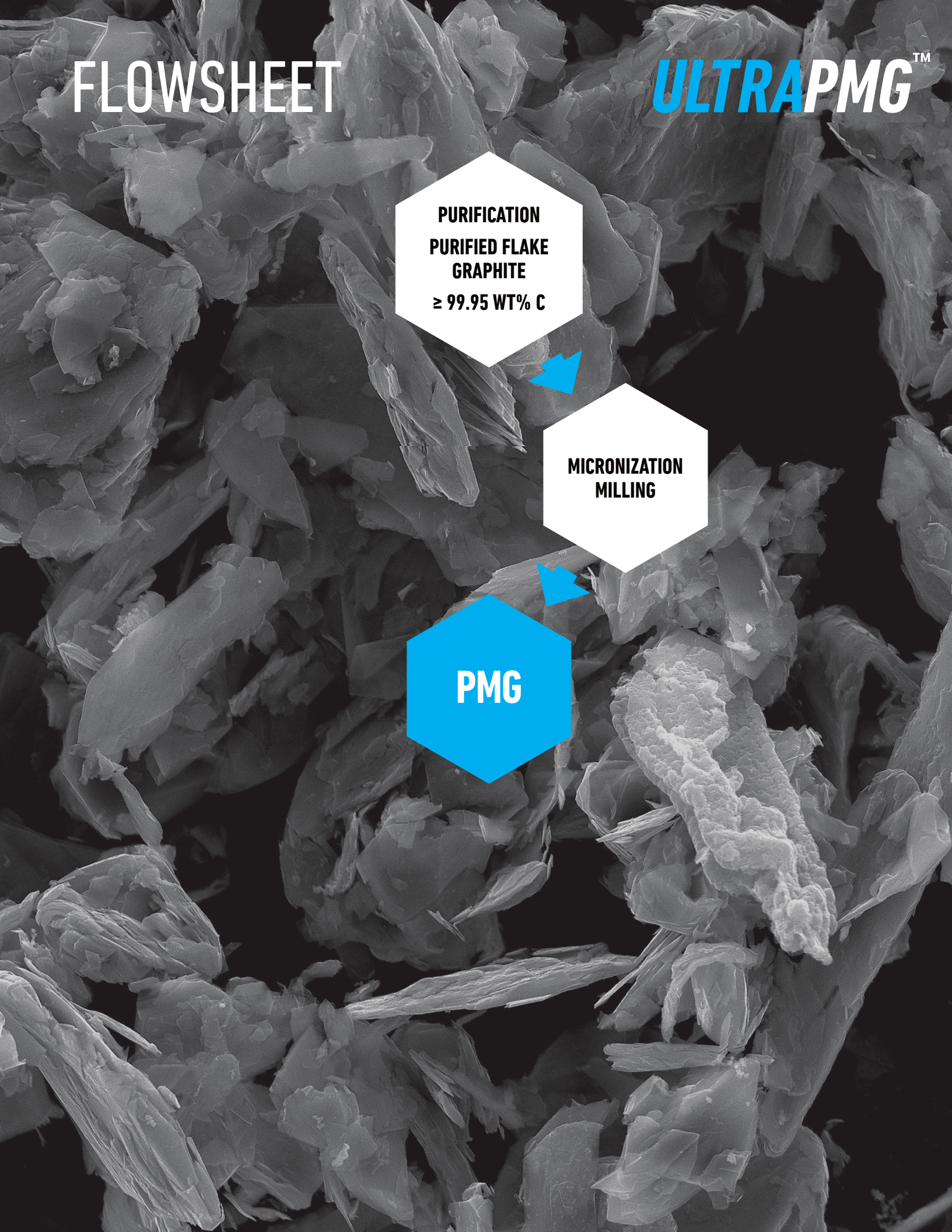
PRODUCT TECHNICAL DATA SHEETS

FLOWSHEET

ULTRAPMG™



WESTWATER RESOURCES

ULTRAPMG™

Made-in-USA Battery-Ready Natural Purified Micronized Graphite (PMG) for Lithium-ion, Lithium Primary, Lead-Acid & Alkaline Batteries

