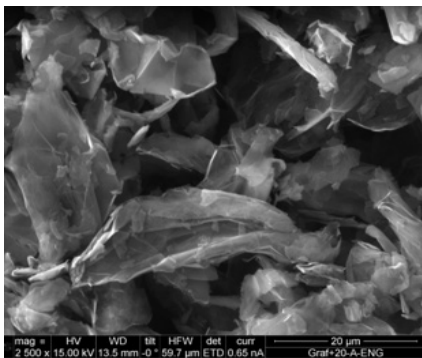


Graf+® Graphite Powders

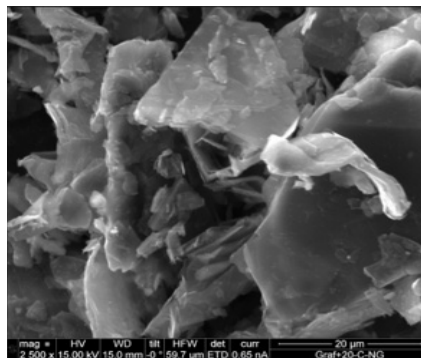
TECHNICAL DATA SHEET 456

Product Overview

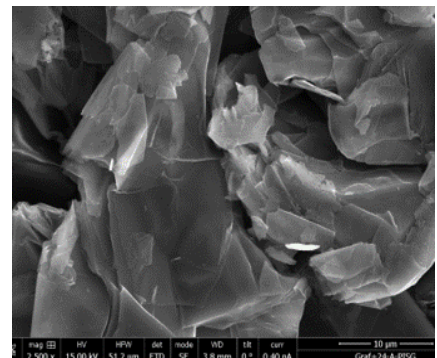
NeoGraf Solutions, LLC manufactures a variety of natural and synthetic graphite powders and nanoplatelets under our Graf+® trade name. Graphite can be added to a range of polymers to enhance thermal and electrical conductivity, reduce degradation to UV radiation, and increase insulation value in foams and boards. Graphite is also an excellent lubricant. Our Graf+ powders are available in a range of particle sizes and purities depending on the end use application. High purity (>99.9% carbon) grades are used in battery applications. Our graphite powders are available as dry powders, compounded with polymers (masterbatches), as pastes with mineral oil and petrolatum or as water-based dispersions/solid lubricant additives.



Expanded Natural Graphite



Flake Natural Graphite



Polyimide Derived Synthetic Graphite

Grade Designations

Graf+ Particle Size D50 - Purity - Graphite Type

- Particle Size D50 varies from ~ 5µm to mm
- Purity available at 99.9+% Carbon (A), 98+% (B), 95+% (C), and < 95% (D)
- Graphite Type – Expanded Natural Graphite (ENG), Flake Natural Graphite (NG) or Coke-based Synthetic Graphite (CSG), Coke/Pitch-based Synthetic Graphite (CPSG), or Polyimide-based Synthetic Graphite (PISG)

Example:

Graf+ 20-C-ENG denotes D50 20 µm, Purity > 95+% Carbon, Expanded Natural Graphite Material

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9.23.2020

Expanded Natural Graphite Grades (ENG)

Expanded natural graphite (ENG) powders are made by intercalating natural graphite flake with acids and then heating to drive off the intercalants to create an expanded or exfoliated graphite. The exfoliated graphite is subsequently milled between ~ 8-30 µm. The main features of expanded graphite materials are their high surface area and low Scott density resulting in a low percolation threshold and high compressibility. Purity levels vary depending on the starting flake purity from ~ 95% carbon to 99.9+% carbon, with lower purity adequate for industrial applications and higher purity required for battery applications. End use applications include extruded polystyrene (XPS) insulation boards, alkaline, lead acid and Li-ion batteries, fuel cells, specialty adhesives, conductive polymers and ceramics. Expanded graphite powders are also available in masterbatches containing between ~ 20-40 wt.% graphite solids and water dispersions containing between 13-18 wt.% graphite solids. Expanded graphite powders are also available un-milled.

Typical Properties*

PROPERTY	UNIT	EXPANDED NATURAL GRAPHITE FLAKES (ENG)			
		Graf+ 20-A-ENG	Graf+ 12-A-ENG	Graf+ 20-B-ENG	Graf+ 16-C-ENG
Ash	%	0.005	0.007	1.11	2.52
Typical Particle Size					
D10	microns	7	5	7	6
D50	microns	19	12	19	16
D90	microns	50	34	50	39
Real Density	g/ml	2.25	2.07	2.25	2.17
Scott Density	g/ml	0.05	0.07	0.06	0.05
BET Surface Area	m ² /g	21	21	20	20.4
Absorption, kerosene	ml/g	3.3	2.4	3.3	3.1
Moisture	%	0.14	0.16	0.19	0.38

Typical Impurity Levels*

ELEMENT	UNIT	Graf+ 20-A-ENG	Graf+ 12-A-ENG	Graf+ 20-B-ENG	Graf+ 16-C-ENG
Aluminum (Al)	ppm	4.8	3.9	45	550
Antimony (Sb)	ppm	<0.1	<0.1	<0.1	<0.1
Arsenic (As)	ppm	<0.05	0.06	<0.05	0.06
Calcium (Ca)	ppm	1.7	1.9	13	3.4
Chromium (Cr)	ppm	<0.5	<0.5	<0.5	2
Cobalt (Co)	ppm	<0.05	<0.05	<0.05	0.06
Copper (Cu)	ppm	0.18	<0.1	0.23	1.7
Iron (Fe)	ppm	6.1	4.8	75	350
Lead (Pb)	ppm	0.17	<0.05	<0.05	0.09
Magnesium (Mg)	ppm	4.9	3.6	54	17
Manganese	ppm	<0.05	<0.05	0.37	0.56
Molybdenum (Mo)	ppm	<0.1	<0.1	0.44	0.76
Nickel (Ni)	ppm	0.26	0.34	<0.05	4.7
Silicon (Si)	ppm	24	12	340	2400
Tin (Sn)	ppm	<0.5	<0.5	<0.5	<0.5
Vanadium (V)	ppm	<0.05	<0.05	<0.05	4.5
Zinc (Zn)	ppm	0.24	<0.1	<0.1	10

Notes:

* Properties listed are typical and cannot be used as accept/reject specifications.

