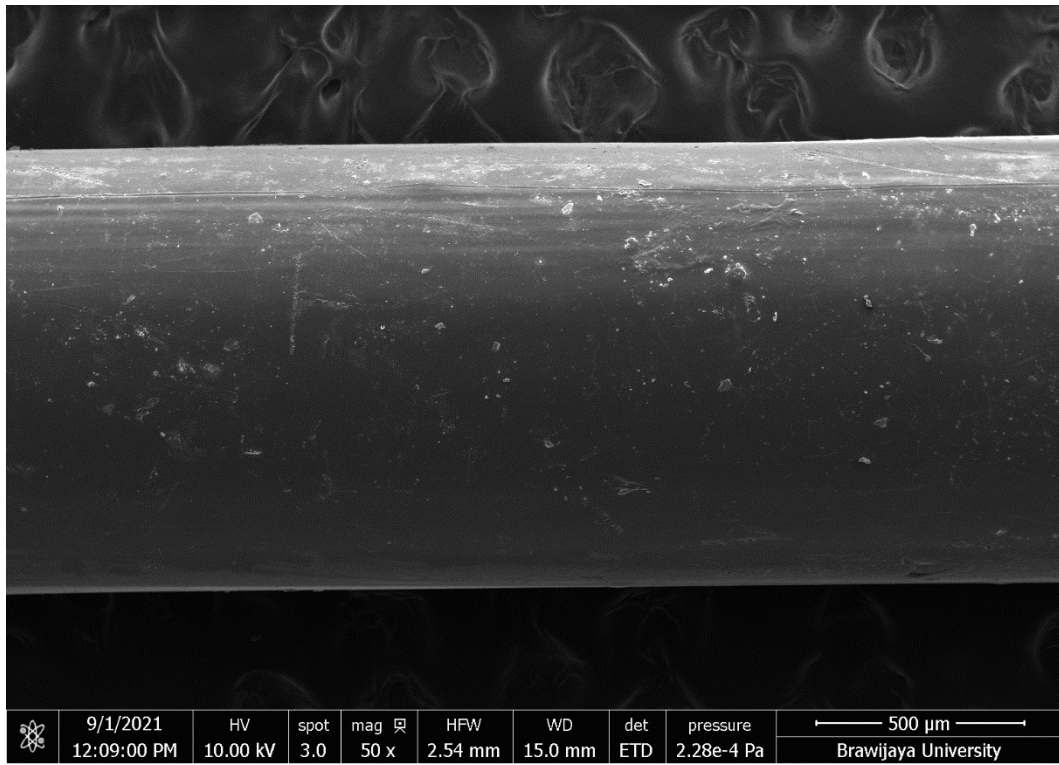
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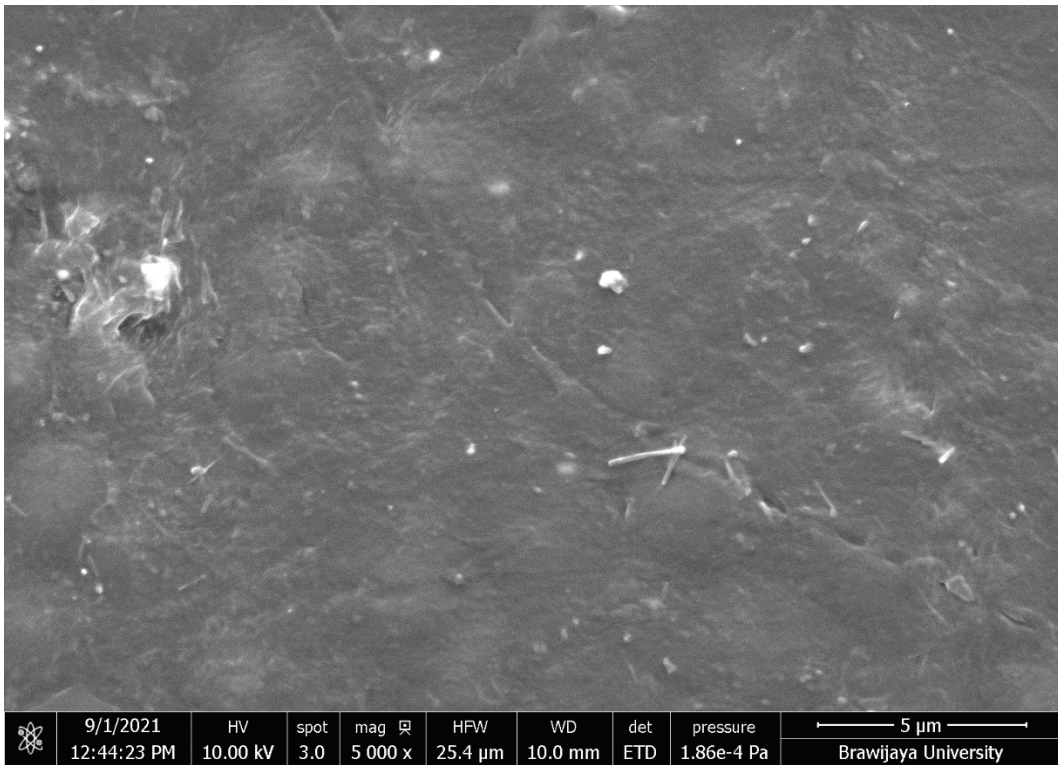
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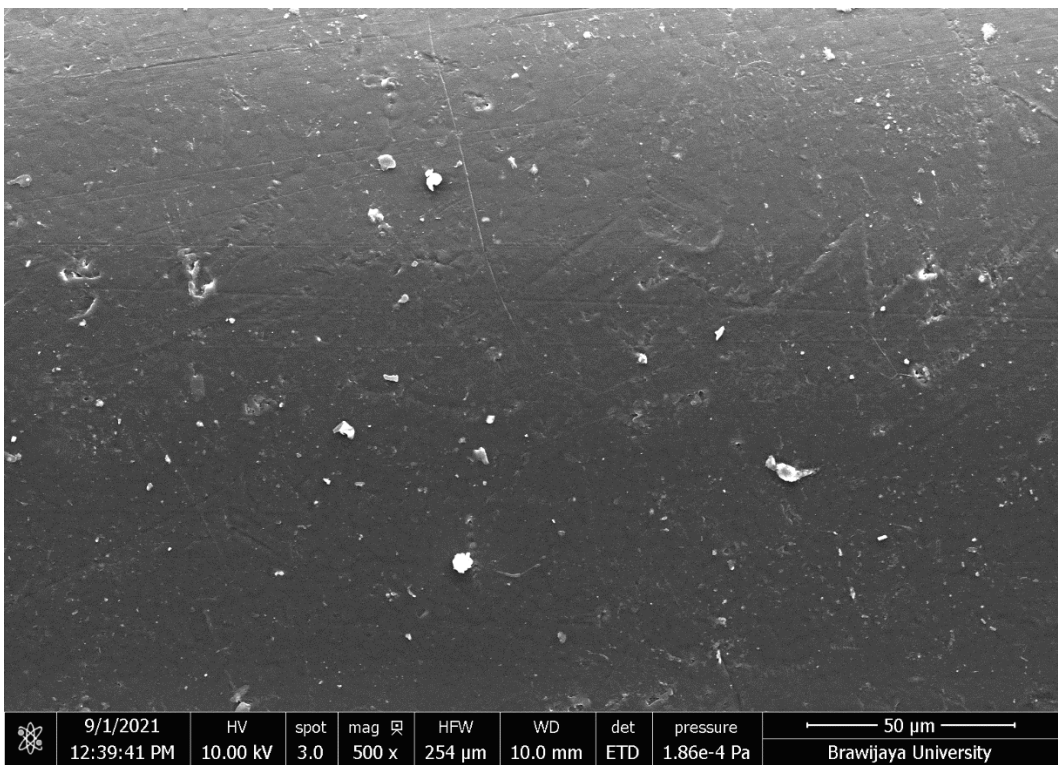
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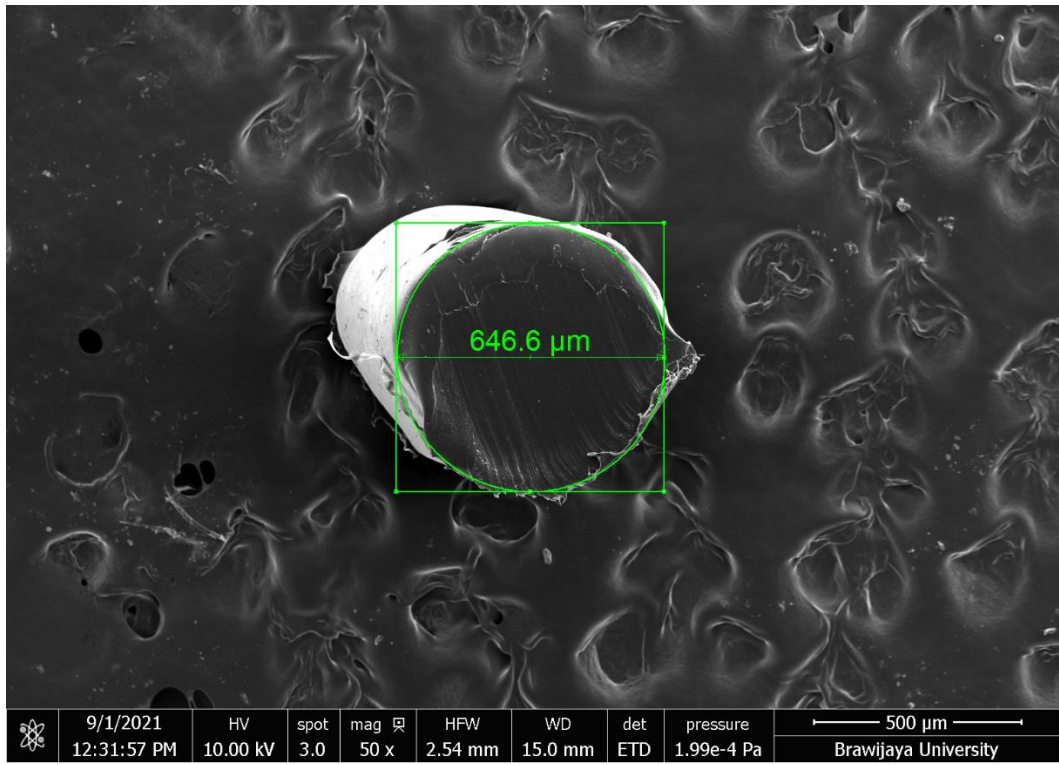
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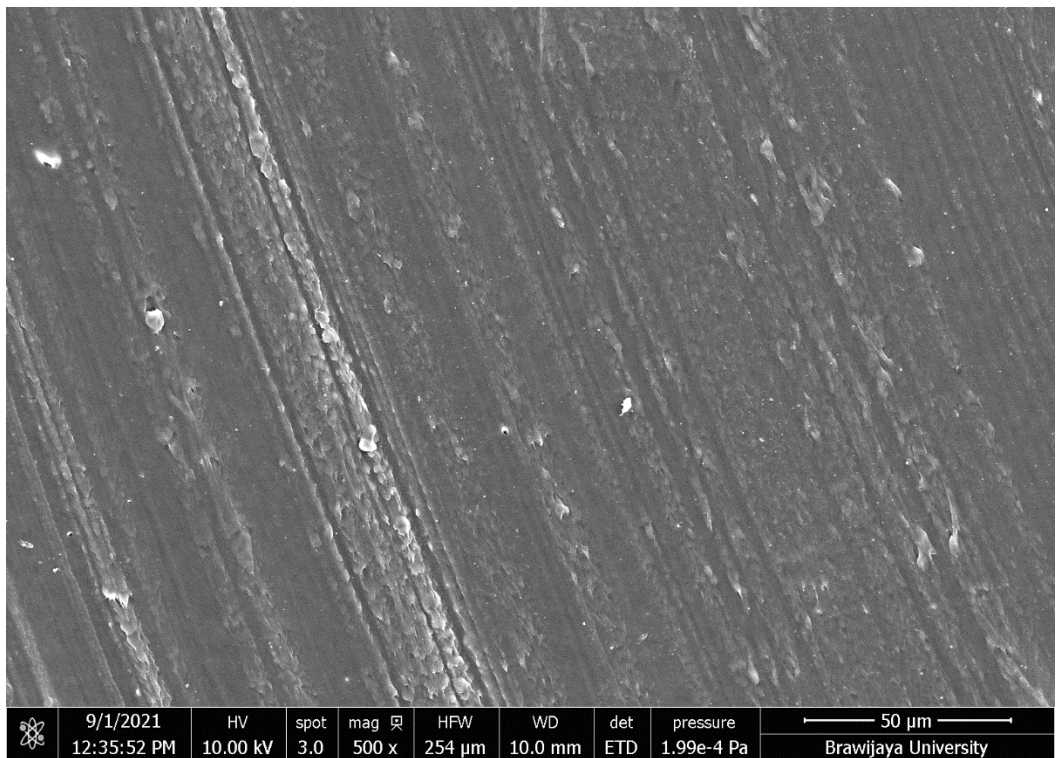
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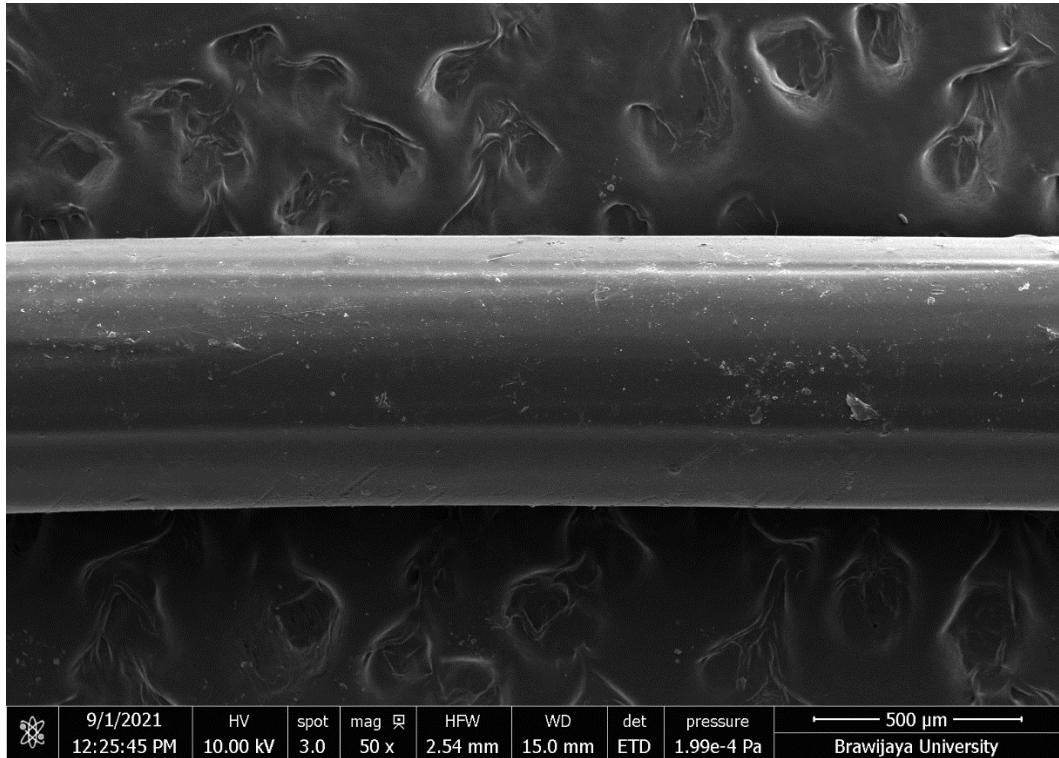
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Plastik LDPE var suhu 220-CS-50X-size



Plastik LDPE var suhu 220-CS-500X



Plastik LDPE var suhu 220-overview

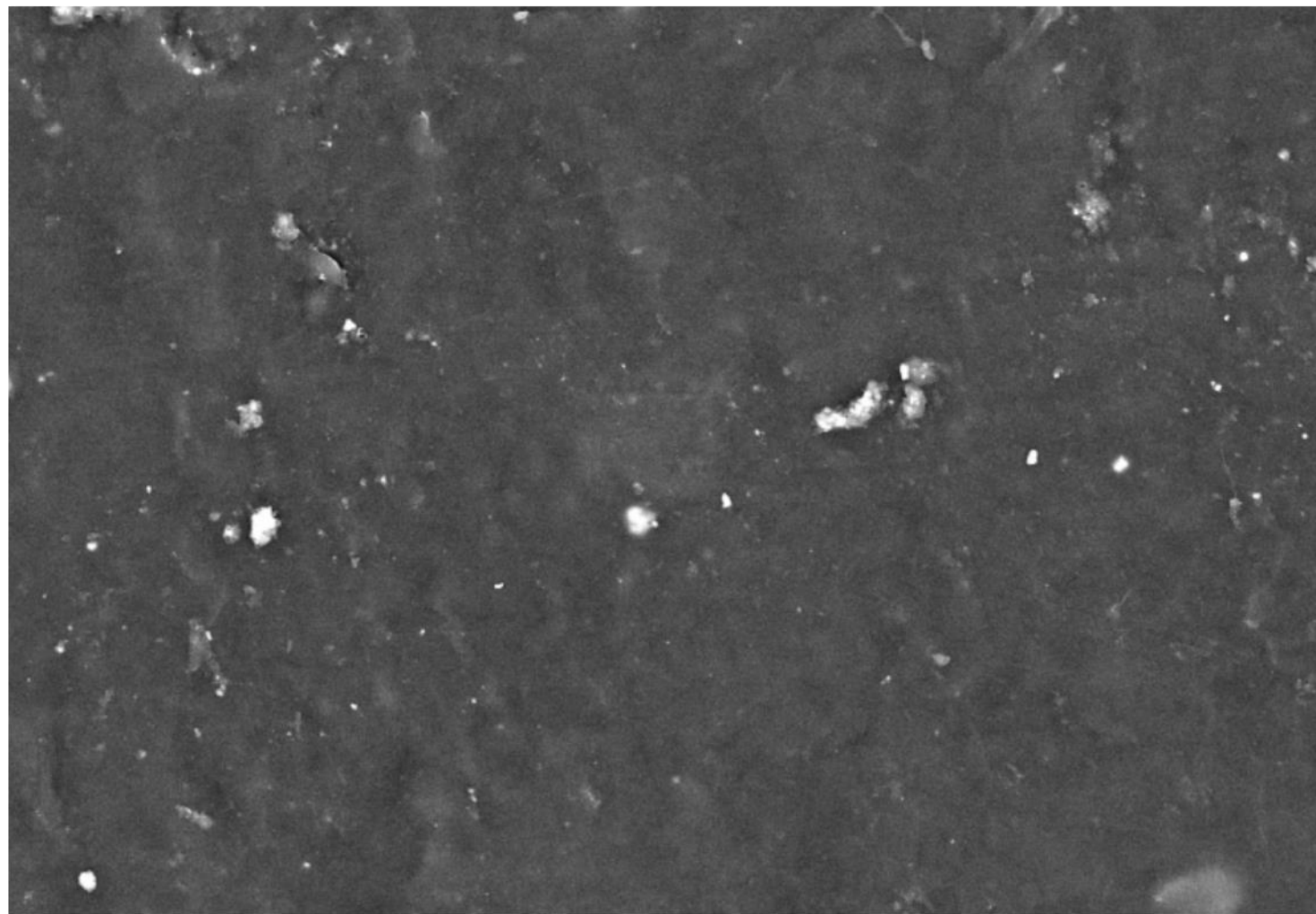
Project Notes

SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 170'

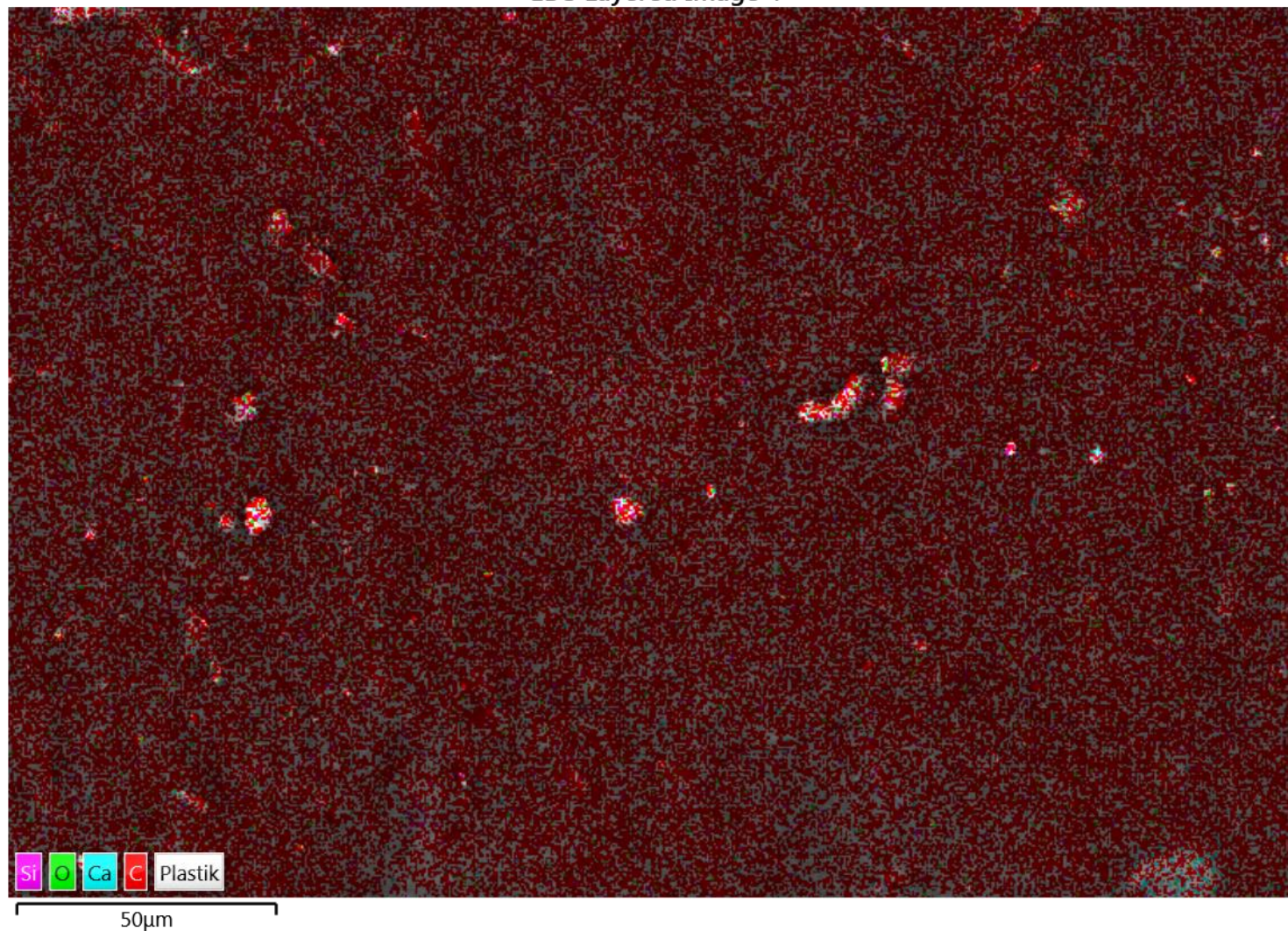
FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