TECHNICAL DATA SHEET

General Characteristics

Product Name	ULTRA-PMG™
Type	Natural Flake Purified Micronized Graphite
Chemical Name	Graphite
Chemical Element	C
Appearance	Fine dark gray powder
True Density	2.23 g/cm^3
County of Origin	USA
Country of Manufacture	USA
Melting Point	3,750 °C (sublimes)
Molecular Weight	12.01 g/mol
CAS Number	7782-42-5
EC Number (EINECS)	231-955-3
Harmonized Tariff Schedule (HTS US)	2504.10.10.00

Physical Characteristics

Purity (LOI$_{950}$)	99.95 to 99.99993 wt% C
Ash, wt%	0.05 to 0.00007%
Moisture	<0.1wt%
BET Surface Area	11.2 m^2/g
Tap Density	0.26 g/cm^3

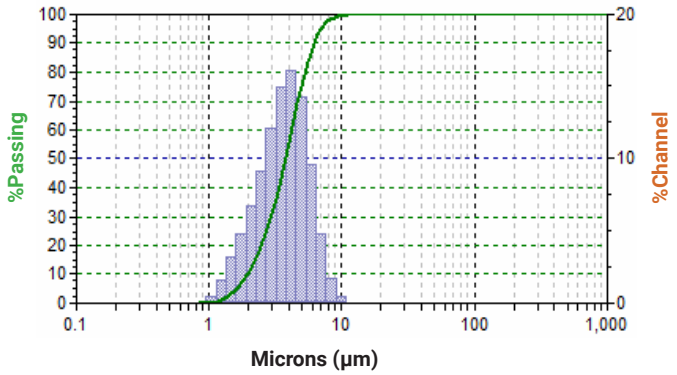
Standard Grades

ULTRA-PMG–25™ Graphite	D_{50} = 25 µm
ULTRA-PMG–12™ Graphite	D_{50} = 12 µm
ULTRA-PMG–035™ Graphite	D_{50} = 3.5 µm

- Westwater Resources is capable of producing natural ULTRA-PMG™ graphite with D_{50} ranging from 3 µm to 45 µm (all data presented is based on a D_{50} particle size of 3.5 µm)