Flake Natural Graphite Grades (NG)

Flake natural graphite powders are derived from naturally occurring flake deposits. The flake is milled between ~ 4-30 µm. The main features of flake natural graphite materials are lower surface area and higher Scott density. Purity levels vary depending on the starting flake purity from ~ 95% carbon to 99.9+% carbon, with lower purity adequate for industrial applications and higher purity required for battery applications. End use applications include expanded polystyrene (EPS) insulation boards, lubricants and greases, friction products, alkaline, lead acid and Li-ion batteries, fuel cells, specialty adhesives, conductive polymers and ceramics. Flake natural graphite powders are also available un-milled.

Typical Properties*

PROPERTY	UNIT	FLAKE NATURAL GRAPHITE GRADES (NG)			
		Graf+ 8-A-NG	Graf+ 27-A-NG	Graf+ 6-B-NG	Graf+ 20-C-NG
Ash	%	0.007	0.007	1.45	5.0
Typical Particle Size					
D10	microns	3	9	2	7
D50	microns	8	27	6	18
D90	microns	16	56	28	38
Real Density	g/ml	2.15	2.19	2.19	2.23
Scott Density	g/ml	0.08	0.16	0.08	0.12
BET Surface Area	m ² /g	8.3	3.8	14	8
Absorption, kerosene	ml/g	1.6	1.6	1.4	1.6
Time to 50% Oxid. Wt. loss @ 670°C	mins	28	98		
Moisture	%	0.3	0.3	0.17	0.19

Typical Impurity Levels*

ELEMENT	UNIT	Graf+ 8-A-NG	Graf+ 27-A-NG	Graf+ 6-B-NG	Graf+ 20-C-NG
Aluminum (Al)	ppm	2.9		230	830
Antimony (Sb)	ppm	<0.1		<0.1	<0.1
Arsenic (As)	ppm	<0.05		<0.05	<0.05
Calcium (Ca)	ppm	0.83		40	7.7
Chromium (Cr)	ppm	<0.5		<0.5	2.8
Cobalt (Co)	ppm	<0.05		<0.05	<0.05
Copper (Cu)	ppm	<0.1		0.6	2
Iron (Fe)	ppm	4.5		190	980
Lead (Pb)	ppm	<0.05		<0.05	<0.05
Magnesium (Mg)	ppm	<0.1		88	20
Manganese	ppm	<0.05		0.64	1.1
Molybdenum (Mo)	ppm	0.48		0.39	0.57
Nickel (Ni)	ppm	0.1		0.36	1.9
Silicon (Si)	ppm	14		670	2300
Tin (Sn)	ppm	<0.5		<0.5	<0.5
Vanadium (V)	ppm	0.16		0.83	4.5
Zinc (Zn)	ppm	<0.1		1.5	9.2

Notes:

* Properties listed are typical and cannot be used as accept/reject specifications.

Polyimide-Based Synthetic Graphite Grades (PISG)

Polyimide-based synthetic graphite powders are derived from polyimide materials that are carbonized and graphitized. The graphitized polyimide is milled between ~ 8-30 µm. The main features of polyimide-based synthetic graphite powders are high oxidation resistance, high electrical and thermal conductivity and high purity (99.9% carbon). End use applications include ad-mixtures for battery applications and specialty applications.

Typical Properties*

PROPERTY	UNIT	POLYIMIDE-BASED SYNTHETIC GRAPHITE GRADES (PISG)		
		Graf+ 8-A-PISG	Graf+ 17-A-PISG	Graf+ 24-A-PISG
Ash	%	0.11	0.11	0.11
Typical Particle Size				
D10	microns	4	6	9
D50	microns	8	17	24
D90	microns	16	35	53
Real Density	g/ml	2.22	2.24	2.29
Scott Density	g/ml	0.088	0.103	0.138
BET Surface Area	m ² /g	9.7	5.6	4.5
Absorption, kerosene	ml/g	1.65	1.62	1.8
Time to 50% Oxid. Wt. loss @ 670°C	mins	77	90	90
Moisture	%	0.2	0.2	0.2

Typical Impurity Levels*

PROPERTY	UNIT	POLYIMIDE-BASED SYNTHETIC GRAPHITE GRADES (PISG)
Aluminum (Al)	ppm	0.27
Antimony (Sb)	ppm	<0.1
Arsenic (As)	ppm	<0.05
Calcium (Ca)	ppm	17
Chromium (Cr)	ppm	<0.5
Cobalt (Co)	ppm	0.26
Copper (Cu)	ppm	<0.1
Iron (Fe)	ppm	3.3
Lead (Pb)	ppm	<0.05
Magnesium (Mg)	ppm	<0.1
Manganese	ppm	<0.05
Molybdenum (Mo)	ppm	0.49
Nickel (Ni)	ppm	6.2
Silicon (Si)	ppm	12
Tin (Sn)	ppm	<0.5
Vanadium (V)	ppm	1.4
Zinc (Zn)	ppm	<0.1

Notes:

* Properties listed are typical and cannot be used as accept/reject specifications.