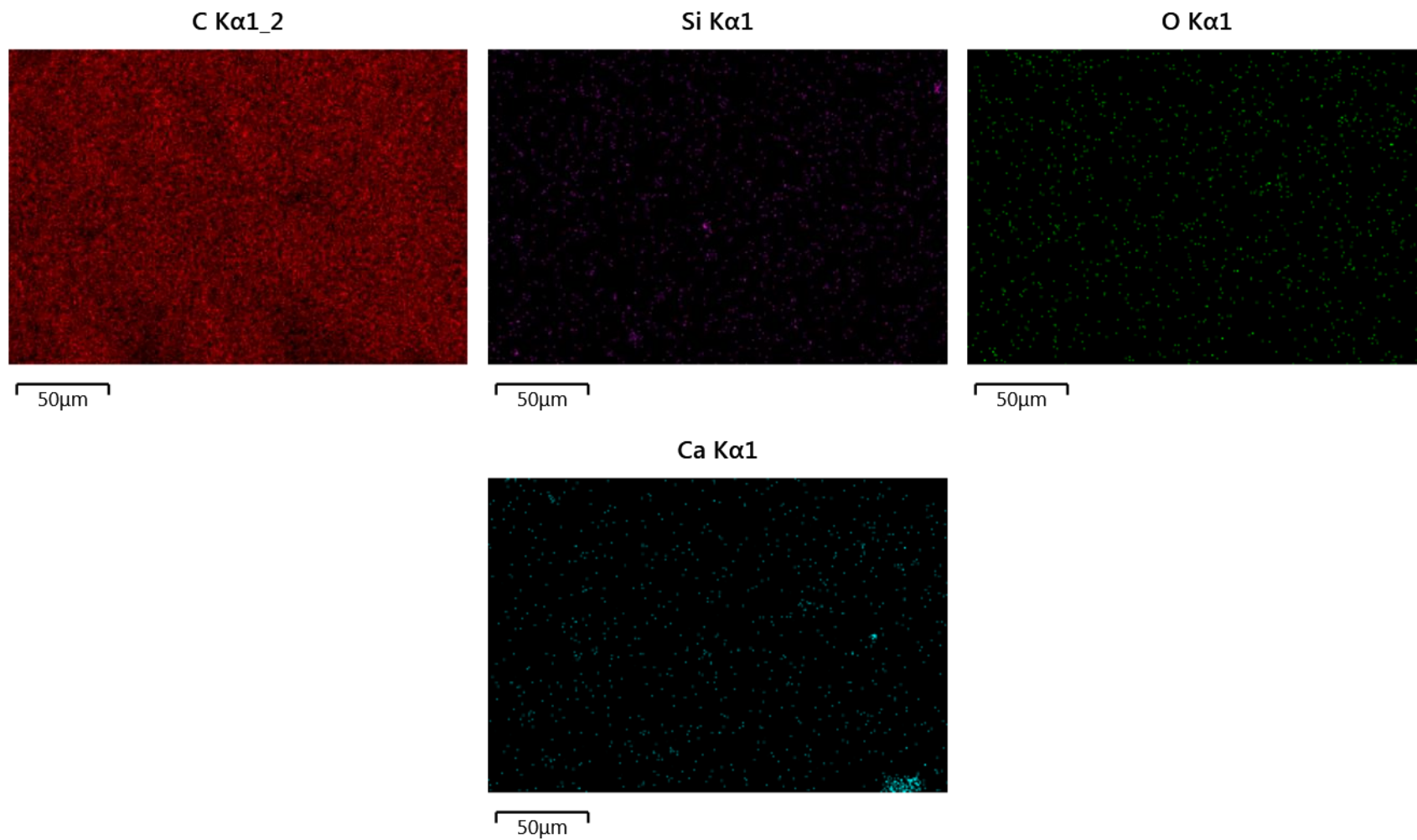
Plastik LDPE var suhu 170



50µm

EDS Layered Image 4





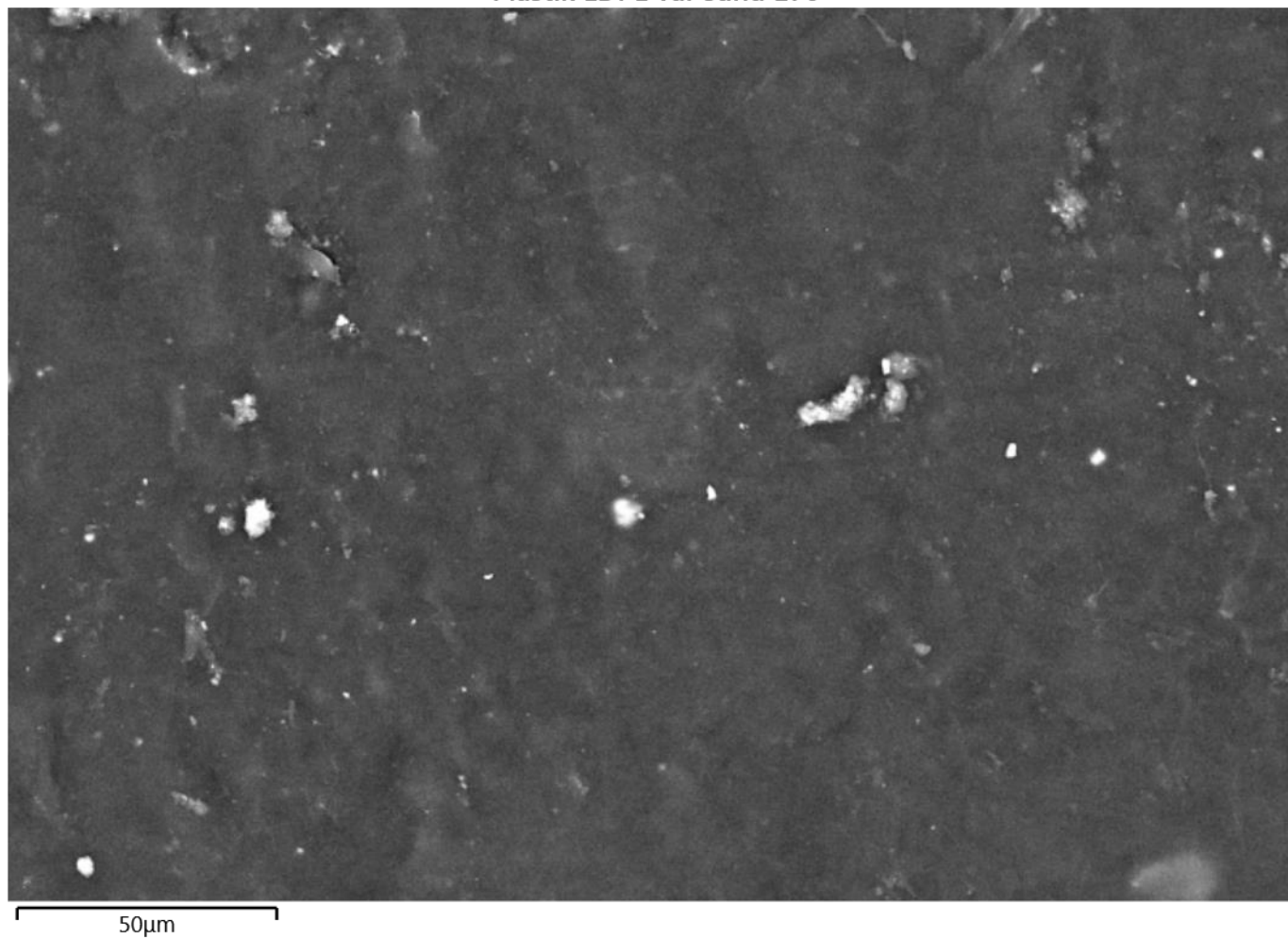
Project Notes

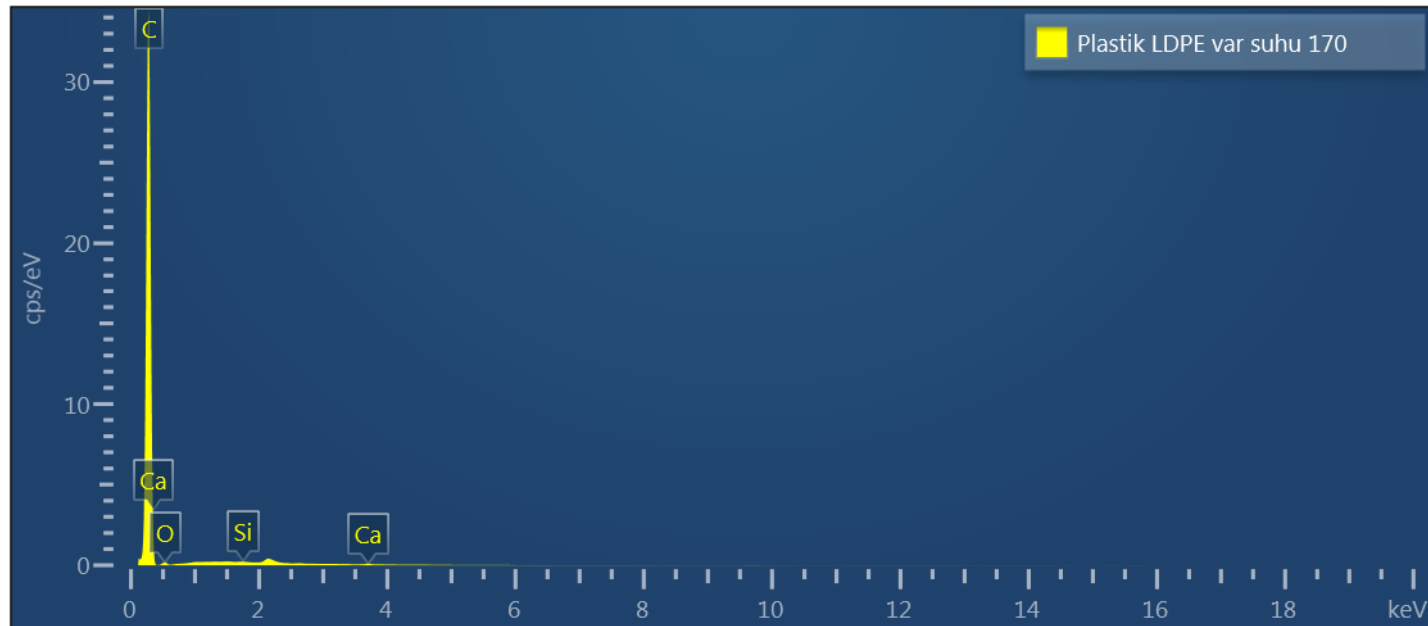
SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 170'

FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 170





Plastik LDPE var suhu 170				
Element	Line Type	Weight %	Weight % Sigma	Atomic %
C	K series	97.98	0.23	98.54
Ca	K series	0.12	0.02	0.04

O	K series	1.88	0.23	1.42
Si	K series	0.03	0.02	0.01
Total		100.00		100.00

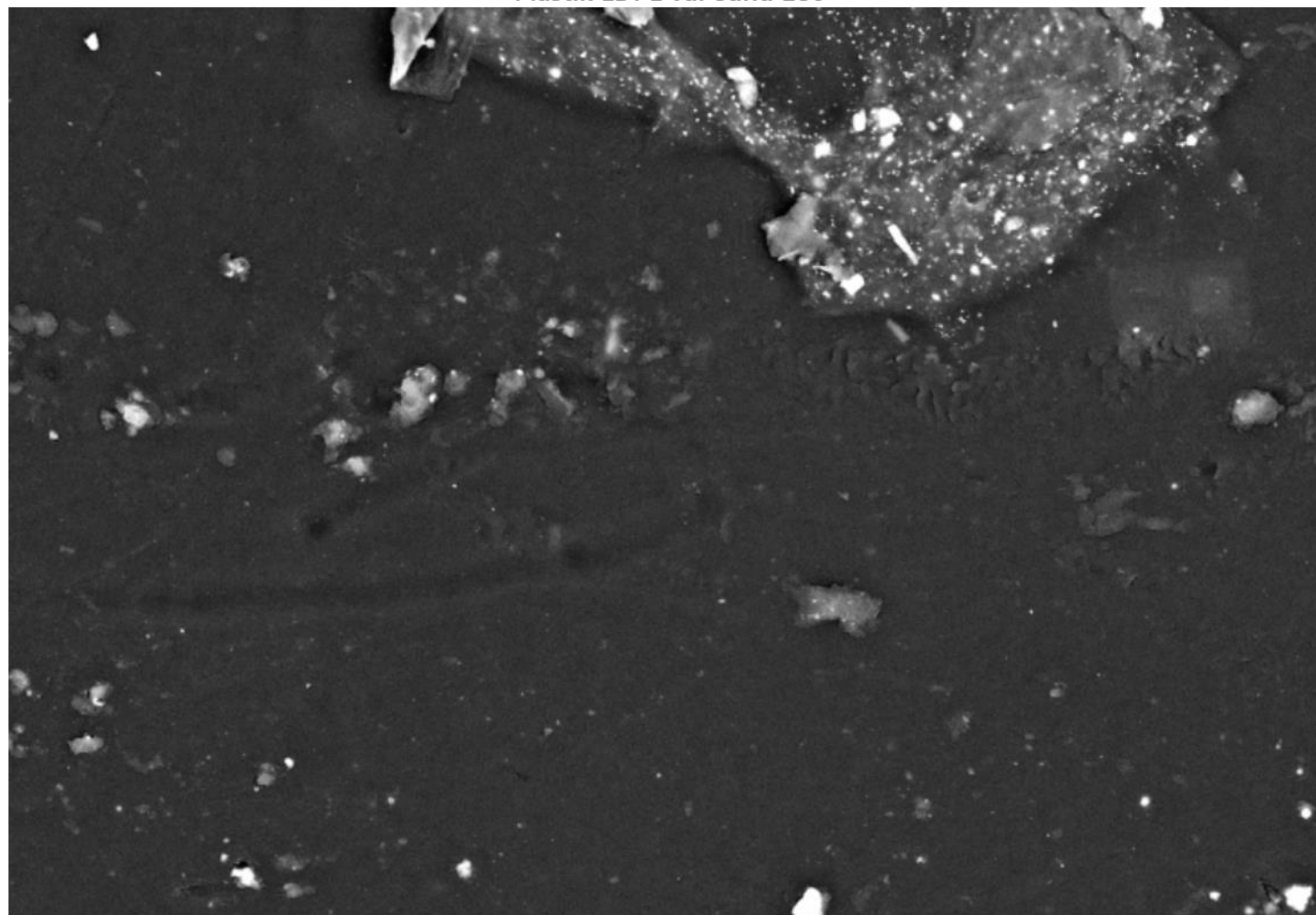
Project Notes

SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 180'

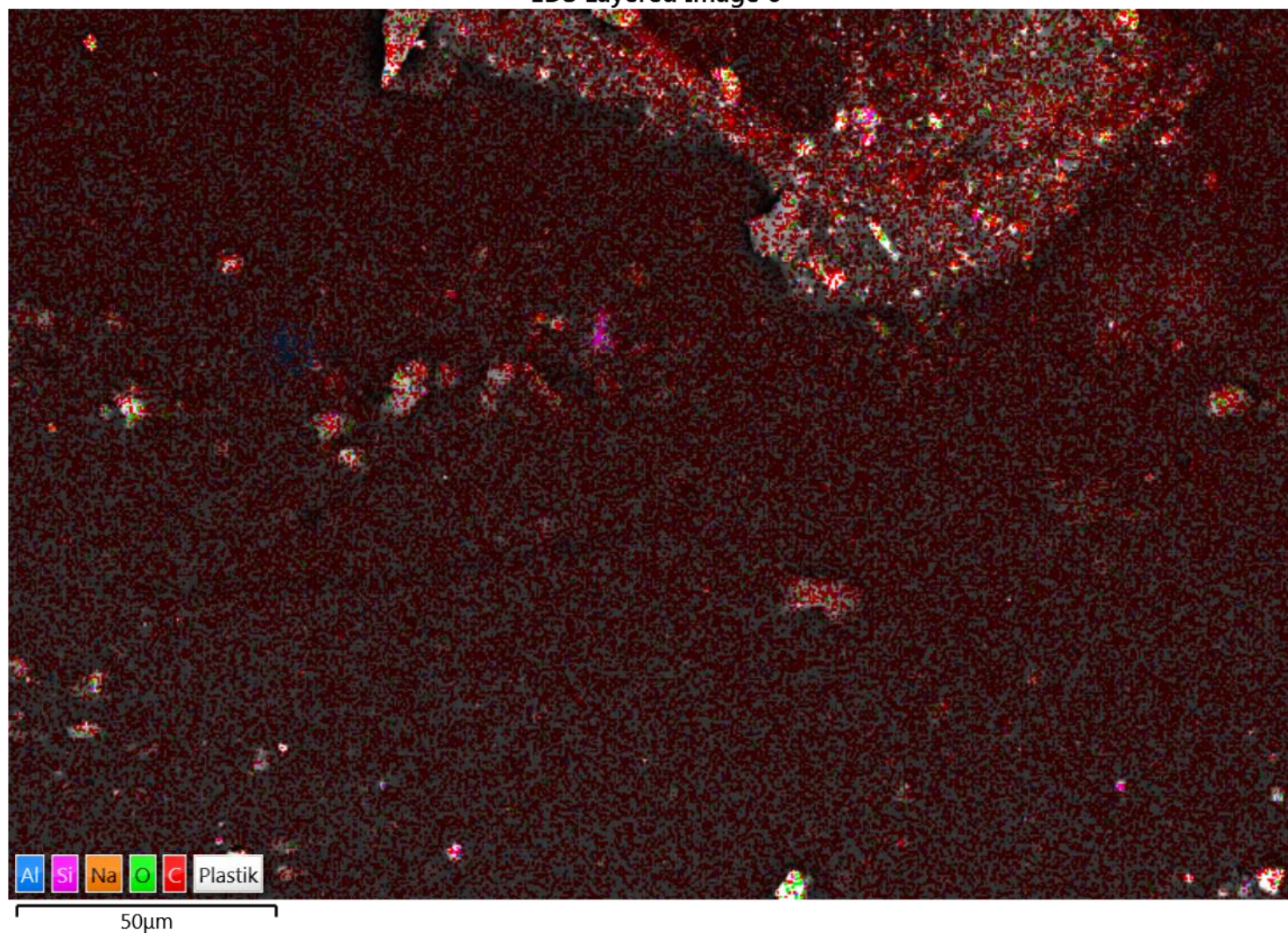
FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