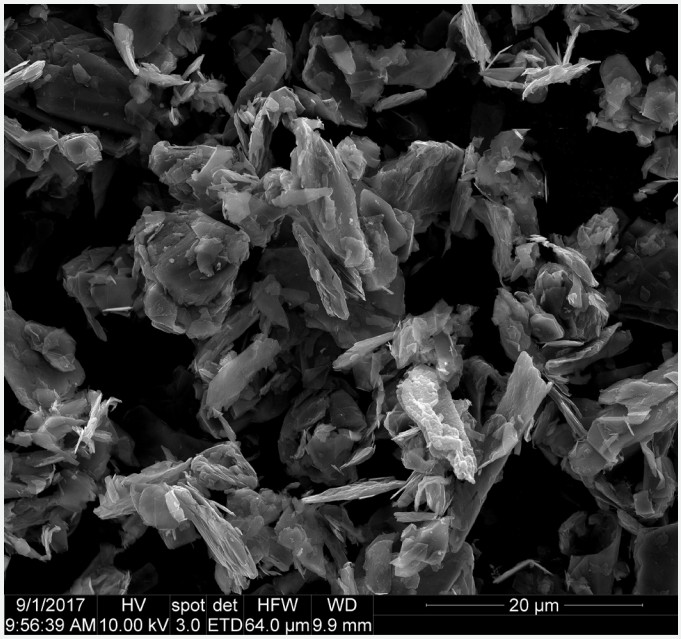
Particle Size Distribution

Laser diffraction particle size analysis by Microtrac S3500



D_{10}	1.9 µm
D_{50}	**3.5 µm**
D_{90}	6.1 µm
Mean Value	3.9 µm

Quality Assurance (QA) test results confirmed as of August 3, 2017

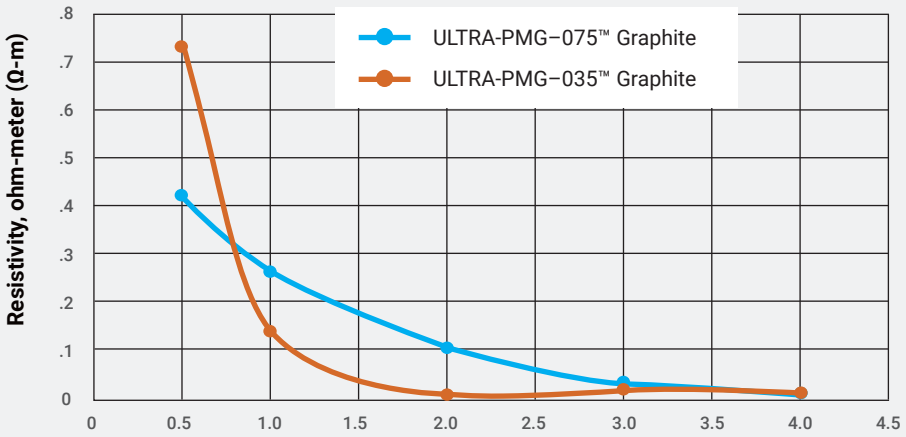


Westwater Resources' natural ULTRA-PMG™ processed natural graphite for conductivity-enhancement applications

WESTWATER RESOURCES

ULTRAPMG™

FOUR-TERMINAL-SENSING RESISTIVITY TEST RESULTS (4T SENSING)



ULTRA-PMG™ Graphite Conductivity-Enhancement Diluent in MnO_2 (wt% diluent)

Note: *Westwater Resources was able to achieve two sub-10-micron (µm) size PMG (D_{50} = 3 µm and D_{50} = 7 µm) ULTRA-PMG™ conductivity-enhancement materials for its preliminary 4T-sensing resistivity testing.*

In the graph above, the horizontal line (or the 'X' axis) represents the weight percent (wt%) addition of conductivity-enhancement graphite in manganese dioxide (MnO_2) matrix as a function of EMD electrode resistivity of the additive. The vertical line (or the 'Y' axis) represents the electrical resistivity measured in SI units of ohm-meters (Ω•m). The ideal is to obtain the lowest resistivity with the least amount of conductivity-enhancement graphite.

Westwater Resources' ULTRA-PMG™ consistently features low resistivity (meaning, higher conductivity) in MnO_2 electrolytic manganese dioxide (EMD) electrode matrices across all practical percentage point additions.

ULTRA-PMG™ GRAPHITE RESISTIVITY DATA

	Resistivity Measurement (Ω·m)	Graphite Conductivity-Enhancement Diluent in MnO_2 (wt% diluent)
ULTRA-PMG–035™ Graphite	0.016	4
	0.025	3
	0.013	2
	0.137	1
	0.730	0.5
ULTRA-PMG–075™ Graphite	0.015	4
	0.037	3
	0.109	2
	0.250	1
	0.422	0.5

TRACE MINERAL IMPURITIES KEY ELEMENTS

Element	Concentration (ppm)
Ag (Silver)	< 0.05
Al (Aluminum)	1
As (Arsenic)	< 0.05
B (Boron)	4.4
Ba (Barium)	< 0.05
Be (Beryllium)	< 0.01
Bi (Bismuth)	< 0.05
Ca (Calcium)	< 0.5
Cd (Cadmium)	< 0.5
Co (Cobalt)	< 0.05
Cr (Chromium)	< 0.5
Cu (Copper)	< 0.05
Fe (Iron)	8.4
Ga (Gallium)	< 0.05
Ge (Germanium)	< 0.1
Hf (Hafnium)	< 0.05
K (Potassium)	< 0.5
Li (Lithium)	< 0.01
Mg (Magnesium)	< 0.1
Mn (Manganese)	0.14
Mo (Molybdenum)	< 0.05
Na (Sodium)	< 0.05
Ni (Nickel)	< 0.05
P (Phosphorus)	0.3
Pb (Lead)	< 0.1
S (Sulfur)	6
Se (Selenium)	< 0.5
Si (Silicon)	37
Sn (Tin)	< 0.1
Te (Tellurium)	< 0.05
Ti (Titanium)	< 0.05
V (Vanadium)	< 0.05
W (Tungsten)	< 0.05
Zn (Zinc)	< 0.1
Zr (Zirconium)	< 0.05