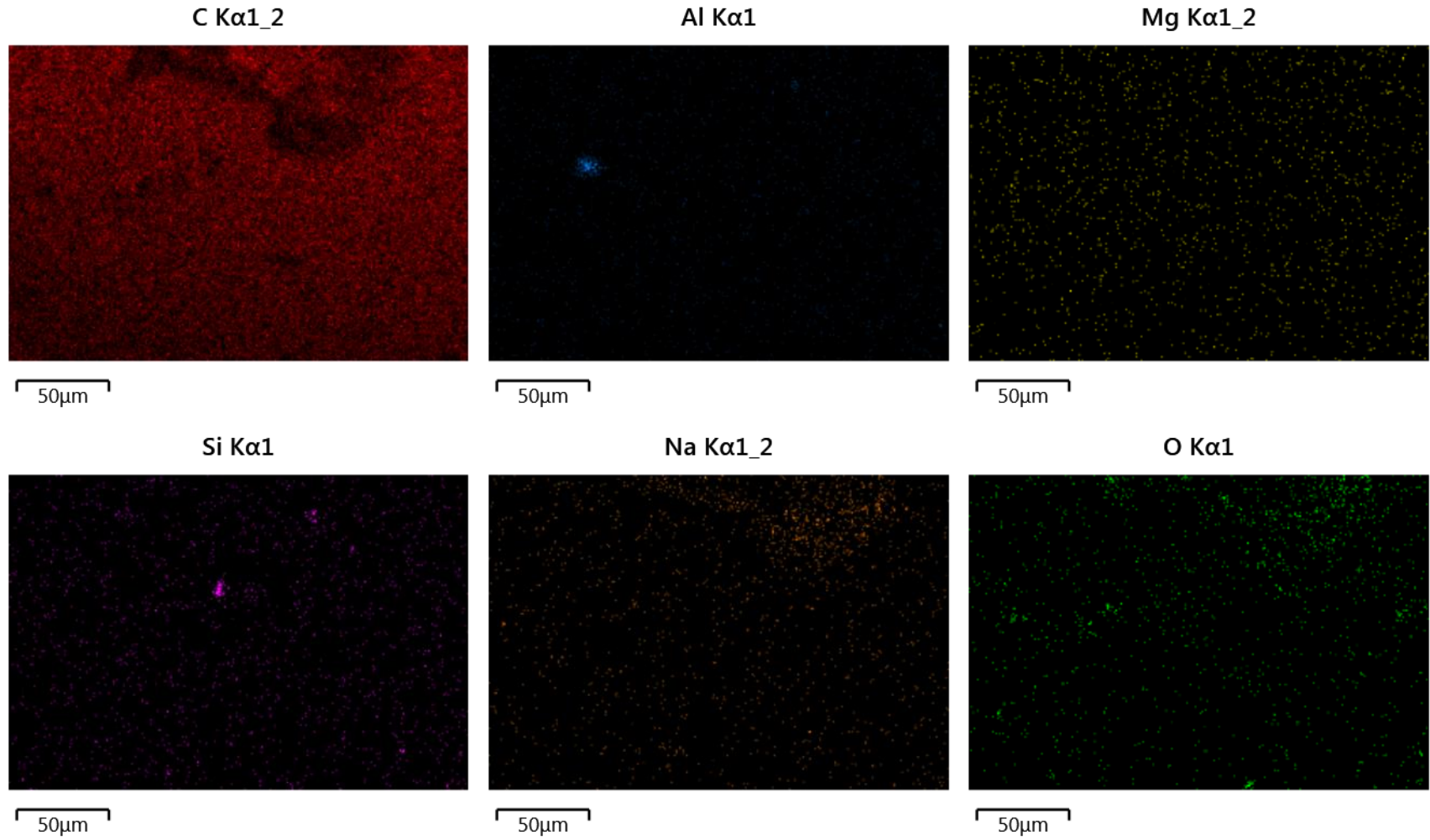
Plastik LDPE var suhu 180



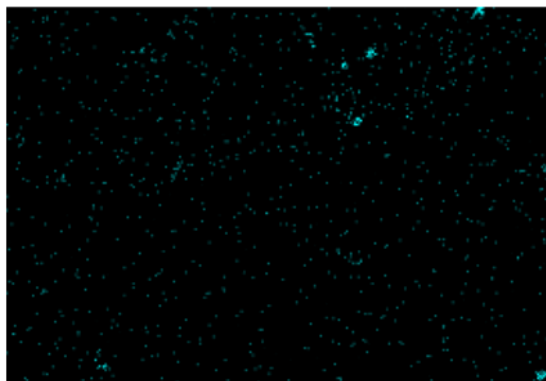
50µm

EDS Layered Image 6





Ca K α 1



50 μ m

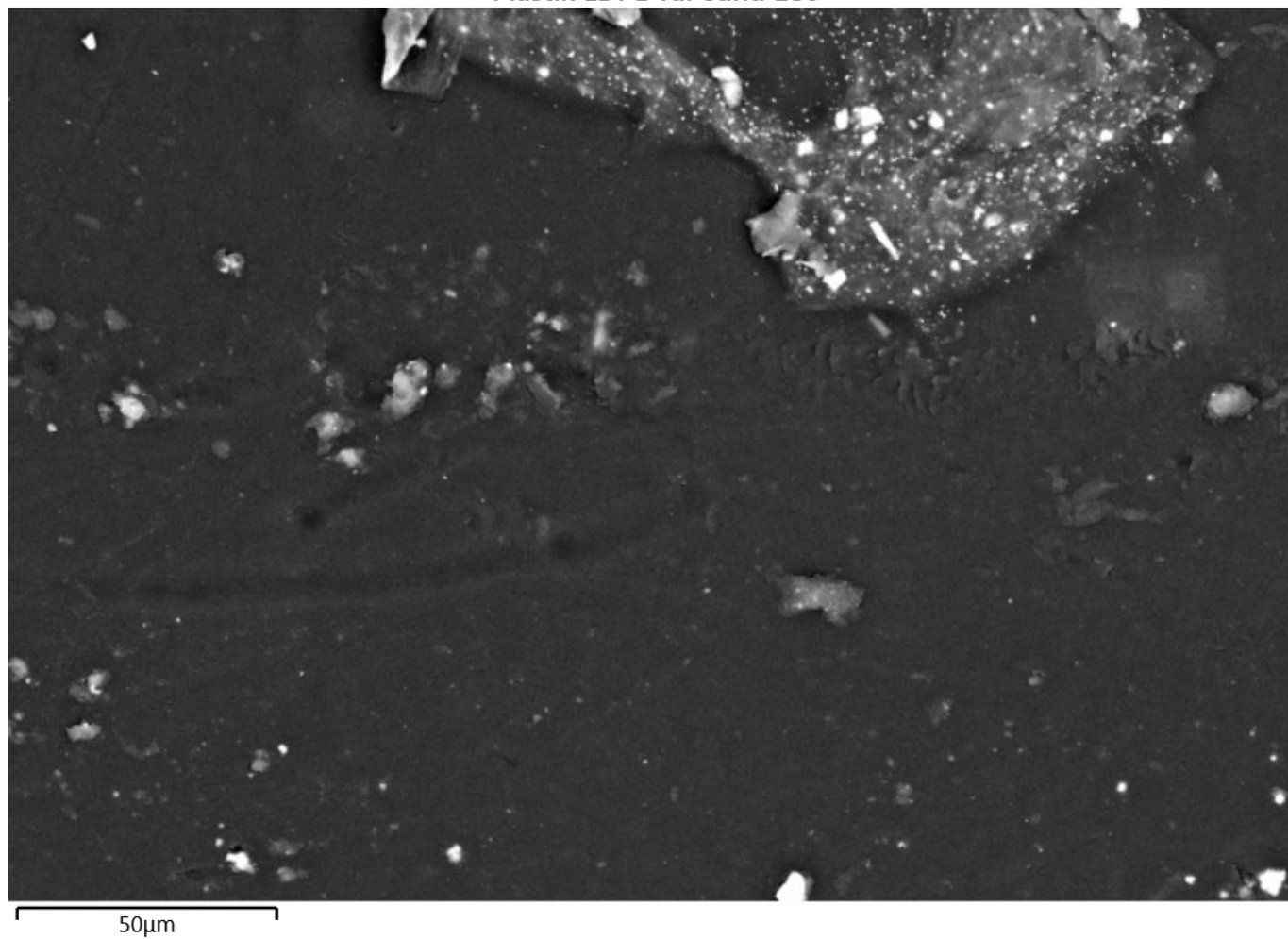
Project Notes

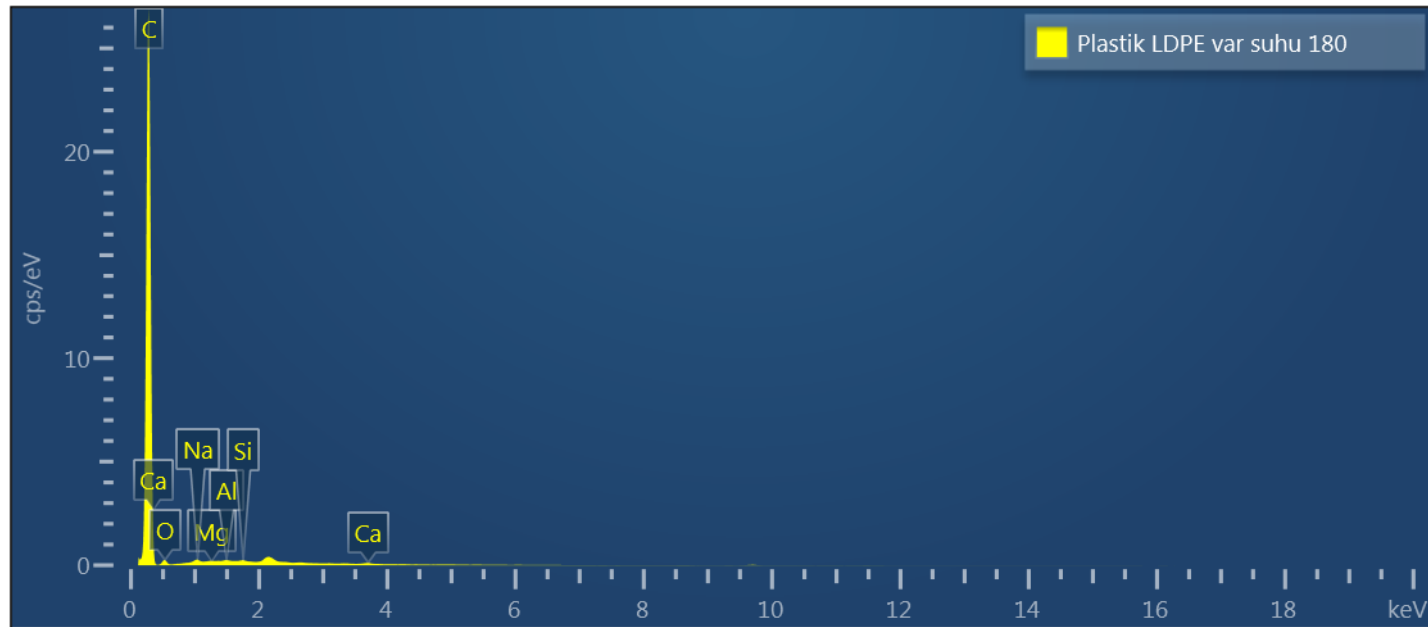
SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 180'

FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 180





Plastik LDPE var suhu 180				
Element	Line Type	Weight %	Weight % Sigma	Atomic %
C	K series	95.69	0.29	96.90
Ca	K series	0.13	0.03	0.04
O	K series	3.75	0.29	2.85
Na	K series	0.23	0.04	0.12
Mg	K series	0.03	0.03	0.01
Al	K series	0.08	0.03	0.03
Si	K series	0.09	0.02	0.04
Total		100.00		100.00

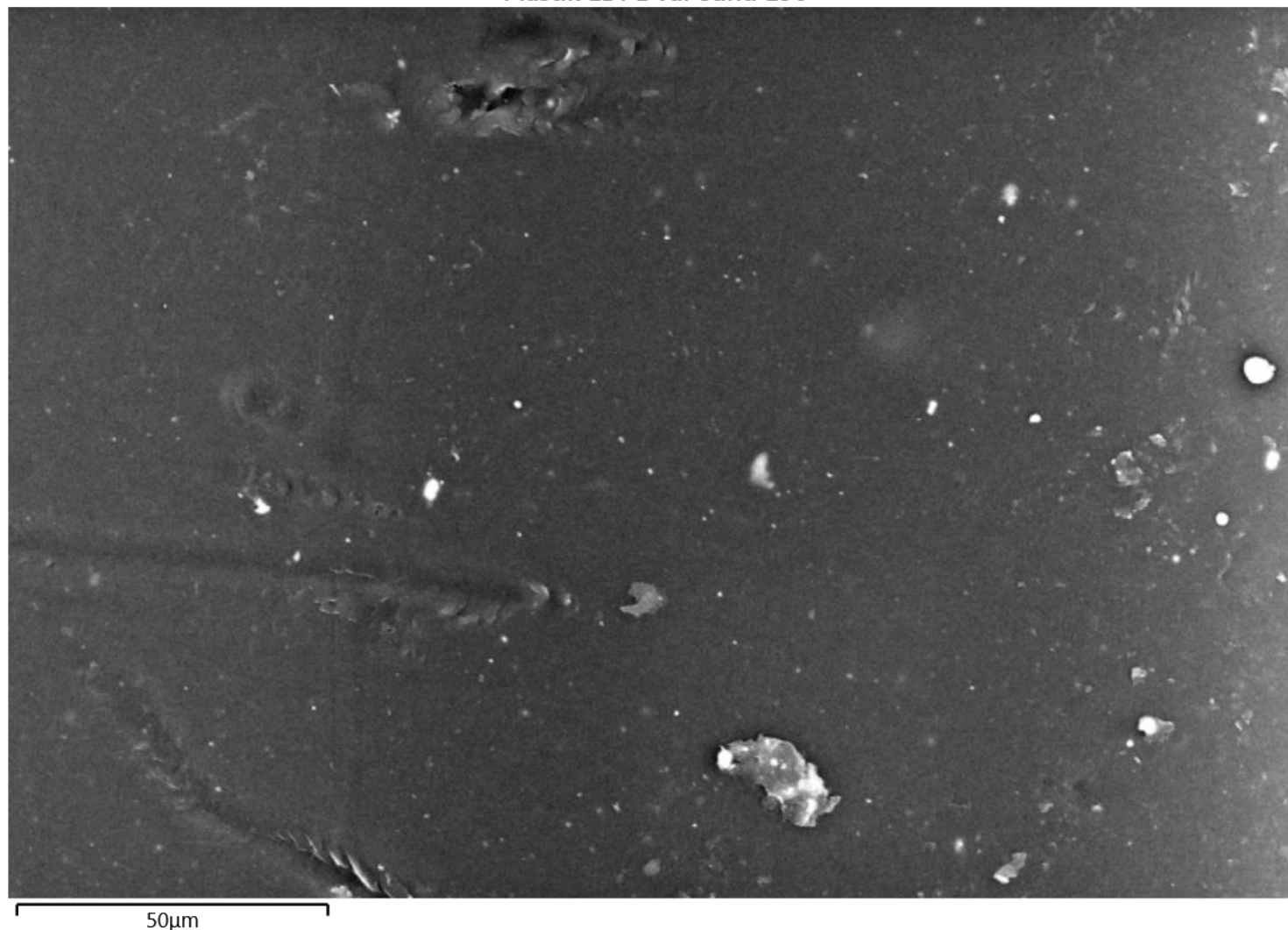
Project Notes

SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

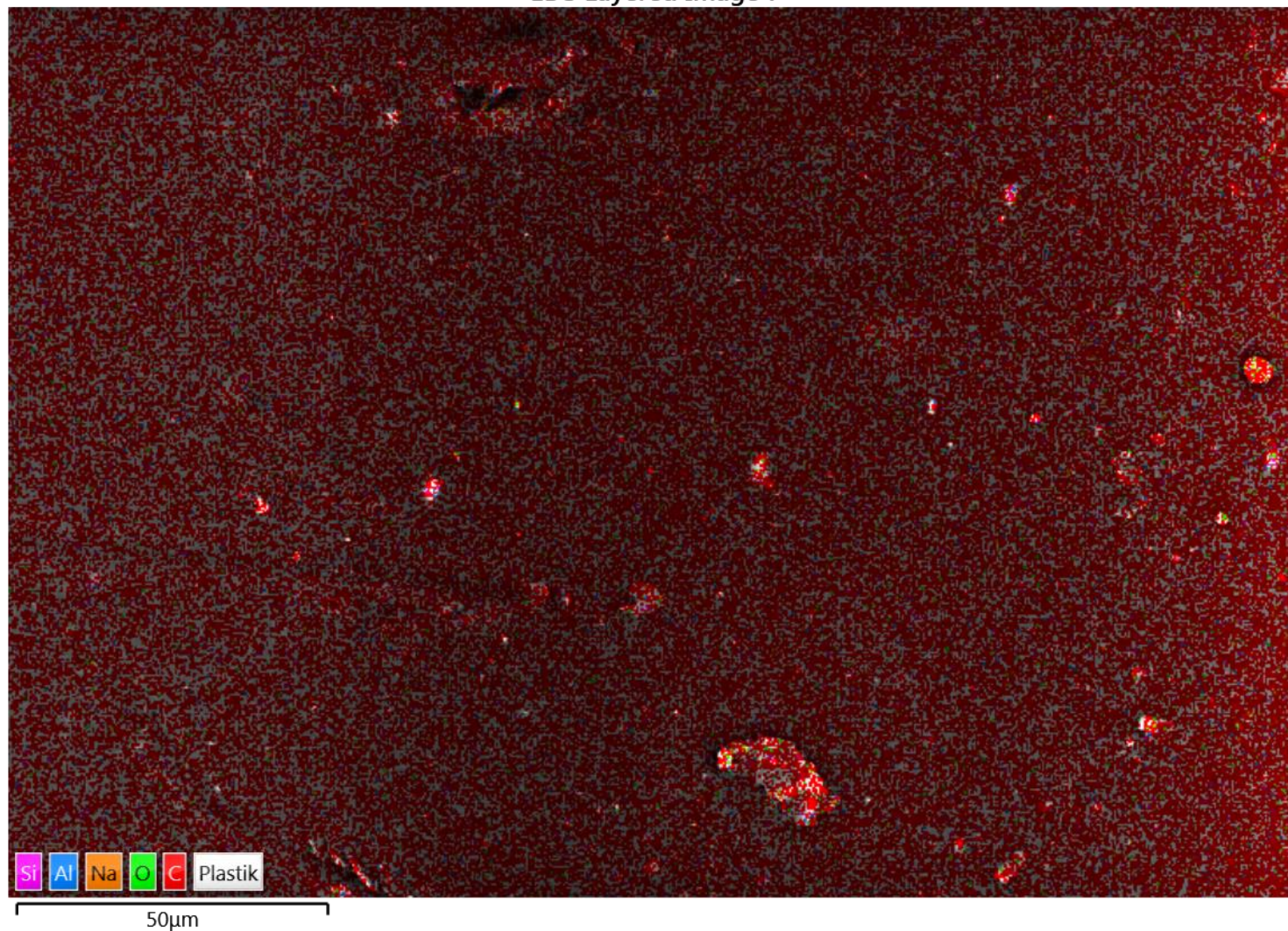
Specimen Notes for 'Plastik LDPE var suhu 190'

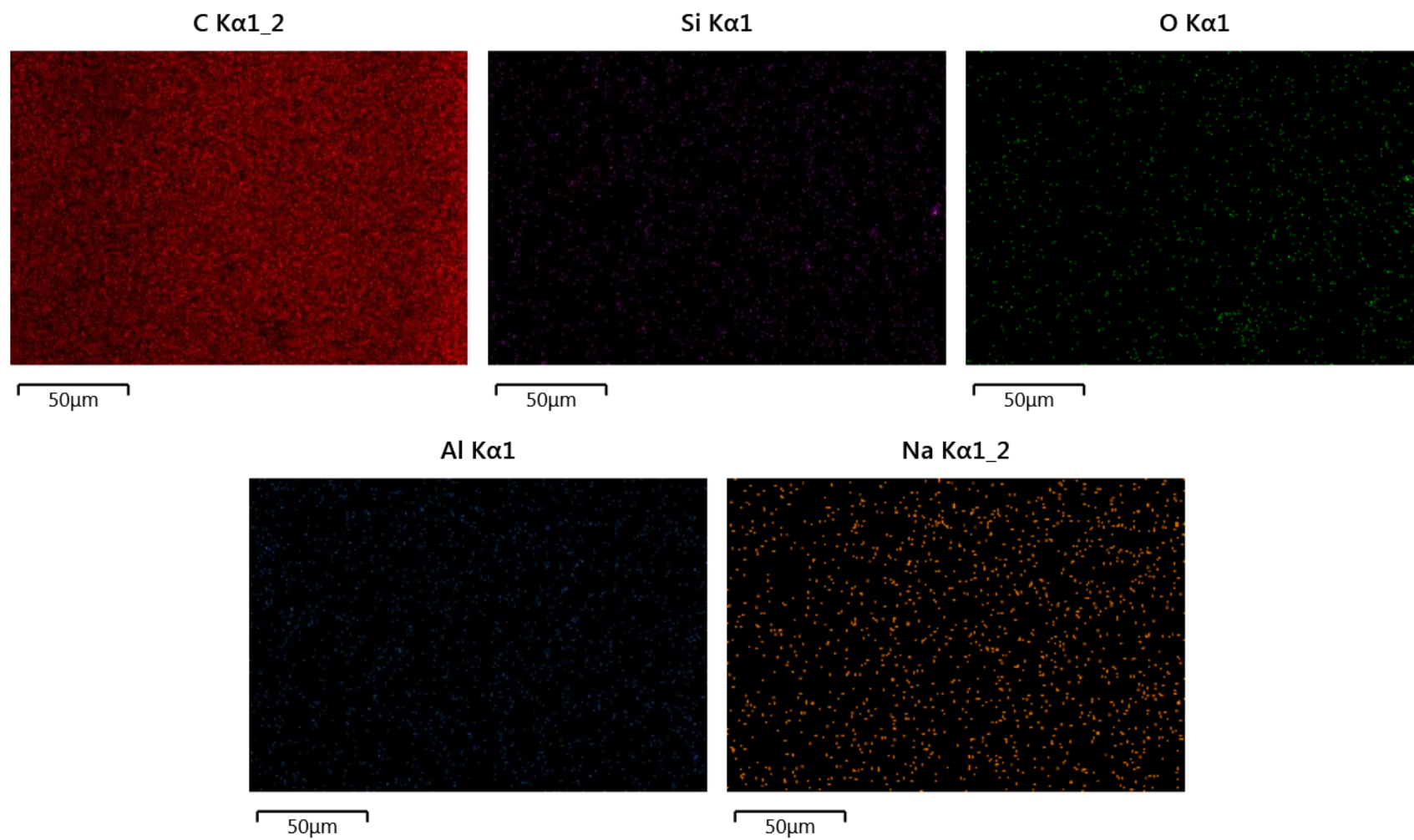
FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 190



EDS Layered Image 7





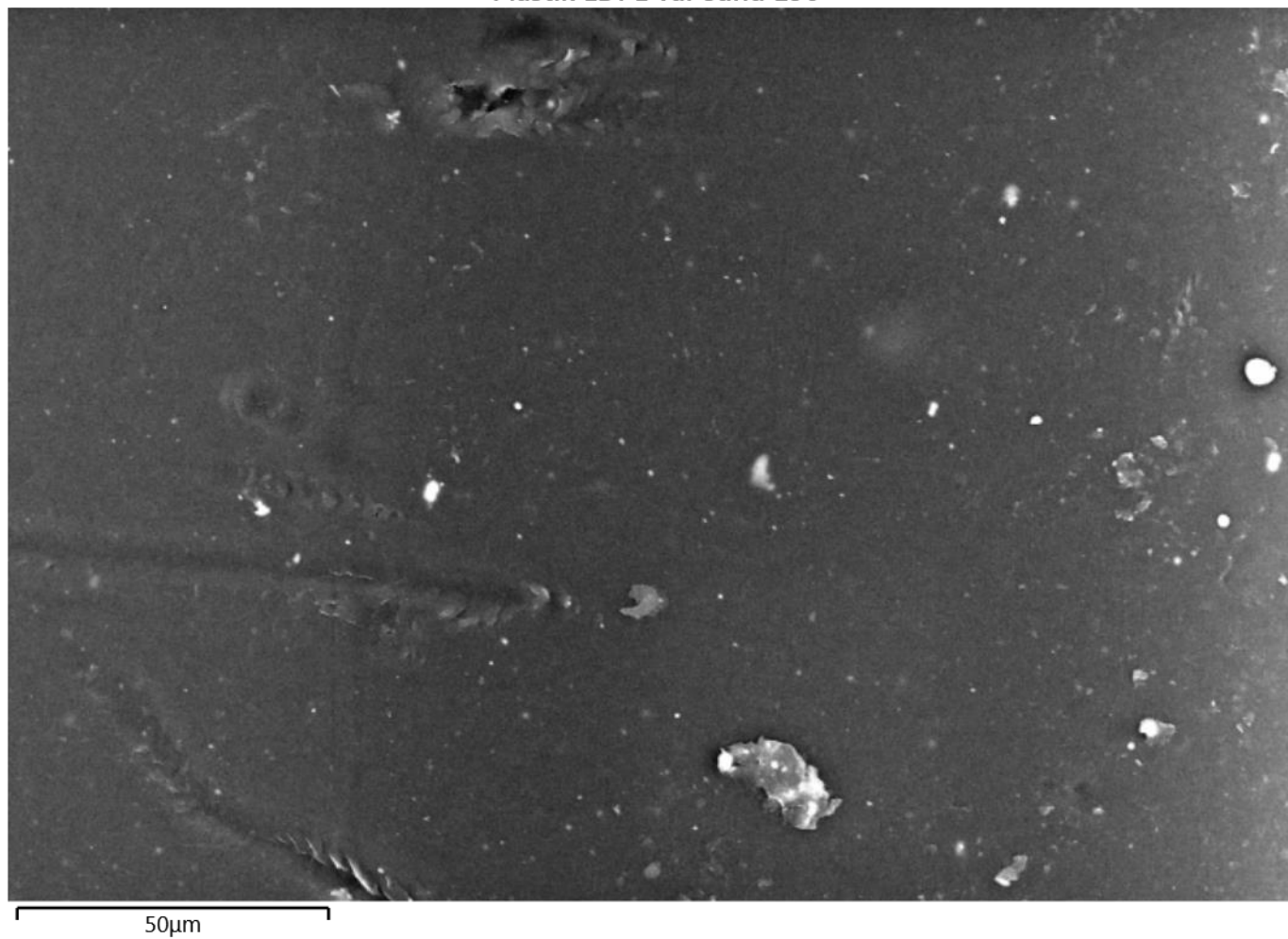
Project Notes

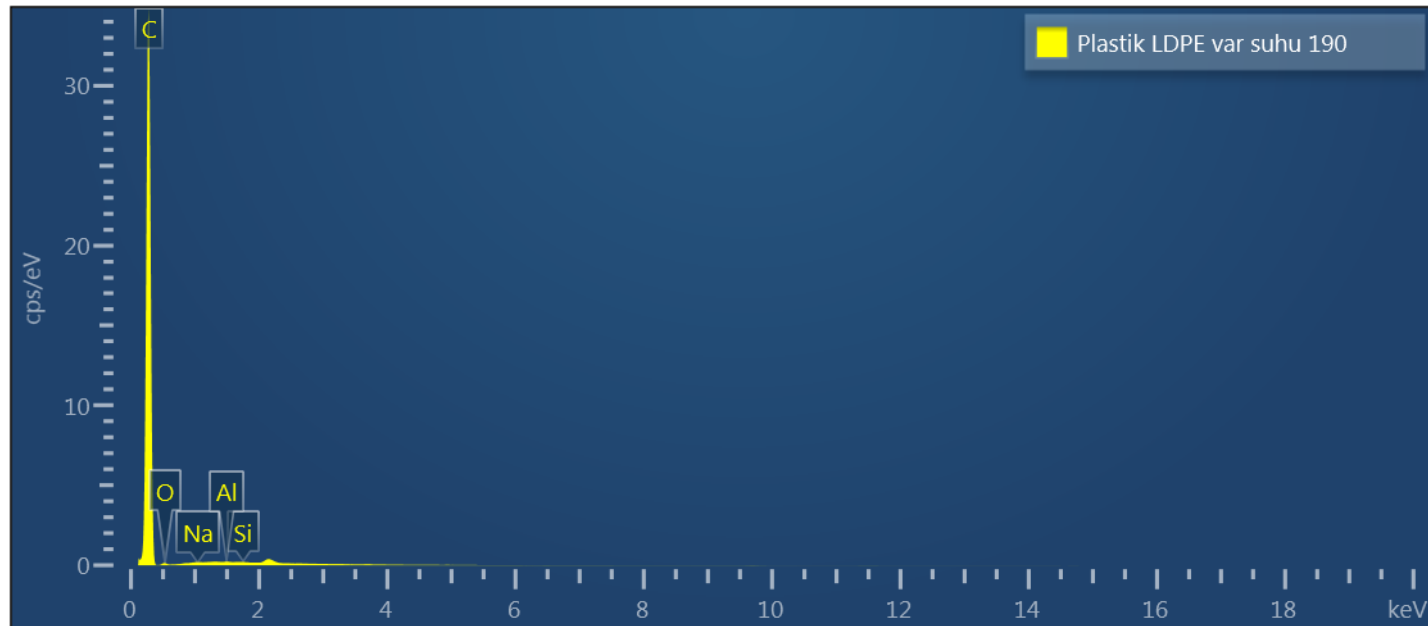
SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 190'

FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 190





Plastik LDPE var suhu 190				
Element	Line Type	Weight %	Weight % Sigma	Atomic %
C	K series	97.54	0.21	98.17
O	K series	2.35	0.20	1.78
Na	K series	0.05	0.03	0.02
Al	K series	0.05	0.02	0.02
Si	K series	0.02	0.02	0.01
Total		100.00		100.00

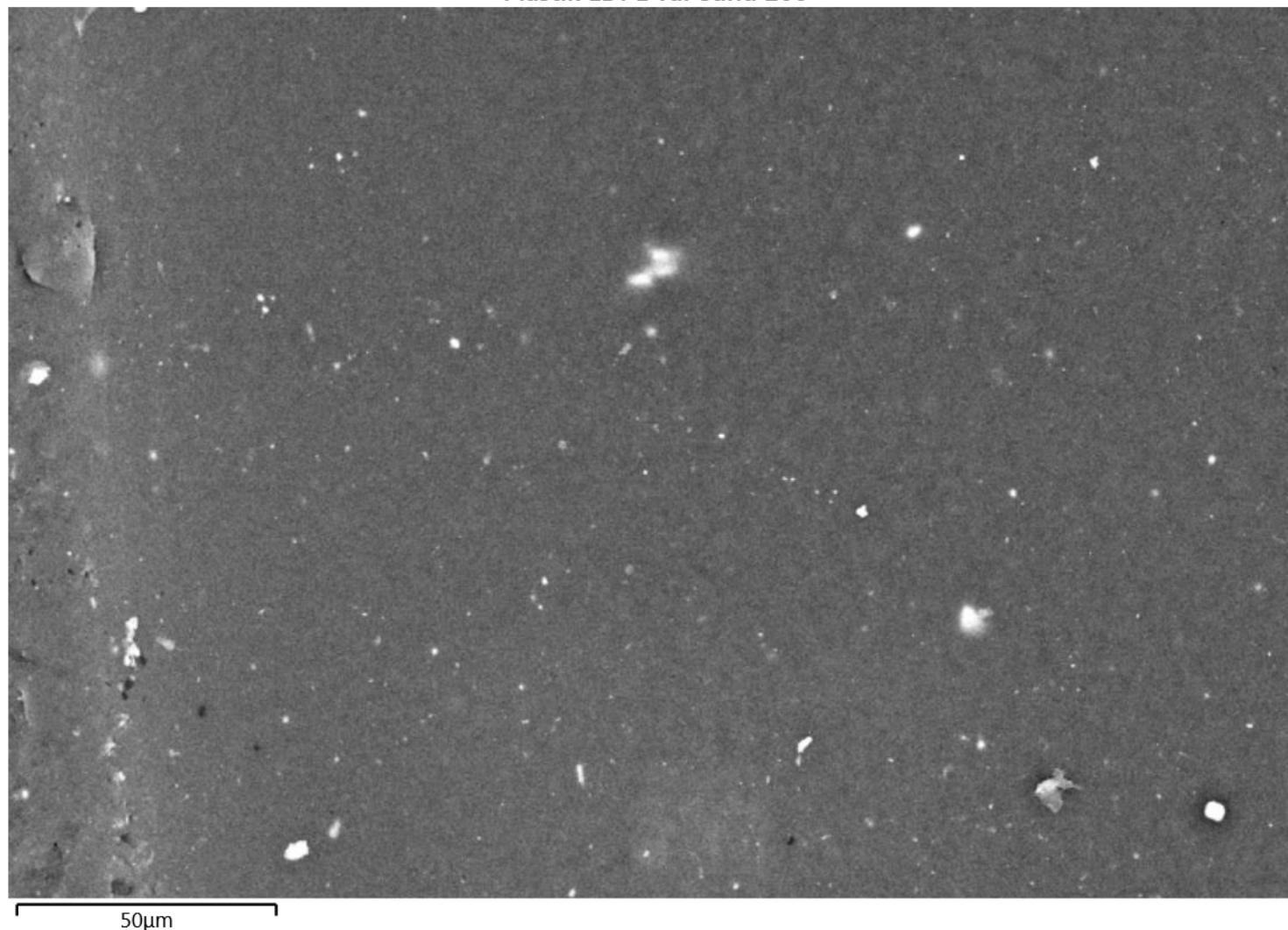
Project Notes

SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

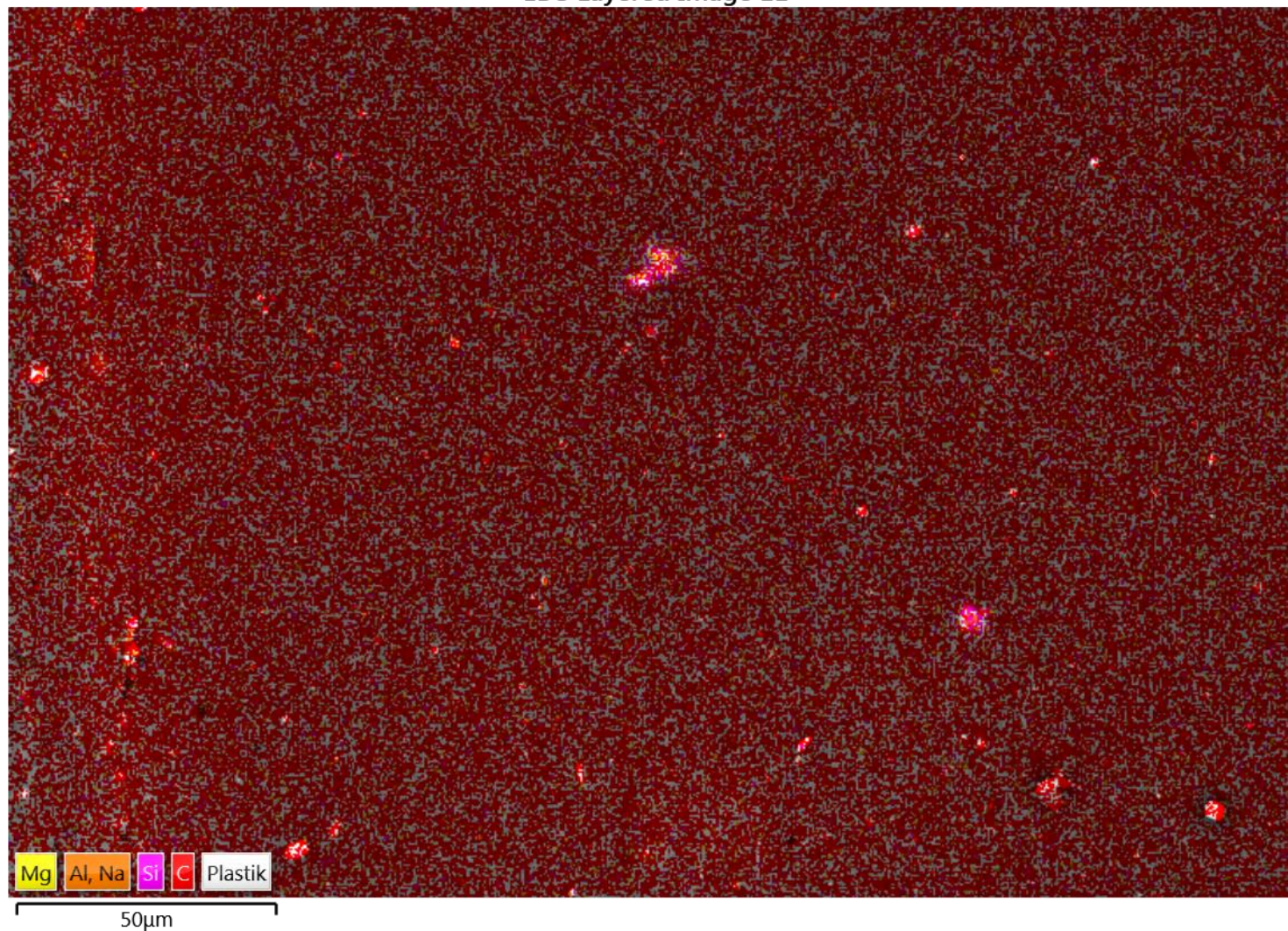
Specimen Notes for 'Plastik LDPE var suhu 200'

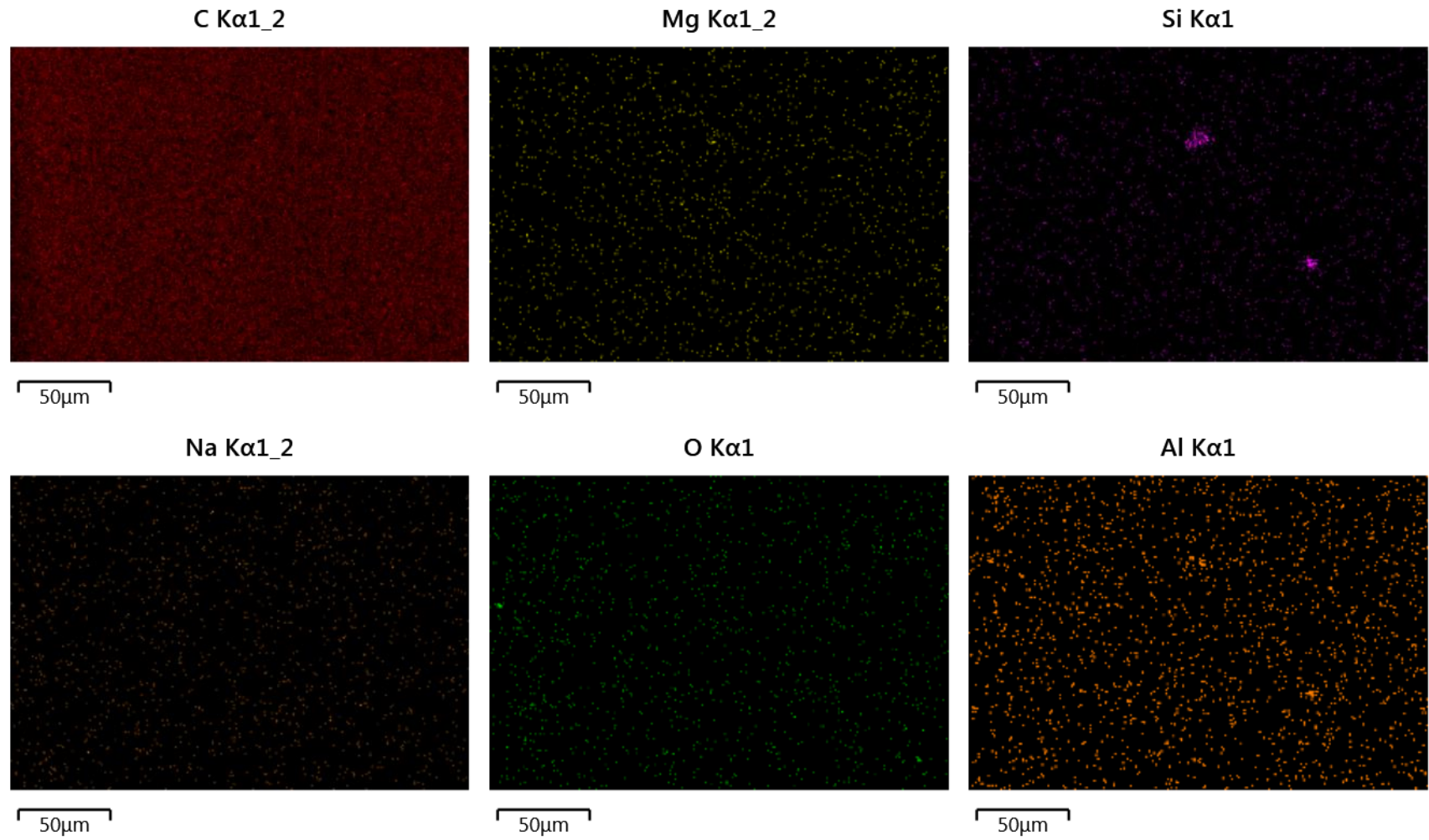
FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 200



EDS Layered Image 11





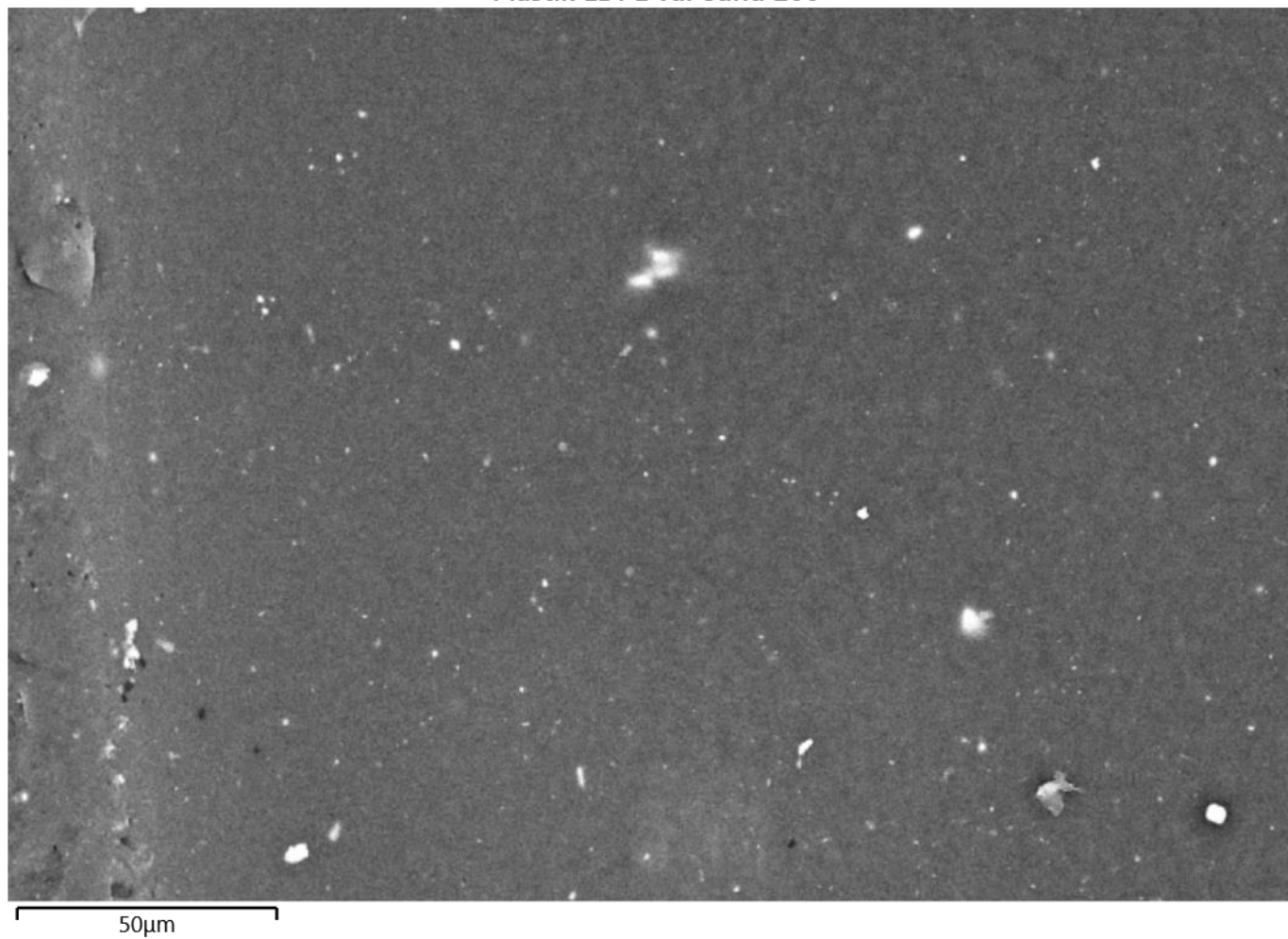
Project Notes

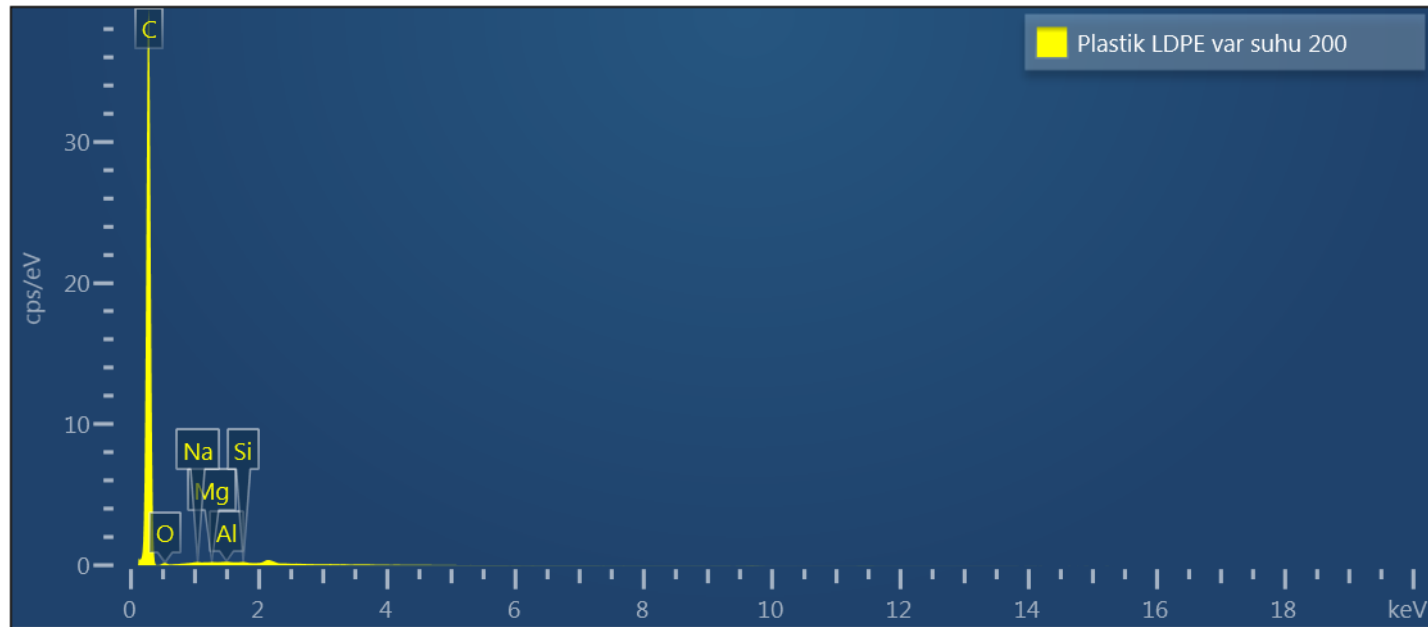
SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 200'

FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 200





Plastik LDPE var suhu 200				
Element	Line Type	Weight %	Weight % Sigma	Atomic %
C	K series	97.41	0.20	98.09
O	K series	2.41	0.20	1.83
Na	K series	0.06	0.03	0.03
Si	K series	0.05	0.02	0.02
Mg	K series	0.02	0.02	0.01
Al	K series	0.03	0.02	0.01
Total		100.00		100.00

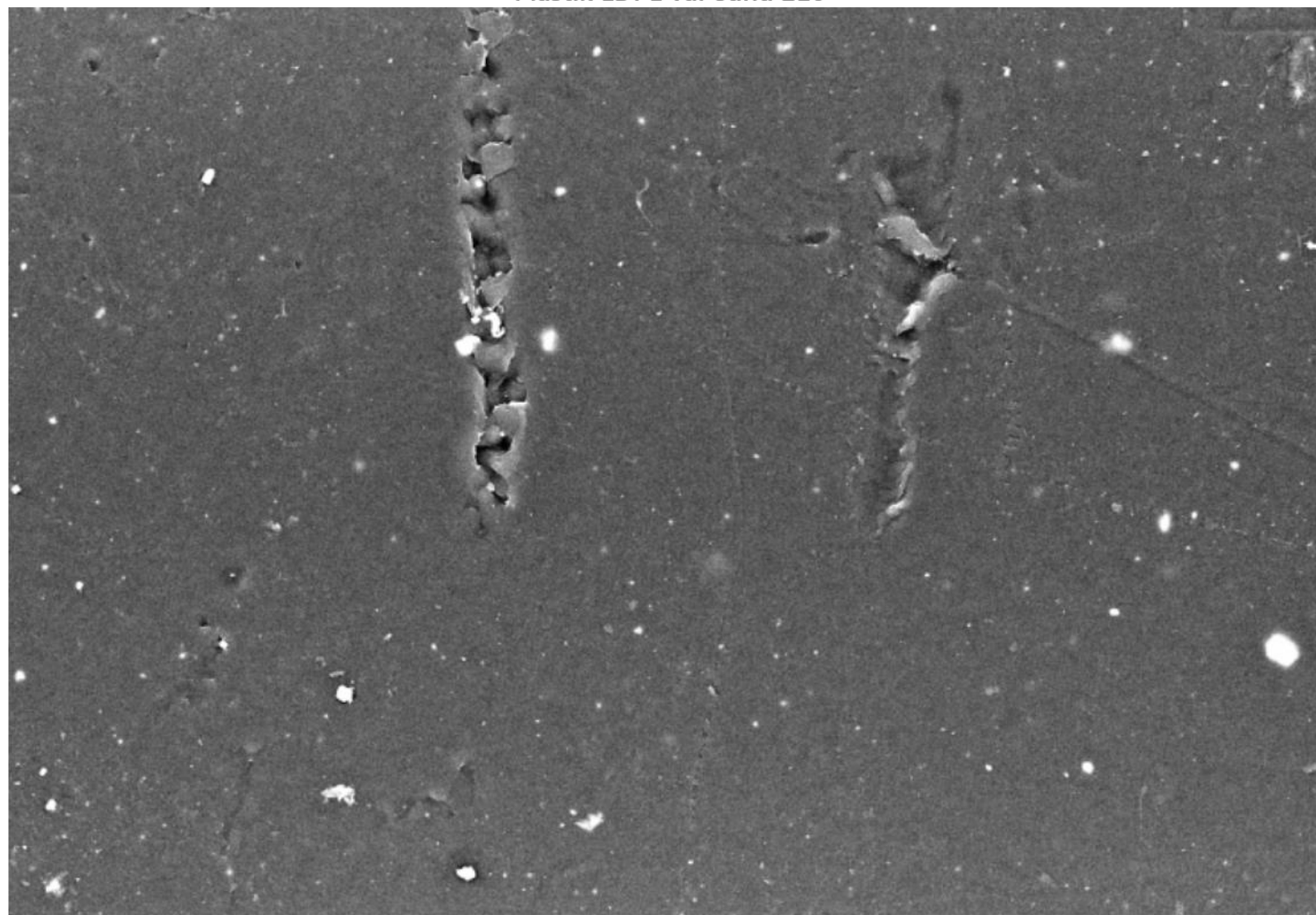
Project Notes

SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 210'

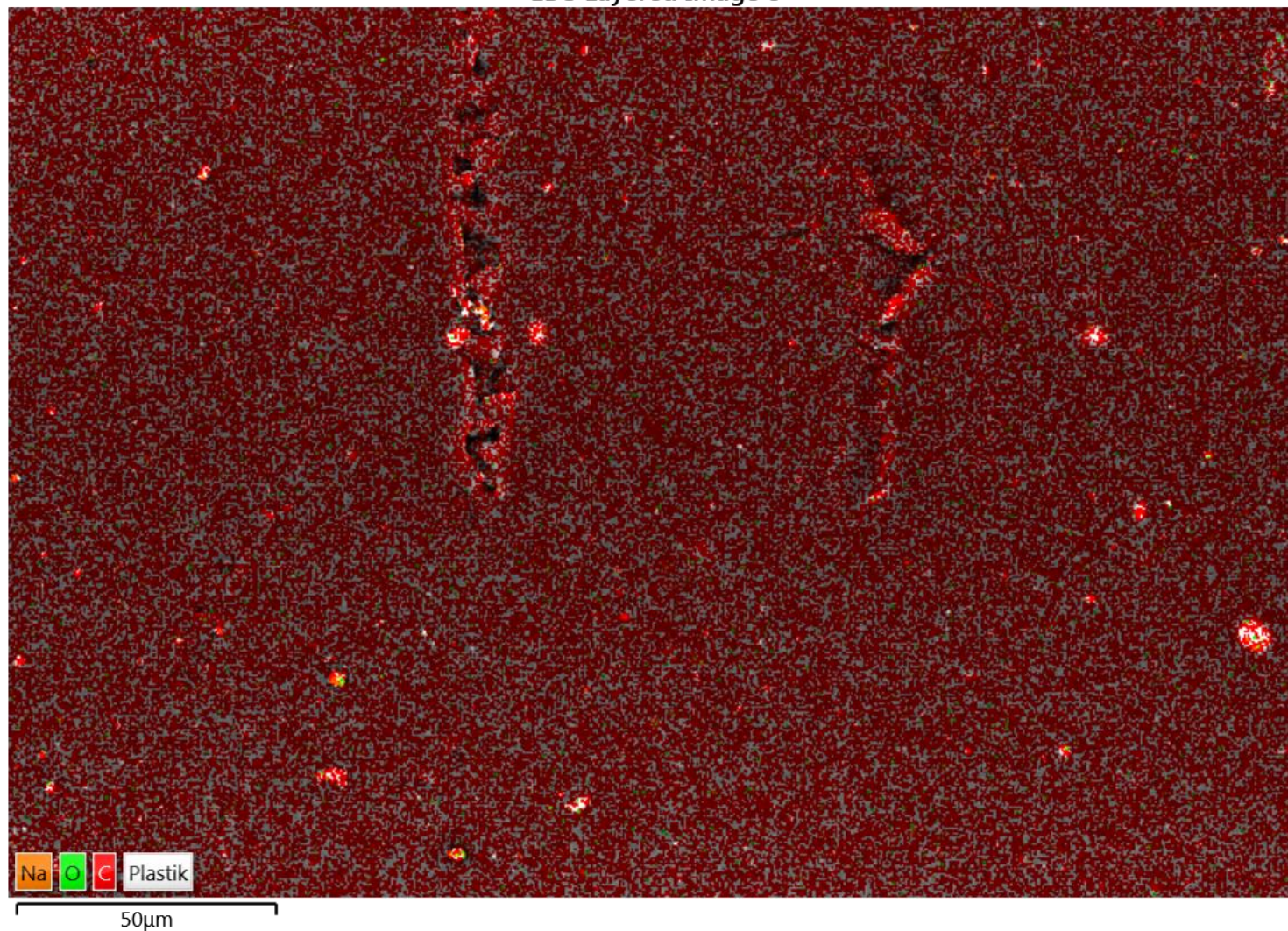
FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coate

Plastik LDPE var suhu 210

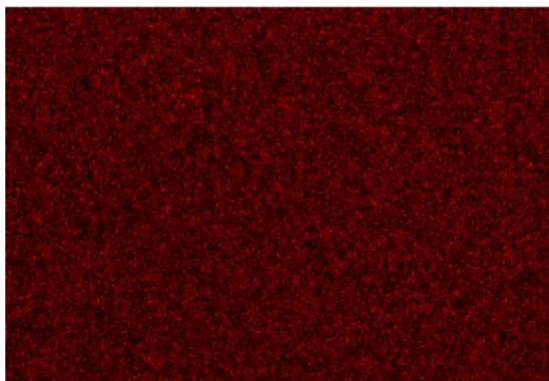


50µm

EDS Layered Image 8

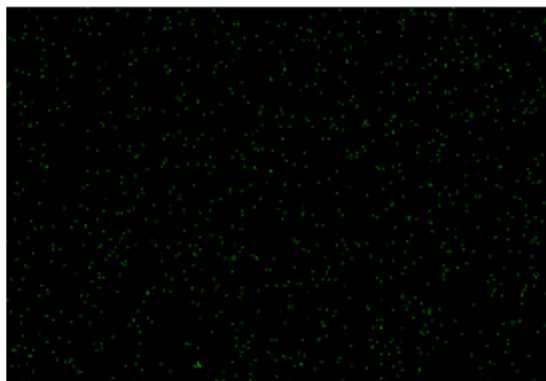


C K α 1_2



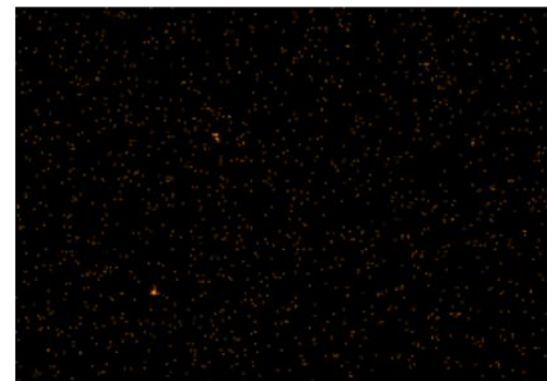
50 μ m

O K α 1



50 μ m

Na K α 1_2



50 μ m

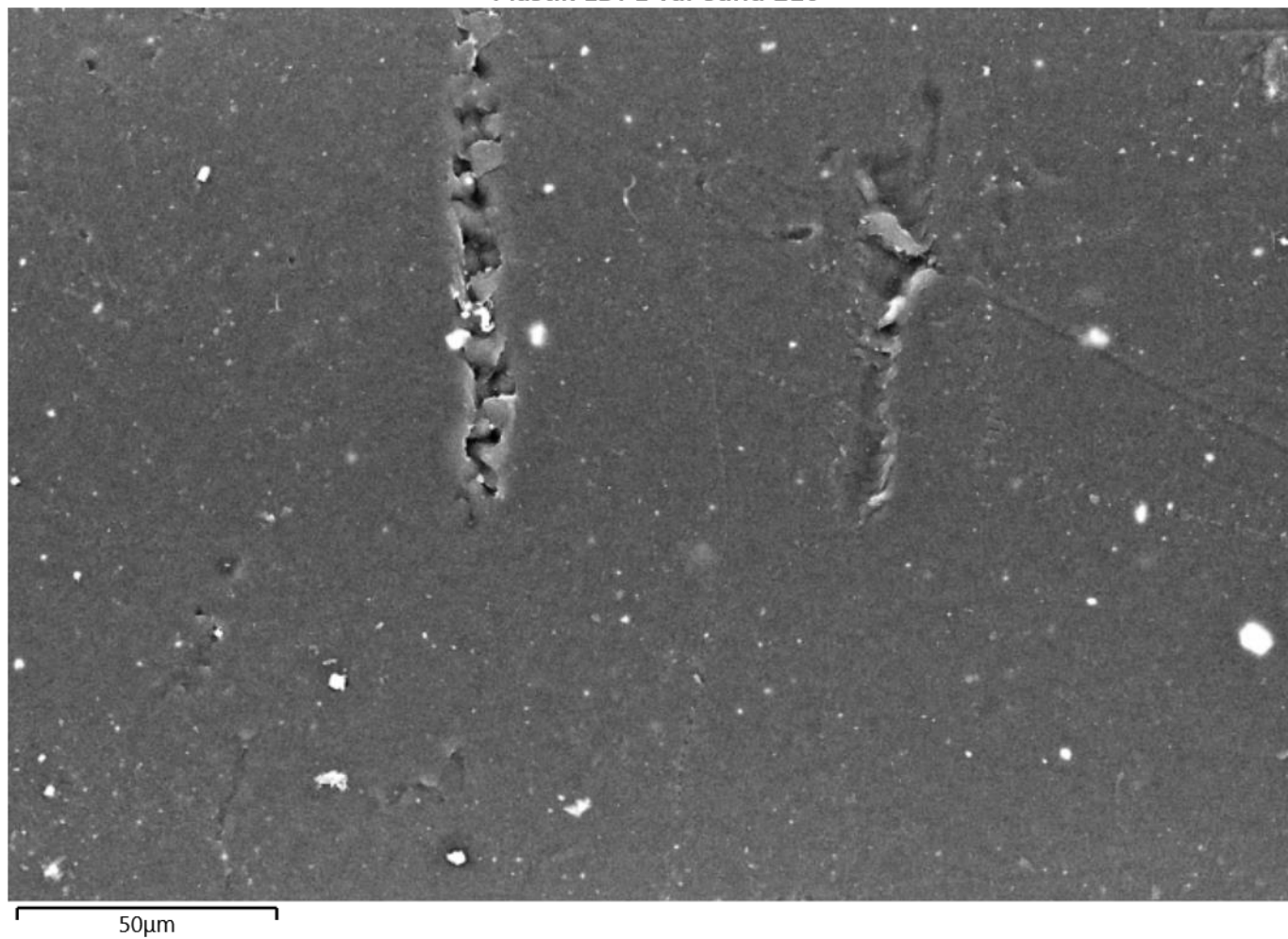
Project Notes

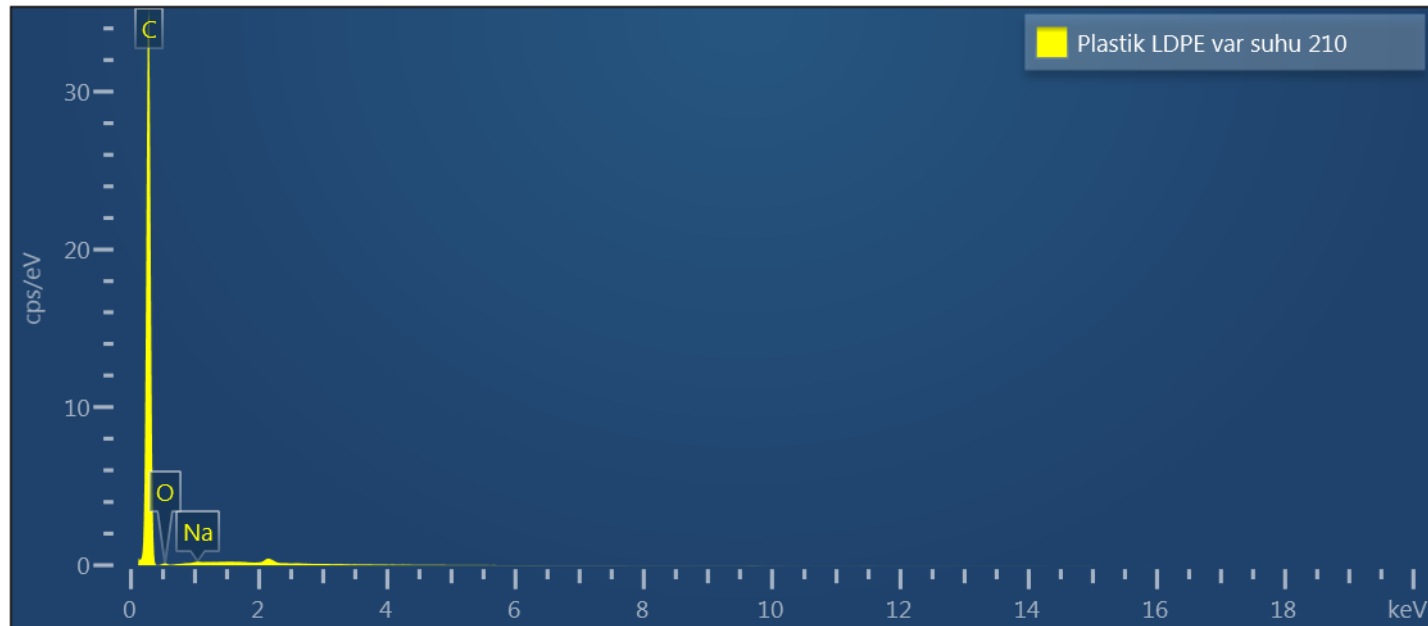
SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 210'

FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 210





Plastik LDPE var suhu 210				
Element	Line Type	Weight %	Weight % Sigma	Atomic %
C	K series	98.04	0.21	98.54
O	K series	1.88	0.21	1.41
Na	K series	0.08	0.03	0.04
Total		100.00		100.00

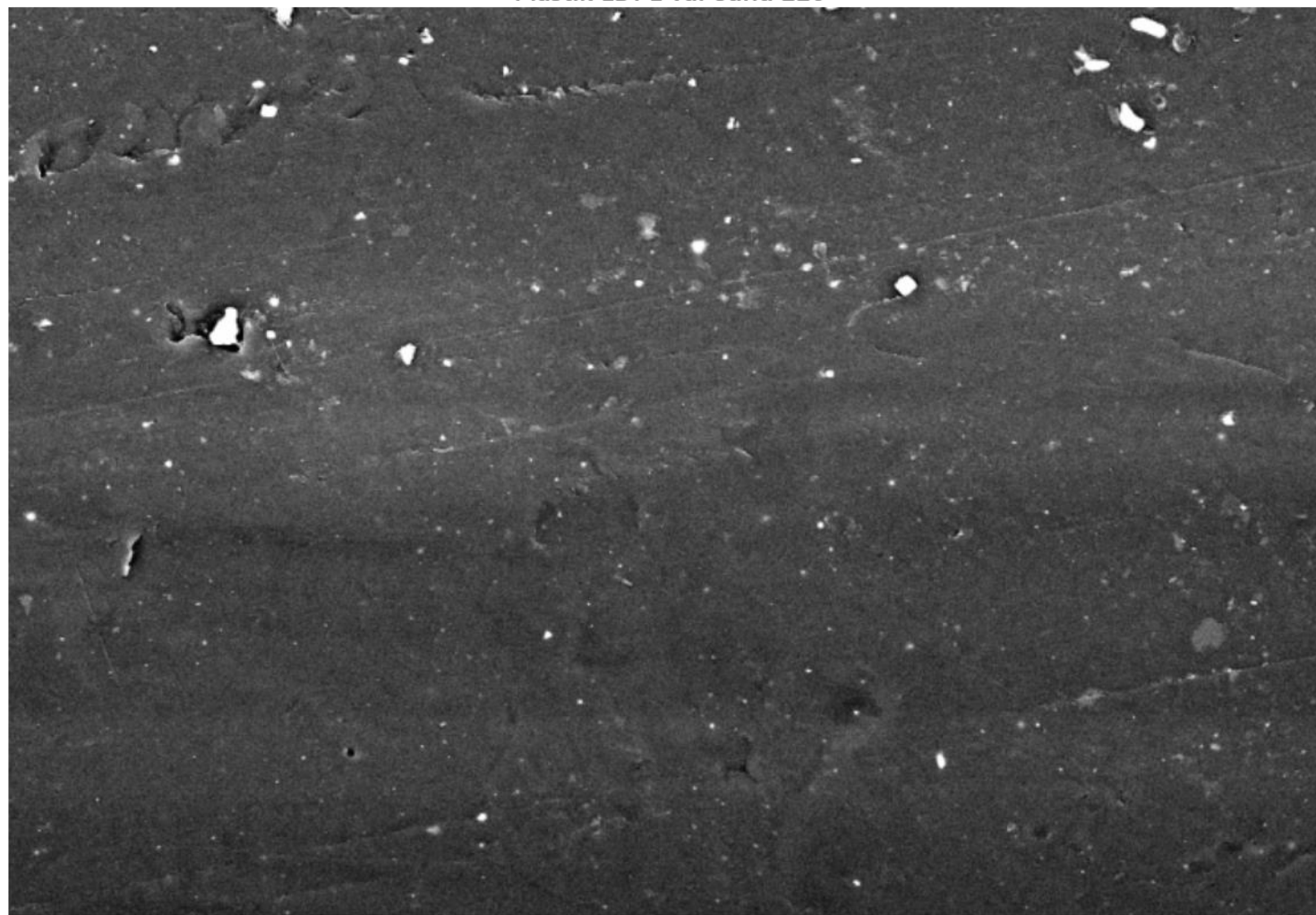
Project Notes

SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 220'