Data by GDMS

DISCLAIMER

FOR REFERENCE ONLY. The information contained within this product information bulletin is not a product specification. Information provided in this document is supplied to indicate the approximate physical and chemical properties of the material. Customers are strongly urged to test the material independently prior to application/purchase.

Westwater Resources, Inc. Technical Advisor, Gareth P. Hatch, PhD, CEng, FIMMM, FIET, has reviewed and approved the scientific and technical disclosure in this technical data sheet.

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WESTWATER RESOURCES

FLOWSHEET

ULTRADEXDG

WESTWATER RESOURCES

ULTRADEXDG™

Made-in-USA Battery-Ready Natural Delaminated Expanded Graphite (DEXDG) for Lithium-ion, Lithium Primary, Lead-Acid & Alkaline Batteries

TECHNICAL DATA SHEET

General Characteristics

Product Name	ULTRA-DEXDG™
Type	Natural Flake Delaminated Expanded Graphite
Chemical Name	Graphite
Chemical Element	C
Appearance	Fine dark gray powder
True Density	2.1 to 2.23 g/cm^3
County of Origin	USA
Country of Manufacture	USA
Melting Point	3,750 °C (sublimes)
Molecular Weight	12.01 g/mol
CAS Number	7782-42-5
EC Number (EINECS)	231-955-3
Harmonized Tariff Schedule (HTS US)	2504.10.10.00

Physical Characteristics

Purity (LOI_{950})	> 99.95 wt% C
Ash, wt%	0.05%
Moisture	< 0.1 wt%
BET Surface Area	18 m^2/g
Tap Density	0.12 g/cm^3
Scott Volume	0.07 g/cm^3

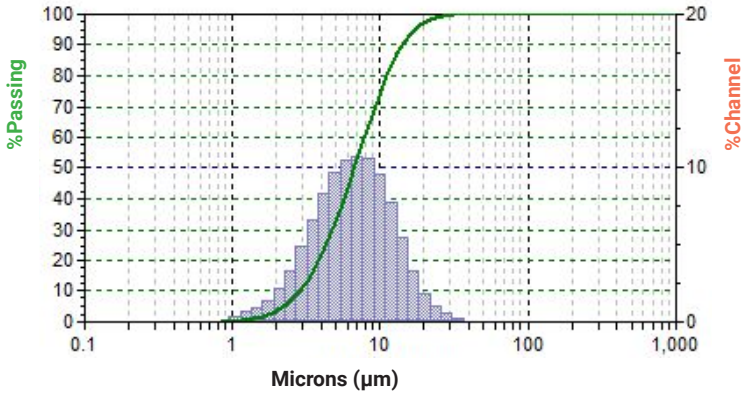
Standard Grades

ULTRA-DEXDG–25™ Graphite	D_{50} = 25 µm
ULTRA-DEXDG–15™ Graphite	D_{50} = 10 µm
ULTRA-DEXDG–07™ Graphite	D_{50} = 7 µm

- Westwater Resources is capable of producing natural ULTRA-DEXDG™ graphite with D_{50} ranging from 3 µm to 45 µm (all data presented is based on a D_{50} particle size of 6.7 µm)

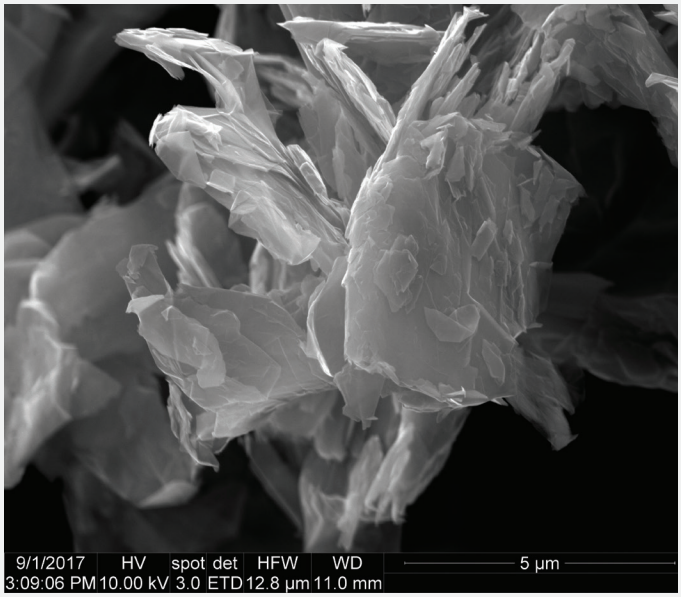
Particle Size Distribution

Laser diffraction particle size analysis by Microtrac S3500



D_{10}	2.9 µm
D_{50}	**6.7 µm**
D_{90}	14.0 µm
Mean Value	7.8 µm

Quality Assurance (QA) test results confirmed as of August 17, 2017

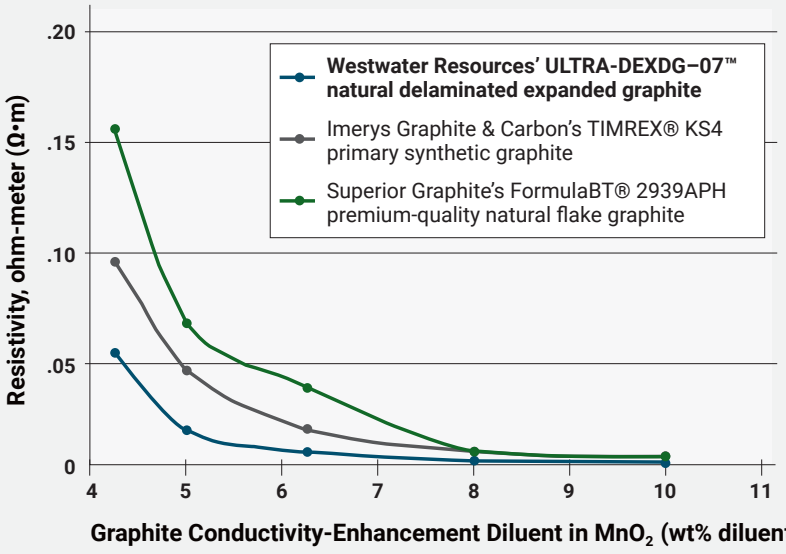


SEM of Westwater Resources' natural ULTRA-DEXDG™ processed natural graphite for conductivity-enhancement applications

WESTWATER RESOURCES

ULTRADEXDG™

4T-SENSING RESISTIVITY TEST RESULTS OF WESTWATER'S DEXDG VS. COMPETITIVE PRODUCTS



In Figure 1, the horizontal line (or the 'X' axis) represents the addition of conductivity-enhancement graphite in manganese dioxide (MnO_2) matrix as a function of total weight percentage (wt%) of the additive. The vertical line (or the 'Y' axis) represents the electrical resistivity measured in SI units of ohm-meters (Ω•m). The ideal is to obtain the lowest amount of resistivity with the least amount of conductivity-enhancement graphite.

TRACE MINERAL IMPURITIES KEY ELEMENTS

Element	Concentration (ppm)
Al	2.67
As	1.36
Ca	1.29
Co	<0.1
Cr	0.075
Cu	0.09
Fe	6.373
Mo	0.849
Ni	0.392
Pb	0.02
Sb	0.124
Si	0.15
Sn	0.08
V	0.119

Data by Solid ICP

4T-SENSING RESISTIVITY TEST RESULTS OF ULTRA-DEXDG™ VS. COMPETITIVE PRODUCTS

Conductivity-Enhancement Material	Graphite Conductivity-Enhancement Diluent in MnO_2 (wt% diluent)	Resistivity Measurement (Ω·m)
Westwater Resources' ULTRA-DEXDG–07™ natural Delaminated Expanded Graphite	**4.25**	**.0533 Ω·m**
Imerys Graphite & Carbon's TIMREX® KS4 primary synthetic graphite	4.25	.0991 Ω·m
Superior Graphite's FormulaBT® 2939APH premium-quality natural flake graphite	4.25	.1524 Ω·m