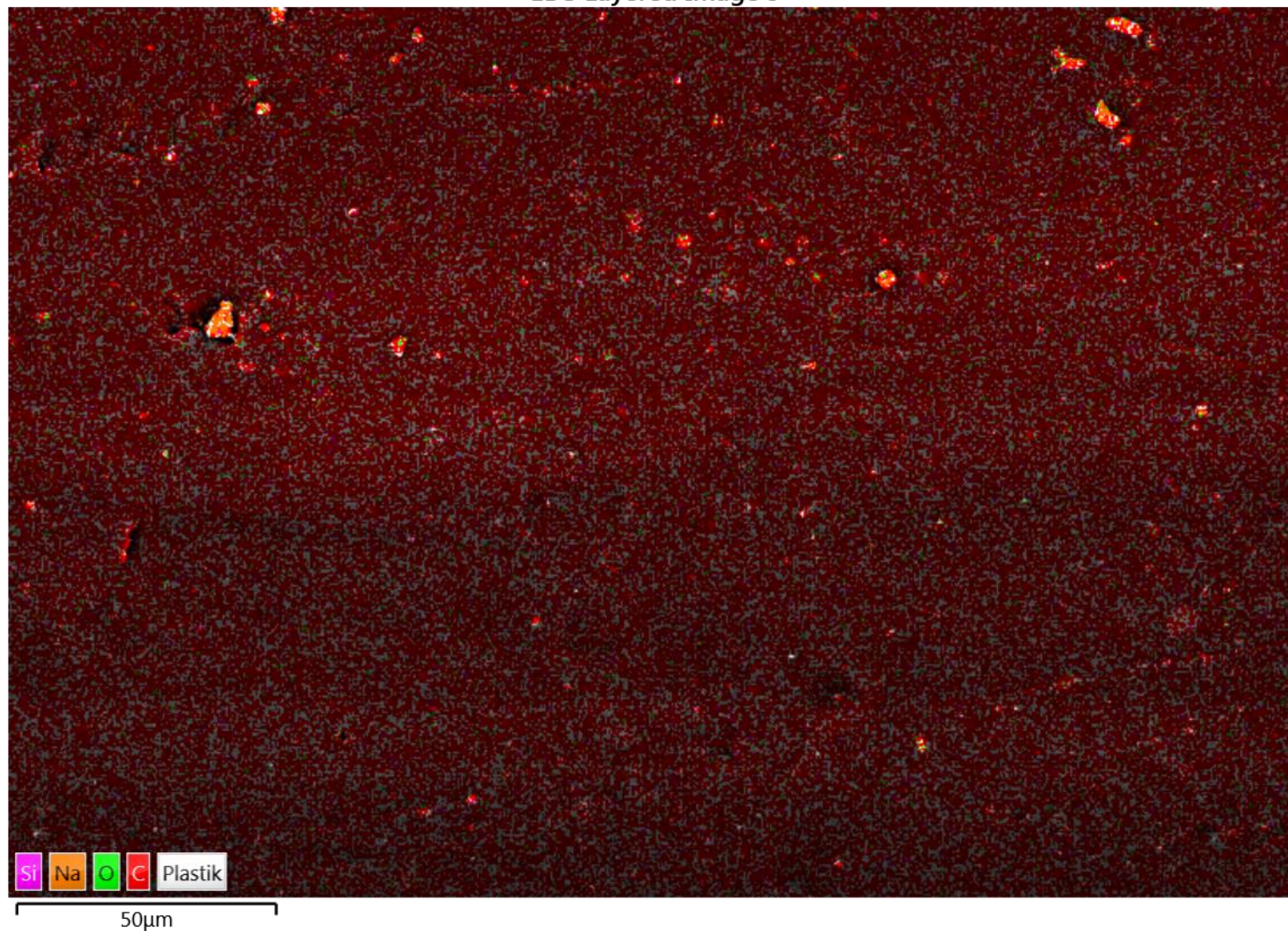
FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

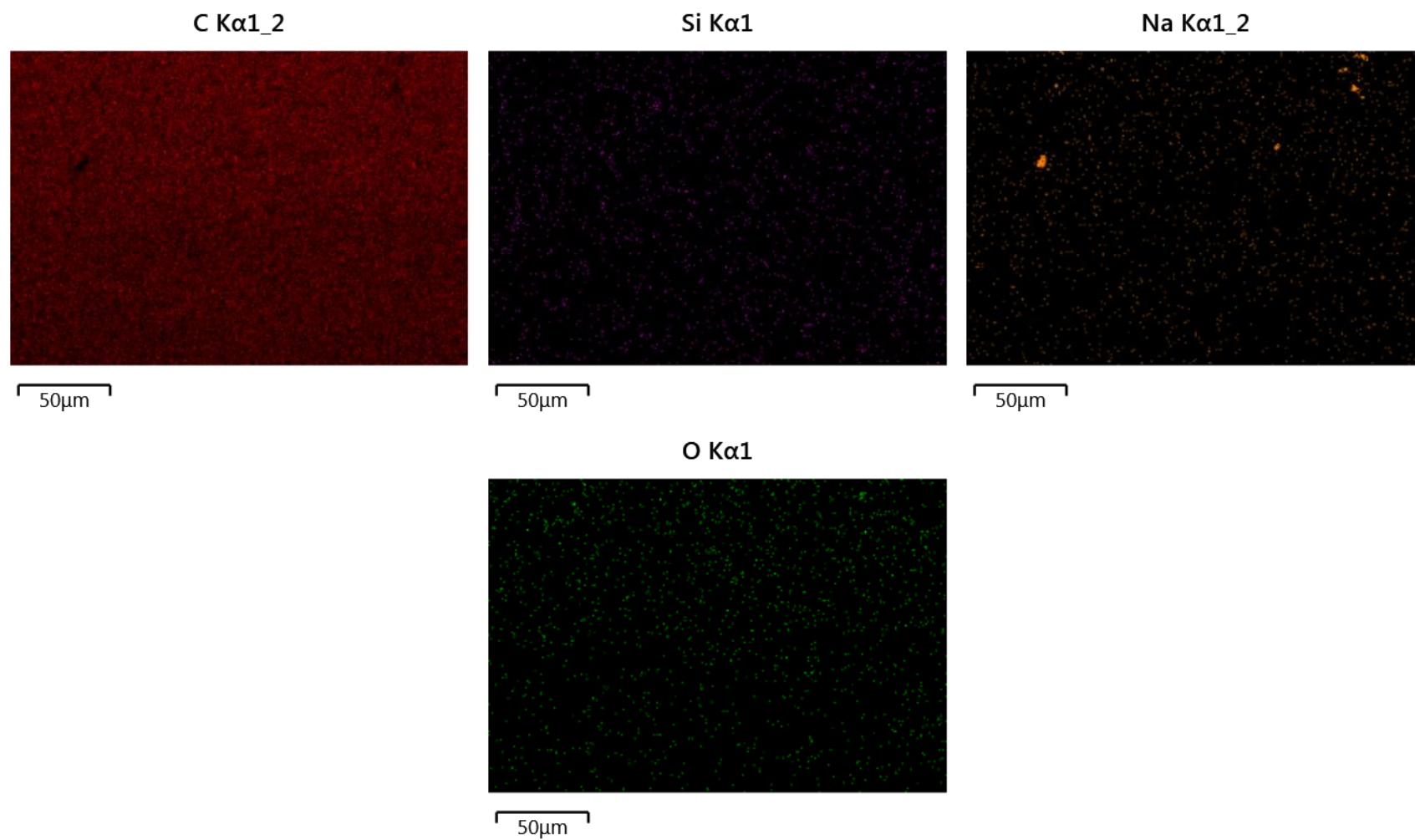
Plastik LDPE var suhu 220



50µm

EDS Layered Image 9





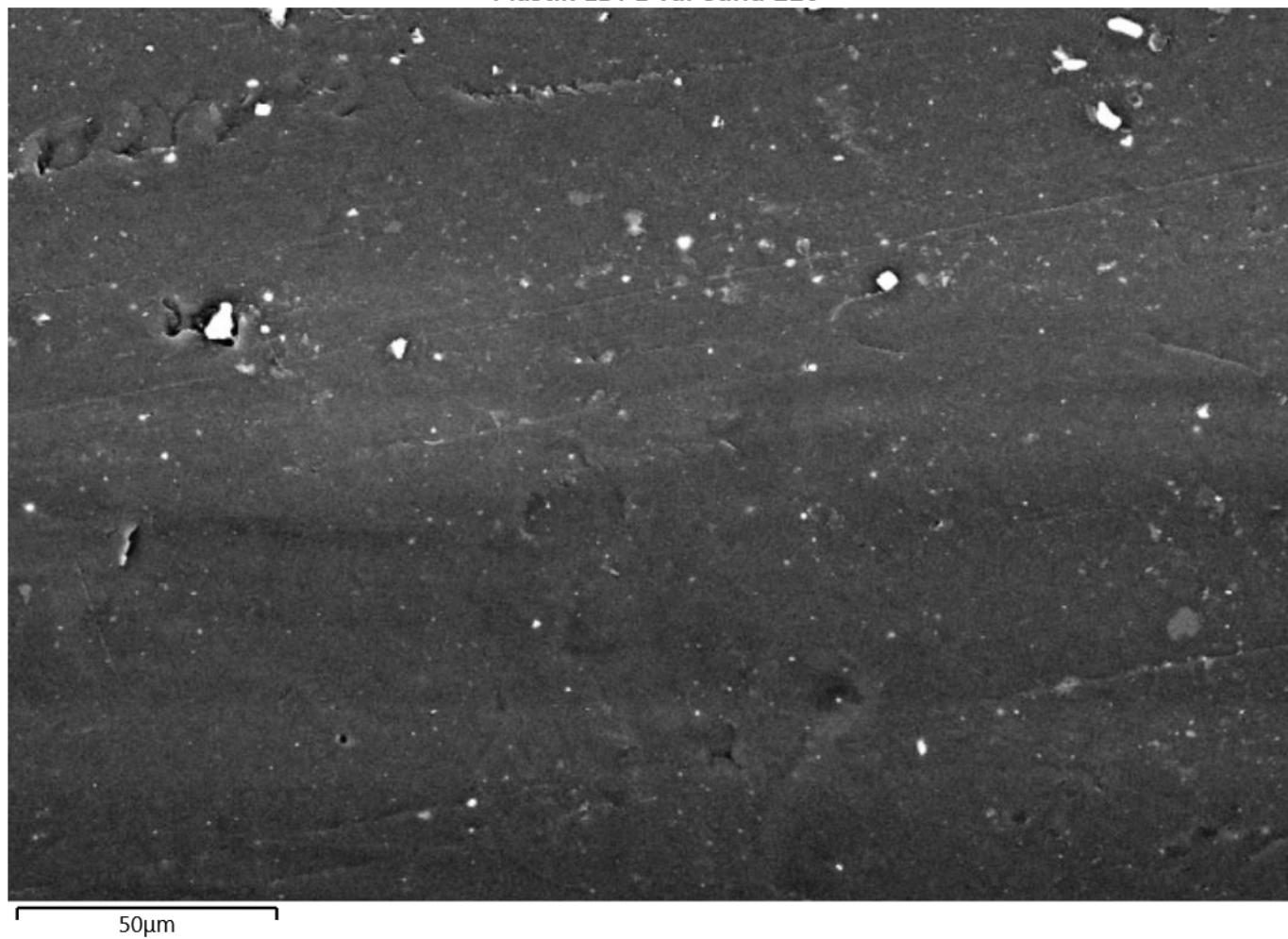
Project Notes

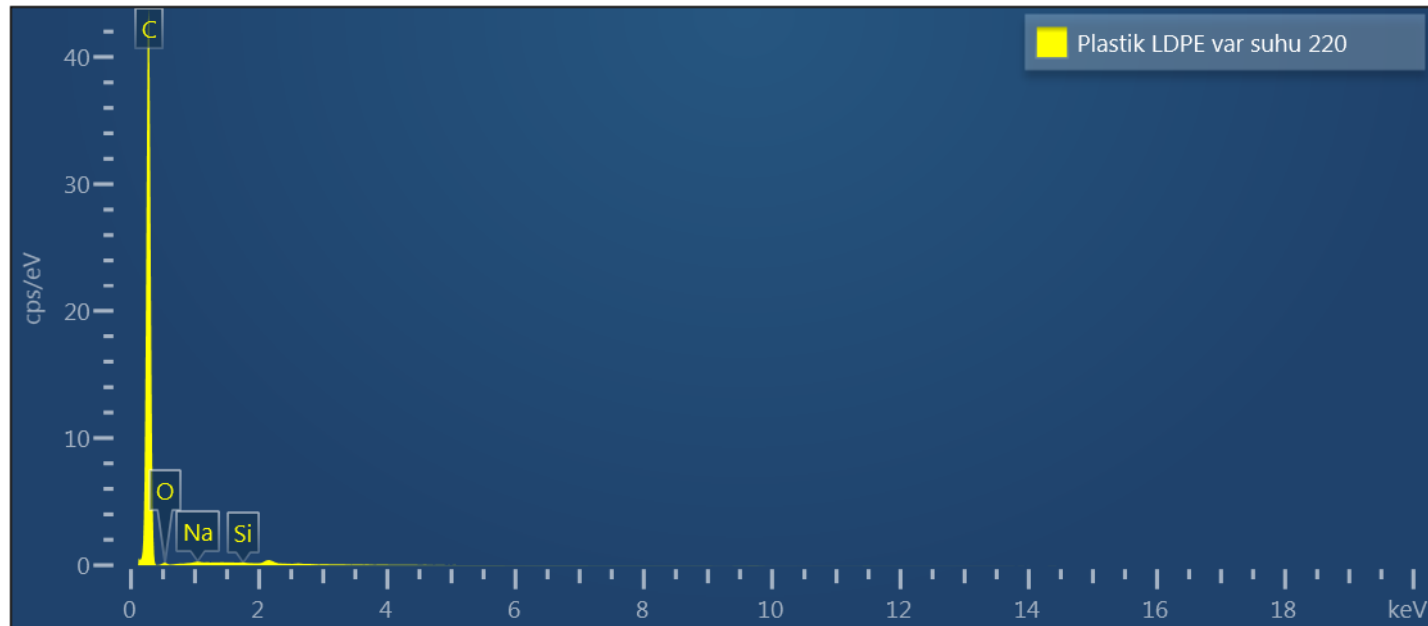
SEM Instrument : FEI - Quanta FEG 650
SEM type : FESEM
License to : Universitas Brawijaya
EDS detector : Oxford Instrument - X-act
EDS software : AZtecOne
Manage by : Laboratorium Sentral Ilmu Hayati (Central Laboratory of Life Science)
Operated by : NFK

Specimen Notes for 'Plastik LDPE var suhu 220'

FESEM set-up for EDS acquisition
Vacuum mode : High Vacuum
HV : 20 kV
spot size : 5
dwell time : 1 us
WD : 10 mm
tilt : 0
SEM det image : vCD (BSE) at 500X polaroid
Sample prep : sample was put on top of the stub with double sided carbon tape. Gold sputter coated.

Plastik LDPE var suhu 220





Plastik LDPE var suhu 220				
Element	Line Type	Weight %	Weight % Sigma	Atomic %
C	K series	97.41	0.19	98.08
O	K series	2.45	0.19	1.85

Na	K series	0.10	0.03	0.05
Si	K series	0.04	0.02	0.02
Total		100.00		100.00



serve you the best

Sertifikat



No : 460/UN10.D40/TU/2021

Diberikan Kepada :

Muhammad ali chandra

Telah berpartisipasi dalam :

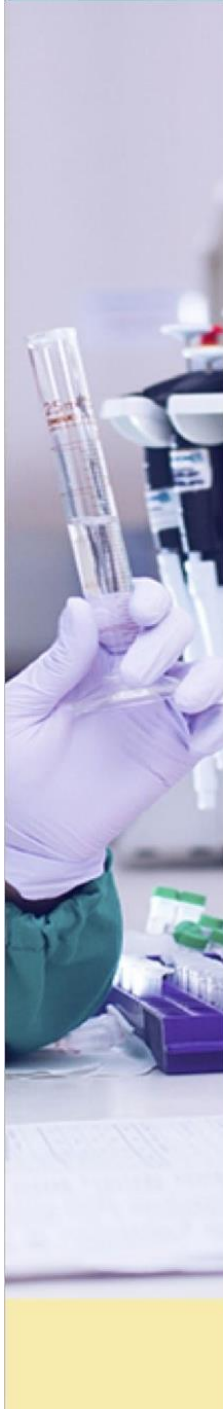
WEBINAR

Building Knowledge using FESEM

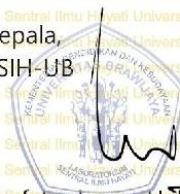
Malang, 25 November 2021

Laboratorium Sentral Ilmu Hayati
Universitas Brawijaya Malang

Sebagai : **PESERTA**



Kepala,
LSIH-UB



Prof. Luchman Hakim, S.Si., M.Agr.Sc., Ph.D.

NIP . 197108081998021001



serve you the best



Sertifikat

No : 459/UN10.D40/TU/2021

Diberikan Kepada :

muhammad ali chandra

Telah berpartisipasi dalam :

WEBINAR

Building Knowledge using XRD

Malang, 26 November 2021

Laboratorium Sentral Ilmu Hayati
Universitas Brawijaya Malang

Sebagai : **PESERTA**

Kepala,
LSIH-UB



Prof. Luchman Hakim, S.Si., M.Agr.Sc., Ph.D.

NIP . 197108081998021001



Lampiran 2. Durometer

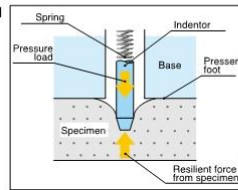
Durometer & IRHD Hardness Tester

Durometers show the degree of hardness by value whether a non-rigid material like rubber is soft or hard (hardness gauge for rubber or plastic). Recently, JIS standard and ISO standard have been drastically revised and details of hardness tester of rubber and method of measuring hardness are changed.

As an all embracing manufacturer of non-rigid material hardness tester, Teclock proposes lots of measuring methods of measuring hardness of not only rubber and plastic but many non-rigid materials and elastic materials.

Model Selection of Durometer

As to measured value by durometer (rubber and plastic hardness tester), when the base of durometer and work piece are



cohered each other, the indentor changes shape of work piece by pressurized force caused by spring of durometer and work piece makes force against this force. Force amount of indentor is indicated as hardness when this pressurized force and repulsive force are equivalent.

If repulsive force is weak, it shows low value (soft), on the contrary, if repulsive force is strong, it shows high value (hard). There are various type of durometers of which force of springs and shape of indentors are different. The reason why there are various kinds of durometers, it is for the purpose of showing degree of hardness with higher sensitivity against difference of material characteristics and shape of surface which work pieces have. Select a suitable product referring to the figure in the right.

FO GS-744G	Soft material	•Urethane foam •Shock absorb material for car sheet •Sponge for dish washer •Konjac
OO GS-754G		•Ultra-soft rubber •Foam rubber •OA equipment roll •Chewing gum
E2 GS-743G		•Very soft rubber •Processed cheese •Cloth scroll •China clay •Sealant
C GS-701N E GS-721N		•Very soft rubber •Eraser •Film roll •Spinning roll •Foam rubber roll
O GS-753G		•Very soft rubber •Spinning roll •Leather •Cardboard •Polystyrene foam
A GS-719N GS-709N GS-706N	Hard material	•General rubber elastomer •Rubber roll •Tire •Rubber hose •Soft plastic
B GS-750G		•Medium-hard rubber •Unglazed China clay •wood
DO GS-752G		•Medium-hard rubber •Flooring and building •Car handle
C GS-751G GS-703N		•Hard rubber •Golf ball •Brake rubber
D GS-720N GS-702N		•Hard rubber •Plastic •Ebonite



As to measuring hardness by pushing by hand, durometer to work piece form the top and read value by making pressed surface adhere to durometer.



In order to solve individual difference of measured value, it is clearly mentioned in the standard to measure hardness by mounting durometer to stand.

Measuring hardness with Durometer

- In case of measuring by pushing by hand, putting pressurized surface of durometer held by hand from the top vertically with a certain speed to the flat face of work piece which is put on the flat face. Then, after adhering it, regard the value measured within the passed time prescribed by standard as "hardness".
- In case of measuring hardness by mounting durometer to stand, measuring speed (not more than 3.2mm/sec.), pressurized load (type A, E is 1kgf, type D is 5kgf) and pressurized surface diameter ($\phi 18\text{mm}$) of type A / D durometers including tolerance are standardized.
- Measuring point of test piece is to be inside from its edge by 12mm or more and clearance is to be 6mm and more. Thickness is normally 6mm and more, and 10mm and more for type E.
- Test environment : Temperature is $23^{\circ}\text{C}\pm 2$, humidity is $50\pm 5\%$ and median or average is applied for measured value. If 50 show in type A case, it is described [A50].
These are ruled for each standard.



Compliance with JIS K 6253 standard for Hardness test of vulcanized or thermoplastic rubber

- Analog
- Digital
- New JIS compliance
- ISO compliance

This is Durometer to comply with JIS K 6253 (new JIS) standard established in 1993 for the purpose of conforming to ISO (International Standard Organization). Durometers consist of 3 types namely, Type A for medium hardness, Type D for high hardness and Type E for low hardness. Type A tends to indicate higher value by 1~2 points compared with former Type A durometers. Type D is suitable for hard rubber having more than 90 hardness measured by type A durometer and Type E is suitable for soft rubber of which hardness is 20 and below measured by Type A durometers.

Standard Type



GS-719N
Type A Durometer
General rubber



GSD-719K
Type A Durometer
Digital type
With peak detection

Digital Durometer with Peak Hold Function

This is the model for which peak hold (Maximum value is held) function is mounted. This is effective to measure hardness of Elastomer of which maximum value is unreadable due to relaxation phenomenon. Minimum read value is 0.5 and it is a half of analog type. Measured data can be treated as statistics by connecting with optional printer SD-763P.

Pressurized Face ϕ 18mm Durometer mounted to Stand

Pressurized face diameter of type A and type D durometer mounted to a stand is defined 18mm by JIS standard and ISO standard. ϕ 18mm type A(GS-719R) and type D (GS-720R) can be used as they are for measuring by pushing by hand.