As indicated in Figure 1 and Table 1 above, Westwater Resources' ULTRA-DEXDG–07™ features lower resistivity in MnO_2 electrolytic manganese dioxide (EMD) electrode matrices across all practical percentage point additions, compared to commercially available grades of both natural and synthetic graphite products, produced by Superior Graphite and Imerys Graphite & Carbon respectively.

DISCLAIMER

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Westwater Resources, Inc. Technical Advisor, Gareth P. Hatch, PhD, CEng, FIMMM, FIET, has reviewed and approved the scientific and technical disclosure in this technical data sheet.

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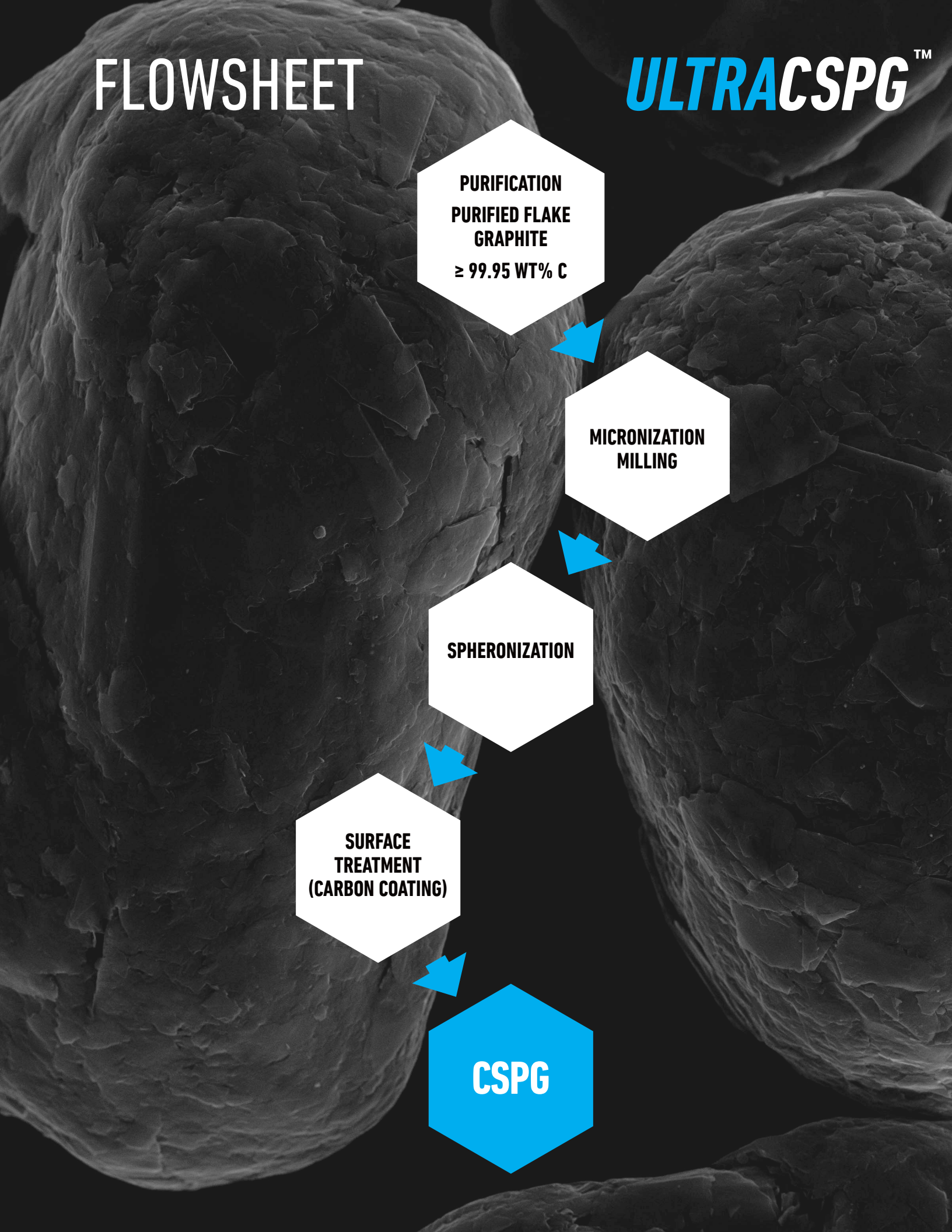
WESTWATER RESOURCES

FLOWSHEET

ULTRACSPG™



WESTWATER RESOURCES

ULTRACSPG™

Made-in-USA Battery-Ready Natural Coated Spherical Purified Graphite (CSPG) for Lithium-ion Battery Anodes

TECHNICAL DATA SHEET

General Characteristics

Product Name	ULTRA-CSPG™
Type	Natural Flake Coated Spherical Purified Graphite
Chemical Name	Graphite
Chemical Element	C
Appearance	Fine dark gray powder
True Density	2.23 g/cm^3
County of Origin	USA
Country of Manufacture	USA
Melting Point	3,750 °C (sublimes)
Molecular Weight	12.01 g/mol
CAS Number	7782-42-5
EC Number (EINECS)	231-955-3
Harmonized Tariff Schedule (HTS US)	2504.10.10.00

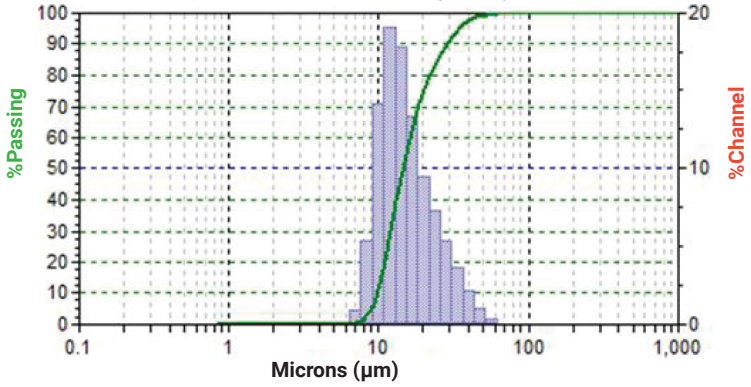
Physical Characteristics

Purity (LOI_{950})	99.95 to ≤99.99993 wt% C
Ash, wt%	0.05 to ≤0.000071%
Moisture	<0.1 wt%
BET Surface Area	0.62 m^2/g
Tap Density	0.985 g/cm^3

- Westwater Resources is capable of producing natural ULTRA-CSPG™ graphite with D_{50} ranging from 10 µm to 35 µm