GS-719R
Type A Durometer
Stand mounting compatible type
Peak pointer type



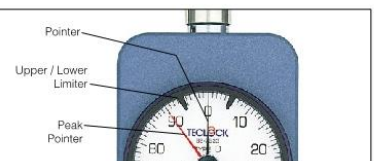
GSD-719K-R
Type A Durometer
Digital type
Stand mounting compatible type
Peak pointer type

Specifications

Model	Type	Application / Materials	Conform Standards	Spring Load Value	Indenter Shape (mm)	Indenter Height (mm)	Weight (g)
Analog	GS-719N	Type A General rubber (Medium hardness)	JIS K 6253	0-100 550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50	200
	GS-719G	Type A(Peak Pointer Type) General rubber (Medium hardness)		550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50	208
	GS-719R	Type A ϕ 18mm / stand combined General rubber (Medium hardness)		ISO 7619	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50
	GS-720N	Type D Hard rubber (High hardness)	ISO 868	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	2.50	200
	GS-720G	Type D(Peak Pointer Type) Hard rubber (High hardness)	ASTM D 2240	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	2.50	208
	GS-720R	Type D ϕ 18mm / stand combined Hard rubber (High hardness)		0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	2.50	213
	GS-721N	Type E (AO) Soft rubber (High hardness)		JIS K 6253 ISO 7619	550-8050mN (56.1-821.1gf)	Hemisphere of SR2.50	2.50
	GS-721G	Type E (Peak Pointer Type) Soft rubber (High hardness)	ASTM D 2240	550-8050mN (56.1-821.1gf)	Hemisphere of SR2.50	2.50	208
	GS-719P	Type A (Pocket Type) General rubber (Medium hardness)	JIS K 6253	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50	100
	Digital	GSD-719K	Type A General rubber, soft plastic	JIS K 6253, JIS K 7215, ISO 7619, ISO 868, ASTM D 2240	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50
GSD-720K		Type D Hard rubber, Plastic	JIS K 6253, ISO 7619, ISO 868, ASTM D 2240	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	2.50	313
GSD-721K		Type E (AO) Very soft rubber	JIS K 6253, ISO 7619, ASTM D 2240	550-8050mN (56.1-821.1gf)	Hemisphere of SR2.50	2.50	313
GSD-719K-R		Type A ϕ 18mm / Stand combined General rubber (Medium hardness)	JIS K 6253, ISO 7619	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50	320
GSD-720K-R		Type D ϕ 18mm / Stand combined Hard rubber (High hardness)	ISO 868, ASTM D 2240	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	2.50	320

Peak Pointer Type

Some of Rubbers, Elastomer' elastic body is not easily read the maximum value after firm contacting with a presser foot of durometer, due to the stress relaxation. The pointer indicates the descendent value but the peak pointer is holding the maximum measured value. The peak pointer type can easily read the maximum value efficiently. In case the pointer cannot be read directly due to some obstacles although the measuring can be done, the measured value can be confirmed from peak pointer after measuring. The upper / lower limiters equipped will be effectively used in tolerance judgment.





Analog

Digital

Compliance with JIS K 7215 standard Durometers for hardness test of plastic

This standard is prescribed by plastic industry in Japan apart from testing method of hardness of rubber. This is basically equal to Durometer of JIS K 6253, as only its round up method of spring load value etc. is different. But we distinguish model name as another Durometer according to the view of conformity to standard.



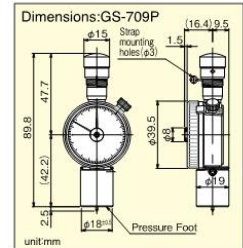
GS-702N
Type D Durometer
Plastics
Hard rubber



GS-709N
Type A Durometer
General rubber
Soft plastic



GS-709P
Type A Durometer
Peak pointer type
Pocket type



Specifications

	Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height(mm)	Weight (g)
Analog	GS-702N	Type D	Plastics / Hard rubber	JIS K 7215	0-44483mN (0-4536gf)	Conical Cone of R0.1 with 35° angle	2.50	200
	GS-702G	Type D (Peak pointer type)	Plastics / Hard rubber		ISO 868	0-44483mN (0-4536gf)	Conical Cone of R0.1 with 35° angle	2.50
	GS-709N	Type A	Soft plastic / General rubber	ASTM D 2240	549-8061mN (56-822gf)	Truncated Cone of φ 0.79 with 35° angle	2.50	200
	GS-709G	Type A (Peak pointer type)	Soft plastic / General rubber		549-8061mN (56-822gf)	Truncated Cone of φ 0.79 with 35° angle	2.50	208
	GS-709P	Type A (Pocket type)	Soft plastic / General rubber		JIS K 7215	550-8050mN (56.1-821.1gf)	Truncated Cone of φ 0.79 with 35° angle	2.50
Digital	GSD-719K	Type A	Soft plastic / General rubber	JIS K 6253, JIS K 7215, ISO 7619, ISO 868, ASTM D 2240	549-8061mN (55-822gf)	Truncated Cone of φ 0.79 with 35° angle	2.50	313
	GSD-720K	Type D	Plastics / Hard rubber		0-44450mN (0-4533gf)	Conical Cone of R0.1 with 35° angle	2.50	313

Compliance with JIS K 7312 standard Thermosetting Poly urethane Estolamer Moldings Physical Test

Analog

Digital



GS-701N
Type C (ASKER)
Soft rubber
for Windings yarn

Standard about physical test method of polyurethane Elastomer. One of the test items is hardness test and rubber industry generally calls type A durometer "shore-A" and type D durometer "shore- D". In addition, type C for low hardness range is called ASKER and GS-701N(G) is the same product ASKER-C. It complies with hardness test of JIS S 6050 "Plastic eraser". Furthermore, SRIS 0101 (ex Society of Rubber Industry, Japan standard of Measure) which was the base of these standard was already discontinued, but only type name is remained.

Specifications

	Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height(mm)	Weight (g)
Analog	GS-701N	Type C	Soft rubber, Foam rubber	JIS K 7312	539-8385mN (55-855gf)	Hemisphere of SR5.08	2.54	200
	GS-701G	Type C (Peak pointer type)			539-8385mN (55-855gf)	Hemisphere of SR5.08	2.54	208
Digital	GSD-701K	Type C	Eraser, Windings yarn	JIS S 6050	539-8385mN (55-855gf)	Hemisphere of SR5.08	2.54	313



Durometer

Deep Hole / Long Leg Type

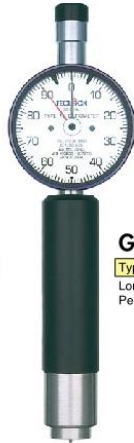
Analog

Digital

In some cases, such as the measurement surface of uneven or with a narrow flat area and the bottom of deep hollow, it may be impossible to achieve the proper results because of the difficult contact of the presser foot. The Deep Hole (H) type and the Long Leg (L) type make such measurements possible with a small or long presser foot. Both are supplied with Peak Pointer and the upper/lower limiters. The Long Leg type meets also to DIN 53505 standard.



GS-720H
Type D Durometer
Deep hole type
Peak pointer type



GS-719L
Type A Durometer
Long leg type
Peak pointer type



GSD-719K-H
Type A Durometer
Digital type
Deep hole type
With peak detection



GSD-719K-L
Type A Durometer
Digital type
Long leg type
With peak detection

Specifications

Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Presser Foot Diameter (mm)	Indenter Height (mm)	Weight (g)
GS-719H	Type A	General rubber / Deep hole type (narrow hole)	JIS K 6253, ISO 7619, ASTM D 2240	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	ϕ 12	2.50	140
GS-719L	Type A	General rubber / Long leg type (thick hole)	JIS K 6253, ISO 7619, ASTM D 2240, DIN 53 505	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	ϕ 18	2.50	360
GS-720H	Type D	Hard rubber / Deep hole type (narrow hole)	JIS K 6253, ISO 7619, ASTM D 2240	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	ϕ 12	2.50	140
GS-720L	Type D	Hard rubber / Long leg type (thick hole)	JIS K 6253, ISO 7619, ASTM D 2240, DIN 53 505	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	ϕ 18	2.50	360
GSD-719K-H	Type A	General rubber / Deep hole type (narrow hole)	JIS K 6253, JIS K 7215, ISO 7619, ISO 868, ASTM D 2240	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	ϕ 12	2.50	194
GSD-719K-L	Type A	General rubber / Long leg type (thick hole)	JIS K 6253, JIS K 7215, ISO 7619, ISO 868, ASTM D 2240, DIN 53 505	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	ϕ 18	2.50	380
GSD-720K-H	Type D	Hard rubber / Deep hole type (narrow hole)	JIS K 6253, JIS K 7215, ISO 7619, ISO 868, ASTM D 2240	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	ϕ 12	2.50	194
GSD-720K-L	Type D	Hard rubber / Long leg type (thick hole)	JIS K 6253, JIS K 7215, ISO 7619, ISO 868, ASTM D 2240, DIN 53 505	0-44450mN (0-4533gf)	Conical Cone of R0.1 with 30° angle	ϕ 18	2.50	380

Mounting impossible to stand with all varieties.

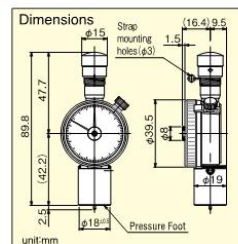
Pocket Type

Analog

New JIS compliance

Durometer of pocket type is convenient to carry.

GS-719P
GS-709P
Type A Durometer
Peak pointer type



* Dimensions of the GS-755 is page 62.

* Dimensions of the GS-779G is Page 63.

Specifications

Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height (mm)	Weight (g)
GS-719P	Type A	General rubber (Medium hardness)	JIS K 6253	550-8050mN (56.1-821.1gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.50	100
GS-709P	Type A	Soft plastic, General rubber	JIS K 7215	549-8061mN (55-822gf)	Hemisphere of SR6.35	1	100
GS-755	Type 000	Ultrasoft rubber	ASTM D 2240	203-1111mN (20.7-113.3gf)	Hemisphere of SR6.35	1	125
GS-779G	Type A approximate	Thin Sheet Hardness	—	388-1289mN (9-131gf)	ϕ 0.35	1	100



Durometer

Compliance with ASTM D 2240 standard Durometers for hardness test of rubber characteristic

Analog

Digital

ASTM (American Society for Testing and Materials) is historically old and various types of durometers are prescribed. Teclock provides all of this ASTM durometers for the usage of hard material application to ultra soft material application in our line up.



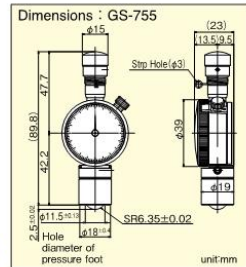
GS-750G
Type B Durometer
Medium-hard rubber



GS-754G
Type OO Durometer
Very soft rubber



GS-755
Type OOO Durometer



Specifications

	Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height (mm)	Weight (g)
Analog	GS-750G	Type B (Peak Pointer type)	Medium-hard rubber	ASTM D 2240	550-8050mN (56.1-821.1gf)	Conical corn of R 0.1 with 30° angle	2.50	208
	GS-751G	Type C (Peak Pointer type)	Hard rubber		0-44450mN (0-4533gf)	Truncated cone of ϕ 0.79 with 35° angle	2.50	208
	GS-752G	Type DO (Peak Pointer type)	Medium-hard rubber		0-44450mN (0-4533gf)	Hemisphere of SR 1.19	2.50	208
	GS-753G	Type O (Peak Pointer type)	Soft rubber		550-8050mN (56.1-821.1gf)	Hemisphere of SR 1.19	2.50	208
	GS-754G	Type OO (Peak Pointer type)	Very soft rubber		203-1111mN (20.7-113.3gf)	Hemisphere of SR 1.19	2.50	208
	GS-755	Type OOO	Very soft rubber		203-1111mN (20.7-113.3gf)	Hemisphere of SR 6.35	2.50	125
Digital	GSD-750K	Type B	Medium-hard rubber		550-8050mN (56.1-821.1gf)	Conical corn of R 0.1 with 30° angle	2.50	313
	GSD-751K	Type C	Hard rubber		0-44450mN (0-4533gf)	Truncated cone of ϕ 0.79 with 35° angle	2.50	313
	GSD-752K	Type DO	Medium-hard rubber		0-44450mN (0-4533gf)	Hemisphere of SR 1.19	2.50	313
	GSD-753K	Type O	Soft rubber		550-8050mN (56.1-821.1gf)	Hemisphere of SR 1.19	2.50	313
	GSD-754K	Type OO	Very soft rubber		203-1111mN (20.7-113.3gf)	Hemisphere of SR 1.19	2.50	313

Analog

Digital

TECLOCK Original Standard Durometer

This is available as TECLOCK original standard based on customers' requirement, even though they are not prescribed in JIS or ISO. Type E 2 durometer for soft rubber with around half of spring load value of Type E, and Type FO to measure hardness of polystyrene sponge for the level of sponge for washing dishes are available.



GS-743G
Type E2 Durometer
Soft rubber



GS-744G
Type FO Durometer
Soft styrene foam



Hardness is measured by placing GS-744G on the sponge sheet. Dispersion of polystyrene level can be judged.

Specifications

	Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height (mm)	Weight (g)
Analog	GS-743G	Type E2 (Peak Pointer type)	Soft rubber	TECLOCK E2	550-4300mN (56.1-438.6gf)	Hemisphere of SR2.50	2.50	208
	GS-744G	Type FO (Peak Pointer type)	Soft styrene foam	TECLOCK FO	550-4300mN (56.1-438.6gf)	Cylindrical cone of ϕ 25.2	2.50	500
Digital	GSD-743K	Type E2	Soft rubber	TECLOCK E2	550-4300mN (56.1-438.6gf)	Hemisphere of SR2.50	2.50	313
	GSD-744K	Type FO	Soft styrene foam	TECLOCK FO	550-4300mN (56.1-438.6gf)	Cylindrical cone of ϕ 25.2	2.50	500



Analog

Digital

Compliance with JIS K 6301 standard Vulcanized Rubber Physical Test (discontinued in 1998 August)



GS-703N
JIS C (old type)
Hard rubber
Ebonite



GS-706N
JIS A (old type)
General rubber

JIS K 6301 was established in 1950 and had sustained base of rubber industry of our country but was discontinued in 1998 because it did not comply with ISO and also JIS K 6253 was prescribed on its behalf. However, It had been used for 60 years as "Rubber hardness tester" and even now it is used as test data between certain parties in charge with mutual consensus although movement to new JIS has progressed and standard is discontinued. There are 2 models such as Spring type A and type C for hard rubber.

Specifications

	Model	Type	Application / Materials	Conform Standards	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height(mm)	Weight (g)
Analog type	GS-703N	JIS C(old type)	Hard rubber	JIS K 6301	980-44100mN (100-4500gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.54	200
	GS-703G	Type C(old type) Peak Pointer type	Hard rubber	JIS K 6301	980-44100mN (100-4500gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.54	208
Digital type	GS-706N	JIS A(old type)	General rubber	JIS K 6301	539-8385mN (55-855gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.54	200
	GS-706G	Type A(old type) Peak Pointer type	General rubber	JIS K 6301	539-8385mN (55-855gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.54	208
	GSD-706K	Type A(old type)	General rubber	JIS K 6301	539-8385mN (55-855gf)	Truncated Cone of ϕ 0.79 with 35° angle	2.54	313

Simplified Micro-Hardness Tester for Thin Sheet Hardness

Analog

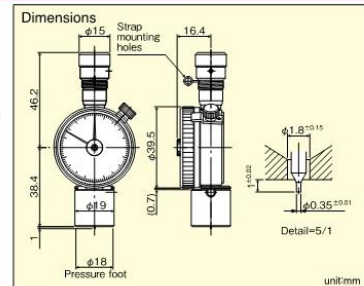


GS-779G
Peak pointer type

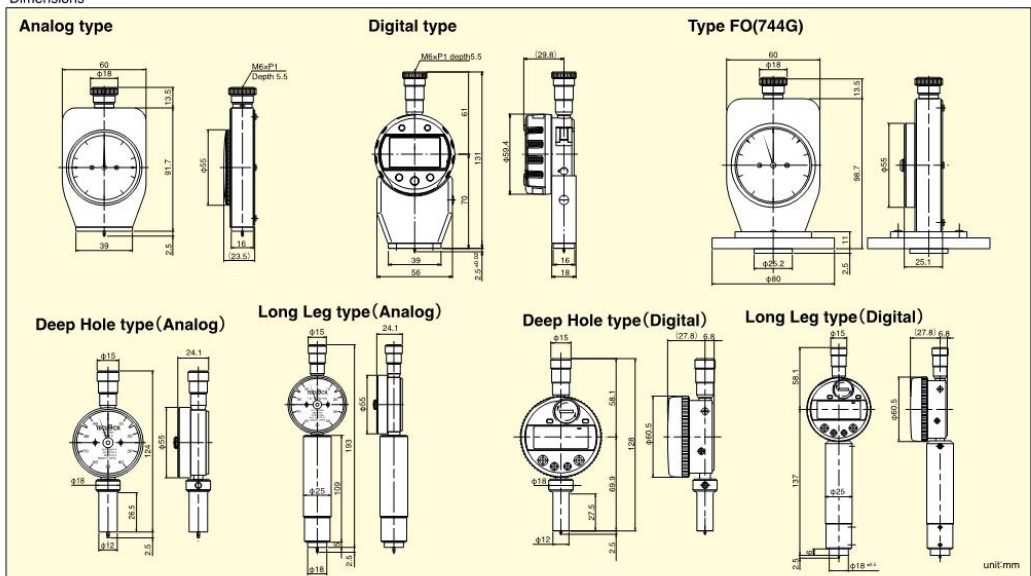
This is simplified micro-hardness tester which measures hardness of thin sheet such as rubber and Estolamer. Height of indenter is 1mm that is 1per 2.5 of that of normal durometer. It is effective for dispersiveness of sheet hardness and its relative comparison. It is original standard of Teclock and designed so as to obtain the value similar to type A durometer.

Specifications

Model	Type	Spring Load Value 0-100	Indenter Shape (mm)	Indenter Height(mm)	Weight (g)
GS-779G	Type A approximate	388-1288mN (9-131gf)	ϕ 0.35	1	100



Dimensions





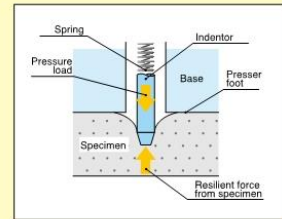
Durometer

Model Selection of Durometer

There are many type of durometers based on spring force, contact point size and its shape. This is according to the international standard, in order to have the most accurate and the precise results with the several shape of works and those material characteristic. Teclock durometers are in comply with the international standards, but also have an own standard to measure the variety of materials. Please refer to the table below to choice the most suitable model.

Mechanism of the hardness measurement

Contact point with the pressurizing force gives deformed surface. Then, a work piece makes force against this force. Hardness means that when both pressurizing force and repulsive force are equivalent, measure the depth of indenter. The depth of indenter indicates from 0 to 100. This figure shows the values of hardness. The figure has no force unit, but only relative physical value.



Note : If model number is the same, it means to apply the same specification. ex : GS-719N and GS-719G are the same specification.

Model	Type	Material Examples
GS-744	FO	Urethane foam, Shock absorb material for car sheet, Sponge for dish washer, Konjac
GS-754	OO	Ultra-soft rubber, Foam rubber, OA equipment roll, Chewing gum
GS-743	E2	Very soft rubber, Processed cheese, Cloth scroll, Chine clay, Sealant
GS-701 / GS-721	SRIS / E	Very soft rubber, Eraser, Film roll, Spinning roll, Foam rubber roll
GS-753	O	Very soft rubber, Spinning roll, Leather, Cardboard, Polystyrene foam

Shape of Contact Point of Durometer

Teclock Durometer has 5 types of contact point shape. Besides, there are some different spring force types. Combination contact point surface and spring force, it can apply the most suitable durometer to a work piece. These shape and pressurizing force are referred to ISO and JIS standard.

Contact Point Shape	Models
Hemisphere of SR5.08 (Unit:mm)	GS-701, GS-721, GS-743
Truncated Cone of Φ 0.79 with 35° angle (Unit:mm)	GS-703, GS-706, GS-709, GS-719, GS-751
Conical Cone of R0.1 with 35° angle (Unit:mm)	GS-702, GS-720, GS-750



New JIS compliance

ISO compliance

Totally Automatic type IRHD / M method Micro – size International Rubber Hardness Tester

- Micro-hardness can be measured by 1/8 scale each durometer of type A, E, E2, OO, FO in addition to IRHD / M method.
- Hardness of O ring and small rubber parts can be measured with totally automatic.
- Voice coil motor is adopted for load system. Friction and reproducibility of inner mechanism is improved, which is different from weight system.
- It is plug-in type that plunger (contact point) can be easily changed and recalibration on test method change is not needed.
- As test piece table is wide, various measuring jigs can be set up.

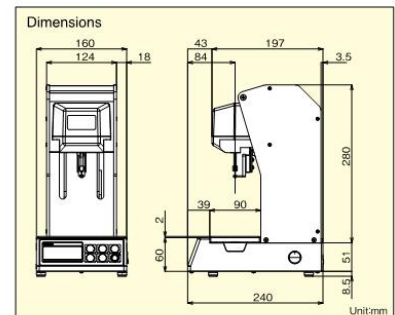


GS-680sel

PC connecting example

Specifications		
Hardness testing method	IRHD · M-method	Durometer Hardness
Compliance standards	ISO 48/JIS K 6253	ISO 7619/JIS K 6253
Measuring accuracy	±0.1 IRHD	TECLOCK Standards/ASTM D 2240
		Type A/E ±1 JIS K 6253
		Type E2/FO ±1 TECLOCK Standards
		Type OO ±2 ASTM D 2240
Measuring range	30~100 IRHD	0~100
Minimum indication unit	0.1	
Measurement part movable distance	100mm	
Measurable test-piece dimensions	W=160 / D=110 / H=100mm	
Conformity standards	EC Directive (EN61326)	
Outside interface	RS-232C	
Power	AC100~200 V/AdapterDC24V	
Weight	7.8kg (Main unit)/0.6kg (Power unit)	
Accessories	PC application CD (for Windows XP & 7)	
	PC connecting cables/AC adapter	
	Spare plunger (x1) (ZS-121) for IRHD	
Rubber specimen	ZY-917 6 types set (w/Inspection table)	

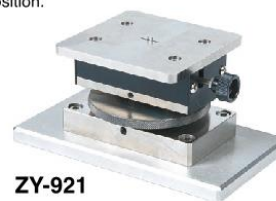
Other functions: Measurement time extension, Return-measurement function, Self-diagnosis function, Statistical processing (Relaxation curve, Average value, Median value etc)



O Ring Measuring Device for GS-680

This is the device for centering of O ring of which wire diameter is 0.5mm-10mm. The pin at stage center which fixes position of O ring slightly moves up/down and left/right independently and fixes the position. In addition, it is possible to rotate it to an arbitrary position.

Specifications	
Model	ZY-921
Stage dimensions	90×86mm
Applicable O-ring diameter	φ0.5~φ10mm
Weight	2.9kg



ZY-921



Calibration certificate can be issued to all Teclock durometers.

There is a case that durometers correspond to "Monitoring Machine" and "Measuring Machine" of ISO 9001. Teclock has obtained the authentication of ISO 9001 and can originally issue 3 kinds of traceability system diagram, calibration certificate and inspection report.





Automatic Hardness Tester GX-02series

JIS K 6253 compliance

ISO compliance

Automatic hardness tester [GX-02 series] can perform the measurement with the operating speed, the measuring weight and the pressing-surface dimensions which are specified in JIS K 6253 "Determination of hardness - Vulcanized rubber and Thermoplastic rubber".

Outline

This product is the automatic hardness meter. The hardness measurement is able to be done with the button-touch by a built-in motor. This product is dedicated for Digital durometer sensor [GSS-619/GS-620/GSS-621]. The product equips the measuring modes of 3 types. The control part pursues the clarity and easiness of use by adopting a touch panel.