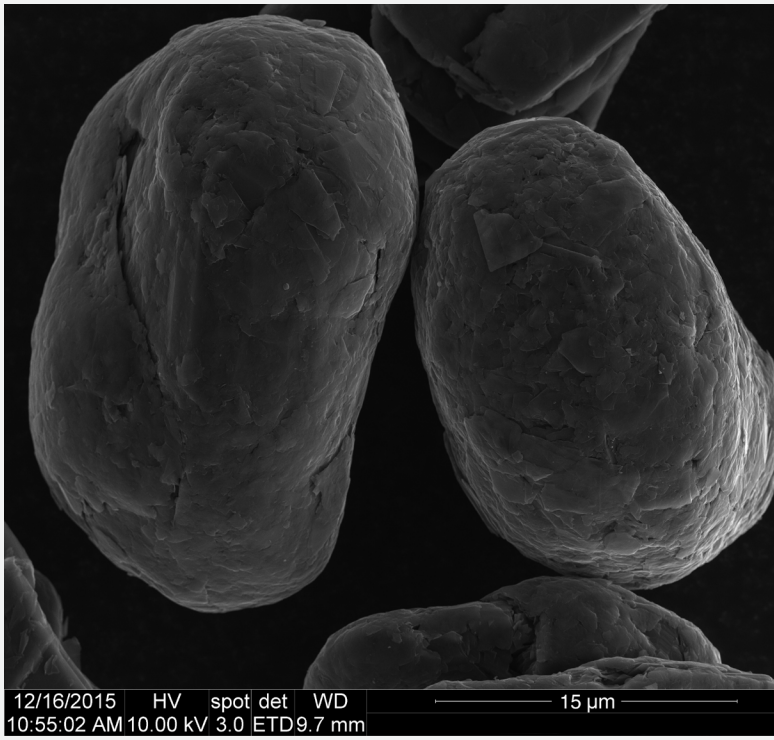
Particle Size Distribution

Laser diffraction particle size analysis by Microtrac S3500



D_{10}	10.7 µm
D_{50}	**14.5 µm**
D_{90}	29.6 µm
Mean Value	19.6 µm

Quality Assurance (QA) test results confirmed as of June 11, 2016

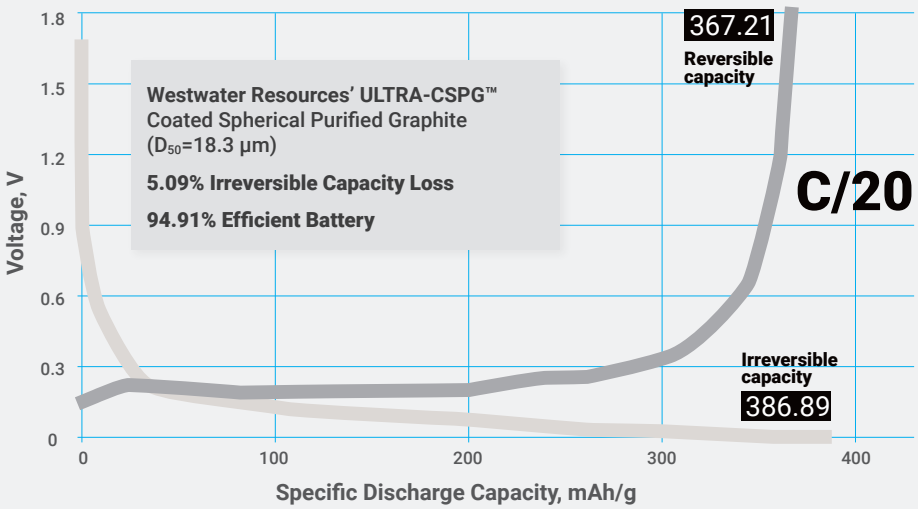


SEM of Westwater Resources' natural ULTRA-CSPG™ anode graphite for Li-ion batteries

WESTWATER RESOURCES

ULTRACSPG™

INITIAL GALVANOSTATIC CYCLING OF ULTRA-CSPG™ IN CR2016 CELLS VS. Li/Li⁺ COUNTER ELECTRODE



Note: *the C-rate of C/20 means that the necessary current is applied or drained from the battery to completely charge or discharge it in 20 hours, which is a low discharge rate.*

TRACE MINERAL IMPURITIES KEY ELEMENTS

Element	Concentration (ppm)
Al	2.67
As	1.36
Ca	1.29
Co	<0.1
Cr	0.075
Cu	0.09
Fe	6.373
Mo	0.849
Ni	0.392
Pb	0.02
Sb	0.124
Si	0.15
Sn	0.08
V	0.119

Data by Solid ICP

ULTRA-CSPG™ VS. COMMERCIAL SYNTHETIC GRAPHITE

CR2016 Li-ion Battery Anode	Reversible Capacity	Irreversible Capacity Loss	BET Surface Area
ULTRA-CSPG™ Natural Graphite D_{50} = 18.3 µm	**367.21 mAh/g**	**5.09% (94.91% efficient)**	**0.62 m^2/g**
Commercial Lithium-ion Synthetic D_{50} = 15.8 µm	347.2 mAh/g	6.06% (93.94% efficient)	1.15 m^2/g

m^2/g = square meter per gram

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