Main features

Measuring modes: 3 types
Normal mode (the maximum value is acquirable), Test time mode (the median value and mean value are calculated), PC mode (operable by PC by using the dedicated software)

Features

• Tolerance judging feature



Specifications

Standards	ISO 7619 / JIS K 6253 compliance
Minimum indication	0.1
System features	Peak-holding function, Timer-holding function (Timer value 0.5, 1 to 99sec), Tolerance judging function, Mean value outputting function (n=1 to 30), Data output (PC printer), Outer functions control output
Outside interface	RS-232C
Power	AC100~240V(ACAdapter)
Dimensions	170(W)×160(L)×470(H)mm
Weight	11kg (Including weight 1kg)
Sensor unit	Model : GSS-619 (Type A) GSS-620 (Type D) GSS-621 (Type E) Pressing-surface diameter : φ 18mm (ESS-621, type E is 127mm) Code length : 2m Dimensions : 50(W)×35(L)×124(H)mm Weight : 320g



System configuration

Model	Body	1kg for weight (Accessories)	Sensor unit	Measuring object
GX-02A	Display unit (with stand)	ZY-090	GSS-619	Normal rubber & soft plastic
GX-02D		ZY-090+ZY-128 (5kg for weight)	GSS-620	Hard rubber & plastic
GX-02E		ZY-090	GSS-621	Soft rubber
GX-02F0		—	GSS-644	Urethane foam



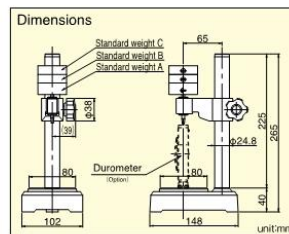
Durometer Periodical Inspection / Calibration

Durometer is a testing machine. In case that it corresponds to "Monitoring Machine" and "Measuring Machine" of ISO 9001 (JIS G 9001), controlling machines along with it is needed. Teclock is one of a few manufacturers of durometer which has obtained the authentication of ISO 9001 and can originally issue 3 kinds of traceability system diagram, calibration certificate and inspection report that are needed for calibration documents. In addition, Teclock can issue 3 kinds of documents for durometer tester and indenter height gauge, that are needed for internal inspection. Use these for control based on internal calibration standard.

Durometer Tester



This is inspection machine which simply checks spring load value of analog type durometer. Putting defined load with 3 pieces of standard weight to the inverted durometer and inspecting whether graduation of 25, 50 and 75 correctly point out. Calibration certificate can be issued. (Digital type durometer and other makes products can not be calibrated.)
In addition, in the standard of overseas and also domestic, inspection method by using mechanism of even balance and with normal position of durometer is introduced.



Code No.	対応機種	Weight (kg)
GS-607	GS-701N/GS-701G/GS-706N/GS-706G	3.7
GS-607A	GS-709N/GS-709G	3.7
GS-607B	GS-719N/GS-719G/GS-721N/GS-721G/GS-750G/GS-753G	3.7
GS-607C	GS-743G	3.7

Type D durometer for tester does not manufacture. Calibration certificate is Available.

Indenter Extension Gauge



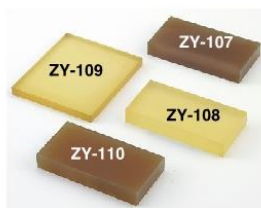
Height of indenter (contact point) of durometer is simply checked. ZY-119 is for JIS K 6301 and ZY-120 is for JIS K 6253. Products of other makers can be checked.

Code No.	Indenter Height (mm)	50DEG	2DEG	Applicable Durometer
ZY-119	2.54 type	1.27mm	2.489mm	GS-701N/G, 706N/G
ZY-120	2.5 type	1.25mm	2.45mm	GS-GSD-719, 720 Series

Calibration certificate is possible.

Rubber Piece for Durometer Measuring

This is not rubber test piece. It is used for easy checking to find out failure of durometer. Measuring hardness when it is purchased and use it for daily control of durometer.



Code No.	Type	Dimension (mm)	Applicable Durometer
ZY-107	Durometer A Hardness:50	40×80×12 Thickness	TypeA (GS, GSD-719J Series)
ZY-108	Durometer A Hardness:80	40×80×12 Thickness	
ZY-109	Durometer D Hardness:40	70×80×7 Thickness	TypeD (GS, GSD-720J Series)
ZY-110	Durometer E Hardness:80	40×80×12 Thickness	TypeE (GS, GSD-721J Series)

* Durometers complying with these test pieces are Type A, Type D, Type E, which are compliant with JIS K 6253.
* Calibration Certificate about test pieces can not be issued.

Alignment Unit for Durometer Stand

As it can move front / back and left / right it is the new function which has materialized high adhesion between pressurized face of durometer and face to be measured of test piece. It is mounted to GS-610, GS-612, GS-615 and all durometers including GX-02 type. Unmovable type is also available. Ask our branch nearby for details.





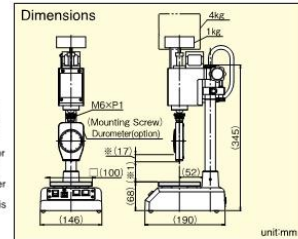
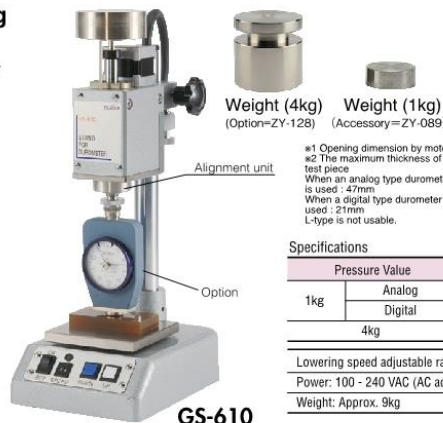
Measuring Stand for Durometer

New JIS compliance

In case of measuring with durometer by pushing by hand, measuring values vary in some degree due to individual difference. Therefore, Measuring stand is materialized as measuring method for high reproducibility, which is prescribed in JIS and ISO.

Automatic type Motor Driving Durometer Stand

- Hardness can be measured by durometer with load and speed prescribed as standard only by operating switch.
- Varying in some degree of data measured by pushing by hand has been dramatically improved due to adopting stepping motor driving system.
- Alignment unit which realizes high contact between indenter (contact point) of durometer and test piece is mounted.
- 1kg can be measured by type A and type E durometer as they are. Measuring by type D needs optional weight ZY-128 for measuring 5kg.. Digital durometer GSD series needs optional weight ZY-090 for measuring 1kg..
- Calibration certificate can be issued.

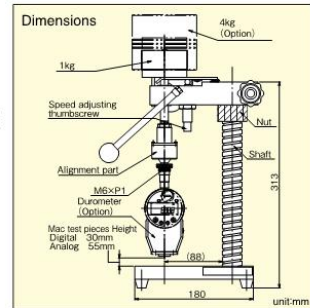


Specifications			
Pressure Value	Weight Code-No.	Applicable Durometer Model	
1kg	Analog	ZY-089(Accessory)	A, B, E, A(Old), TypeC(ASKER C), O
	Digital	ZY-090(Optional)	
4kg		ZY-128(Optional)	D, ASTM C, DO, JIS C(old type)

Lowering speed adjustable range: 1[mm/sec] - 19[mm/sec], by 1[mm/sec]
 Power: 100 - 240 VAC (AC adapter accessory)
 Weight: Approx. 9kg

Manual Operation type Durometer Stand with Speed Controller

- Speed controller with high reliability is adopted for moving down speed adjustment unit.
- Alignment unit which realizes high contact between indenter (contact point) of durometer and test piece is mounted.
- 65mm for analog and 40mm for digital are obtained for possible measuring range.
- Shaft with square thread is adopted that can prevent holder falling down and moving up and down.
- 1kg can be measured by type A and type E durometer as they are. Measuring by type D needs optional weight ZY-128 for measuring 5kg.. Digital durometer GSD series needs optional weight ZY-090 for measuring 1kg..
- Calibration certificate of mass (with durometer) can be issued, which are prescribed in ISO / JIS.

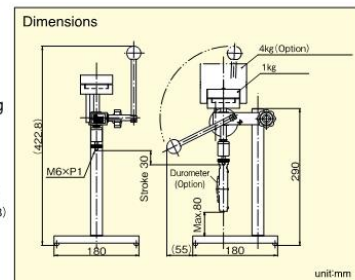
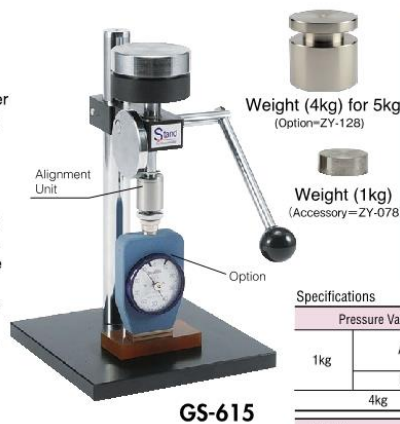


Specifications			
Pressure Value	Weight Code-No.	Applicable Durometer Model	
1kg	Analog	ZY-089(Accessory)	A, B, E, A(Old), TypeC(ASKER C), O
	Digital	ZY-090(Optional)	
4kg		ZY-128(Optional)	D, ASTM C, DO, JIS C(old type)

Weight: 8.5kg

Manual Operation type Durometer Stand

- Hardness can be measured by durometer with load prescribed by JIS by mounting durometer and manual operation.
- Adopting cam has realized easy operation and cost performance.
- Alignment unit which realizes high contact between indenter (contact point) of durometer and test piece is mounted.
- 1kg can be measured by type A and type E durometer as they are. Measuring by type D needs optional weight ZY-128 for measuring 5kg.. Digital durometer GSD series needs optional weight ZY-079 for measuring 1kg..
- Calibration certificate can be issued (Operation speed certificate can not be issued.).



Specifications			
Pressure Value	Weight Code-No.	Applicable Durometer Model	
1kg	Analog	ZY-078(Accessory)	A, B, E, A(Old), TypeC(ASKER C), O
	Digital	ZY-079(Optional)	
4kg		ZY-128(Optional)	D, ASTM C, DO, JIS C(old type)

Weight: 3.9kg



Comparison of Measured Value by Durometer

It is the comparison list of measured data by each durometer based on type A. As hardness values fluctuate owing to various factors temperature and humidity on measuring, dimension and shape, and vulcanizing condition in a certain range, it is impossible to verify complete relative relation between each type. However, refer to the list in right side for comparison value.

TYPE A JIS K6253 JIS K7215	0 10 20 30 40 50 60 70 80 90 100
(old A) JIS K6301 (Discontinued standard)	10 20 30 40 50 60 70 80 90
TYPE E JIS K6253	20 30 40 50 60 70 80 90
TYPE SRIS SRIS 0101 (Discontinued standard)	20 30 40 50 60 70 80 90
TYPE E2 TECLOCK E2	30 40 50 60 70 80 90
TYPE D JIS K6253 JIS K7215	10 20 30 40 50
TYPE DO ASTM D2240	10 20 30 40 50 60 70 80 90
TYPE O ASTM D2240	20 30 40 50 60 70 80
TYPE OO ASTM D2240	50 60 70 80 90
TYPE B ASTM D2240	10 20 30 40 50 60 70 80 90
TYPE C ASTM D2240	10 20 30 40 50 60 70 80

TYPE A GS-706, GS-709, GS-719

- General rubber elastomer
- Rubber roll
- Rubber roll
- Tire
- Rubber hose
- Soft plastic

TYPE B GS-750

- Medium-hard rubber
- Unglazed China clay
- Wood

TYPE DO GS-752

- Medium-hard rubber
- Flooring and building
- Car handle

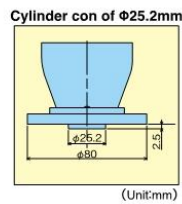
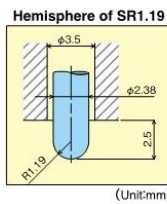
TYPE C GS-703, GS-751

- Hard rubber
- Golf ball
- Brake rubber

TYPE D GS-702, GS-720

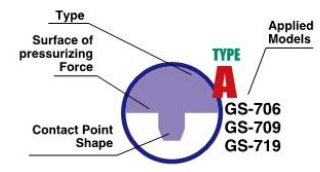
- Hard rubber
- Plastic
- Ebonite

The above table also refers to the digital types.



How to read table

Pressurizing Force to a work piece.
The arrow size above shows the strength of the pressurizing force. The biggest arrow shows the most pressurizing force which are type D, C and DO. The smallest arrows the minimum pressurizing force.





Durometer Standard Table

Specification of Testers	Name of standard	ASTM D 2240-05					
	Presser foot dimension	Type B	Type C	Type D0	Type O	Type O0	
Test Piece and Measuring Condition	Indenter shaft diameter	6mm diameter 2.5~3.2mm hole					
	Indenter tip diameter						
	Indenter tip angle						
	Indenter amount exceeding from presser foot						
	Weight at 0	550mN (56.1gf)	0 mN (0 gf)	550mN (56.1gf)	550mN (56.1gf)	203mN (20.7gf)	
	Weight at 100	8,050mN (821.1gf)	44,450mN (4,533gf)	8,050mN (821.1gf)	8,050mN (821.1gf)	1,111mN (113.3gf)	
	Load accuracy	Load allowance value	±0.075N	±0.4445N	±0.075N	±0.0182N	
		Indicating tolerance value		±1		±2	
	Other standards						
	Test pieces	Flat area dimension	More than radius 6mm than				
		Thickness	More than 6mm				
		Measuring position	More than 12mm (Length and Width)				
		Time to read	Within 1-sec.				
		Number of measurement and data summary	5-points of average value or medium 6mm off				
		Weight of constant pressure weighter	1kg Recommendation	5kg	1kg		
	Temperature condition	23±2°C					
	Acclimate time of specimen						
	Use range	20~90					
Suitable specimen to the standards	Rubber, Cellular, Elasticity material, Thermoplastic elastomers, Hard plastic, Soft plastic						
Our original durometers	Standard						
	Peak Pointer	GS-750G	GS-751G	GS-752G	GS-753G	GS-754G	
Our original digital durometers		GSD-750K	GSD-751K	GSD-752K	GSD-753K	GSD-754K	

Specification of Testers	Name of standard	Teclock standard		
	Presser foot dimension	Type E2	Type F0	
Test Piece and Measuring Condition	Indenter shaft diameter	More than 16mm, Diameter 5.5mm hole		
	Indenter tip diameter	More than 80mm diameter, 26mm hole in Center diameter		
	Indenter tip angle			
	Indenter amount exceeding from presser foot			
	Weight at 0	550mN (56.1gf)	550mN (56.1gf)	
	Weight at 100	4,300mN (438.6gf)	4,300mN (438.6gf)	
	load accuracy	Load allowance value	0.4N (±4gf)	0.4N (±4gf)
		Indicating tolerance value	±1	±1
	Other standards			
	Test pieces	Flat area dimension	More than pressurized surface	
		Thickness	More than 10mm	
		Measuring position	More than 30mm	
		Time to read	Within 1-sec.	
		Number of measurement and data summary	5-points median more than 6mm off	
		Weight of constant pressure weighter		
	Temperature condition	23±2°C		
	Acclimate time of specimen	23±2°C		
	Use range			
Suitable specimen to the standards	Soft sponge		Foam sponge, Polyurethane foam	
Our original durometers	Standard			
	Peak Pointer	GS-743G	GS-744G	
Our original digital durometers		GSD-743K	GSD-744K	



Durometer Standard Table

Name of standard	JIS K 6253-2012			JIS K 6301-1995 (1998 Abolition)		
	Type A	Type D	Type E ※Note1	Type A	Type C	
Presser foot dimension	More than 12mm			More than Diameter 10mm, Approx. 3.2mm hole		
Indentor shaft diameter						
Indentor tip diameter						
Indentor tip angle						
Indentor amount exceeding from presser foot						
Weight at 0	550mN (56.1gf)	0 mN (0 gf)	550mN (56.1gf)	539.5mN (55gf)	981mN (100gf)	
Weight at 100	8,050mN (821.1gf)	44,450mN (4,533gf)	8,050mN (821.1gf)	8,385mN (855gf)	44,130mN (4,500gf)	
Load accuracy	Load allowance value	±75mN (8.16gf)	±445mN (44.9gf)	±75mN (8.16gf)	±20gf	
	Indicating tolerance value	± 1	± 1	± 1	±0.45	
Other standards	ASTM D 2240 - ISO 7619					
Test Piece and Measuring Condition	Test pieces	Flat area dimension			More than pressurized surface	
		Thickness			More than 12mm	
		More than 6mm			More than 10mm	
	Measuring position	More than 12mm			More than 15mm	
	Time to read				Read at once (Or after regulating time)	
	Number of measurement and data summary	5-points median more than 6mm off			5-points average value	
		Test report (Example):A45	Test report (Example):D50	Test report (Example):E 60	Test report (Example):Hs (JIS A) 50	Test report (Example):Hs (JIS C) 50
	Weight of constant pressure weighter	1 ^{+0.1} / ₀ kg	1 ^{+0.5} / ₀ kg	1kg (Preferable) ^{+0.1} / ₀	1kg	5kg
	Temperature condition	23±2°C / More than 3 hours			20°~30°C / One hour	
	Acclimate time of specimen				A >70 Use C type	
Use range	More than A90 Use TypeD Under D20 Use TypeA			C type is preferable for range of 30-90		
Suitable specimen to the standards	Normal Rubber	Normal Rubber (Hard)	Soft Rubber	Normal Rubber	Hard Rubber	
Our original durometers	Standard	GS-719N	GS-720N	GS-721N	GS-703N	
	Peak Pointer	GS-719G	GS-720G	GS-721G	GS-706G	
Our original digital durometers	GSD-719K Series		GSD-720K Series	GSD-721K Series	GSD-706K	

Note1 ISO 7619 is referred to as a type A Note2 For stand 500mm² more

Name of standard	JIS K 7215-1986		JIS S 6050 / JIS K 7312	
	Type A	Type D		
Presser foot dimension	More than diameter 12mm, diameter3 ^{+0.5} mm hole Center		About 14×50mm Approx. 5.2mm hole in Center	
Indentor shaft diameter				
Indentor tip diameter				
Indentor tip angle				
Indentor amount exceeding from presser foot				
Weight at 0	549mN (56gf)	0 mN (0 gf)	0.54N (55.185gf)	
Weight at 100	8,061mN (822gf)	44,483mN (4,536gf)	8.39N (855.595gf)	
Load accuracy	Load allowance value	±78mN (± 8 gf)	±441mN (±45gf)	
	Indicating tolerance value	± 1	± 1	
Other standards	ASTM D 2240 / ISO 868 (SHORE A) DIN 53505	ASTM D 2240 / ISO 868 (SHORE D) DIN 53505	JIS S 6050 (Plastics Erasers)	
Test Piece and Measuring Condition	Test pieces	Width : about 25mm or more		
		Thickness		
		6mm or more, 2mm acceptable for HDD 40 pr above		
	Measuring position	12mm or more from edge		
	Time to read	1sec or less (Time to be specified for over 1sec)		
	Number of measurement and data summary	5 or preferably 10meas, at 6mm or more		
		Test report (Example):HDA83	Test report (Example):HDD56	Average value of 3initial and 30sec later measurement, JIS S 6050 Average value of 5initial and 30sec later measurement, JIS K 7312
	Weight of constant pressure weighter	Approx. 1kg	Approx. 5kg	1kg
	Temperature condition	23±2°C	50± 5 % (humidity)	20 ⁺¹⁰ / ₀ /h
	Acclimate time of specimen	88h (Time can be shortened if measured value does not vary)		
Use range	As a rule, use in range 20-90 Use D for A>90, Use A for D<20			
Suitable specimen to the standards	Plastic (Plastic Film, Tape and Foam Plastic Excluded) (Usable for Elastomer)		Expanded rubber	
Our original durometers	Standard	GS-709N	GS-702N	
	Peak Pointer	GS-709G	GS-702G	
Our original digital durometers	GSD-719K Series		GSD-701K	

Precautions on use of Durometer (Rubber / Plastic hardness measurement)

1. Confirmation of performance

Please confirm requested standard and type of durometer on the occasion of receiving.
Please refer to the standard of JIS K 6253, K 7215, K 6301, ISO 7619, ISO 868 and ASTM D 2240 in detail.

2. Test environment

- (1) Test environment for measuring samples is prescribed at internal and external standard as " $23 \pm 2^{\circ}\text{C}$. humidity $50 \pm 5\%$ ".
- (2) please avoid using it where dust and oil mist attach to it.

3. Precaution on use

- (1) Check before using
 - ① Confirm whether operation is smooth.
 - ② Confirm whether accretion is on pressurized surface or indenter.
 - ③ Confirm whether the indicator indicates "0 point".
- (2) Never disassemble device and loose screws.
- (3) Do not give the products any shock by being dropped or excessive load.
- (4) Keep the products away from direct sun light, excessive high or low temperature, and high humidity or dust. Avoid using and storing the products under the circumstances of water or oil.
- (5) Do not press the products to hard samples like glass or metals excepting for the purpose of checkup and inspection.
- (6) Do not clean with organic detergent (thinner or benzine) and not put oil onto the products.
- (7) Do not apply a load to the indenter in right angle. Do not hit the products with a hard item.

4. Maintenance

- (1) In case that outer dial can not be read due to dirt of crystal, please wipe stains from the crystal by using a dry cloth or a cloth dampened with neutral detergent.
- (2) In case that some sort of defect is observed for indicator, indenter and spring load value by check up and repair or adjustment is needed, please inform the sales outlet where the products are bought. Products repaired or adjusted by parties not authorized by TECLOCK can not be warranted by us.

5. Periodical inspection

Durometers are needed to be inspected during a certain period, which depends on usage frequency. Especially, in case that instruments are controlled by "inspection, measuring and test instruments " of ISO 9000 series, it is important element.

- (1) Indenter height : Indicator should indicate 0 on free condition. Then it is checked whether indicator is in 100 by pressing pressurized surface onto hard and flat and smooth surface. Meanwhile, be careful so that indenter edge shape of Type D durometer is not changed.
- (2) Indenter shape : It is checked by measuring microscope whether dimension and shape of indenter edge is in the permissible value of standard. In case that there is abrasion or damage , indenter needed to be changed.
- (3) Spring force : It is checked by giving load against each indicated value whether indicator correctly indicates. Please use durometer tester "GS-607 series" to check load of ● mark check point of 25, 50 and 75 on outer dial. Permissible error of indicated value is ± 1 .

