

Understanding the Worldwide “Graphite” Market

TREM12

Critical Material for Energy & Security

March 13-14, 2012



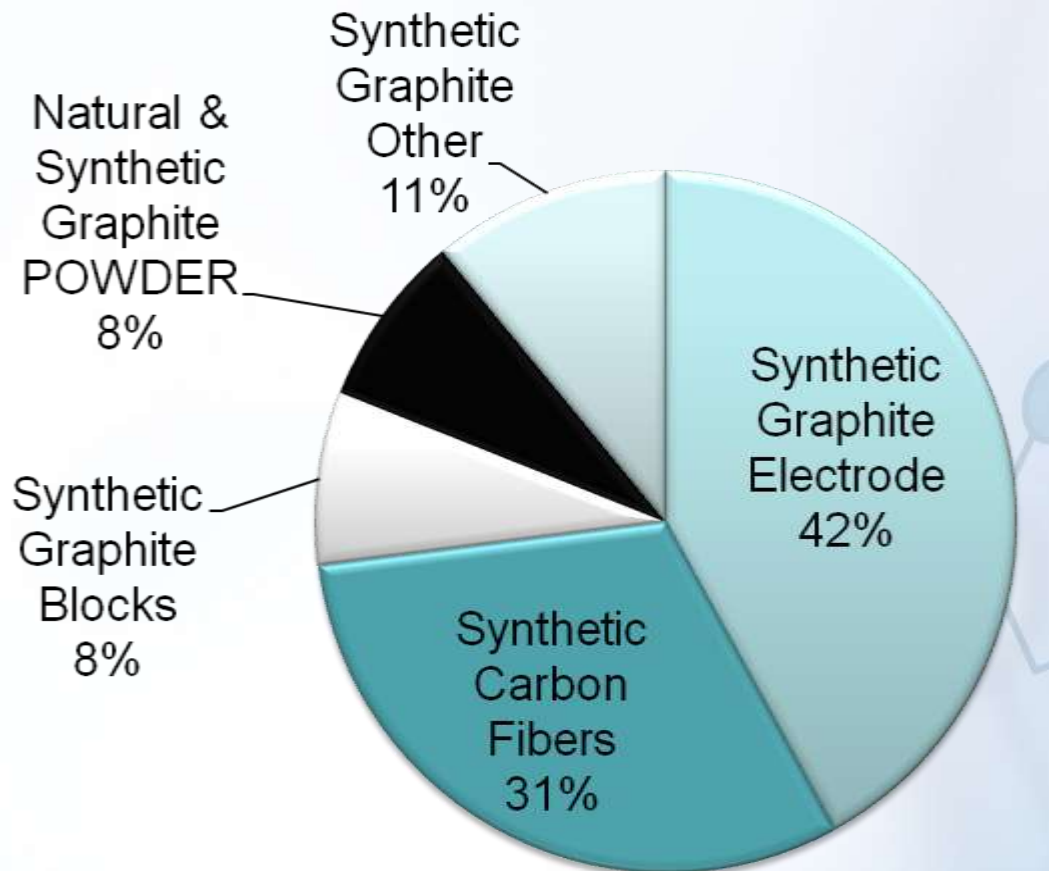
Key Properties of Graphite

- Thermally Conductive
- Electrically Conductive
- Lubricating
- Thermally Resistive
- Chemically Resistive
- High Strength (Graphene)



Total Worldwide Graphite Market

is Estimated to be:
USD \$13 Billion



% by Graphite Type

Synthetic Graphite & Carbon Electrodes

**The largest Graphite Market
is estimated to be:**

**USD \$5.5 Billion – 42%
of the worldwide Graphite market**



Synthetic Graphite & Carbon Electrodes

Major Worldwide Manufacturers

(Excludes China)

- GrafTech International, Ltd.
- Graphite India, Ltd.
- HEG, Ltd.
- JSC Energoprom Management
- Nippon Carbon Co., Ltd.
- SEC Carbon, Ltd.
- SGL Carbon Group
- Showa Denko Carbon, Inc.



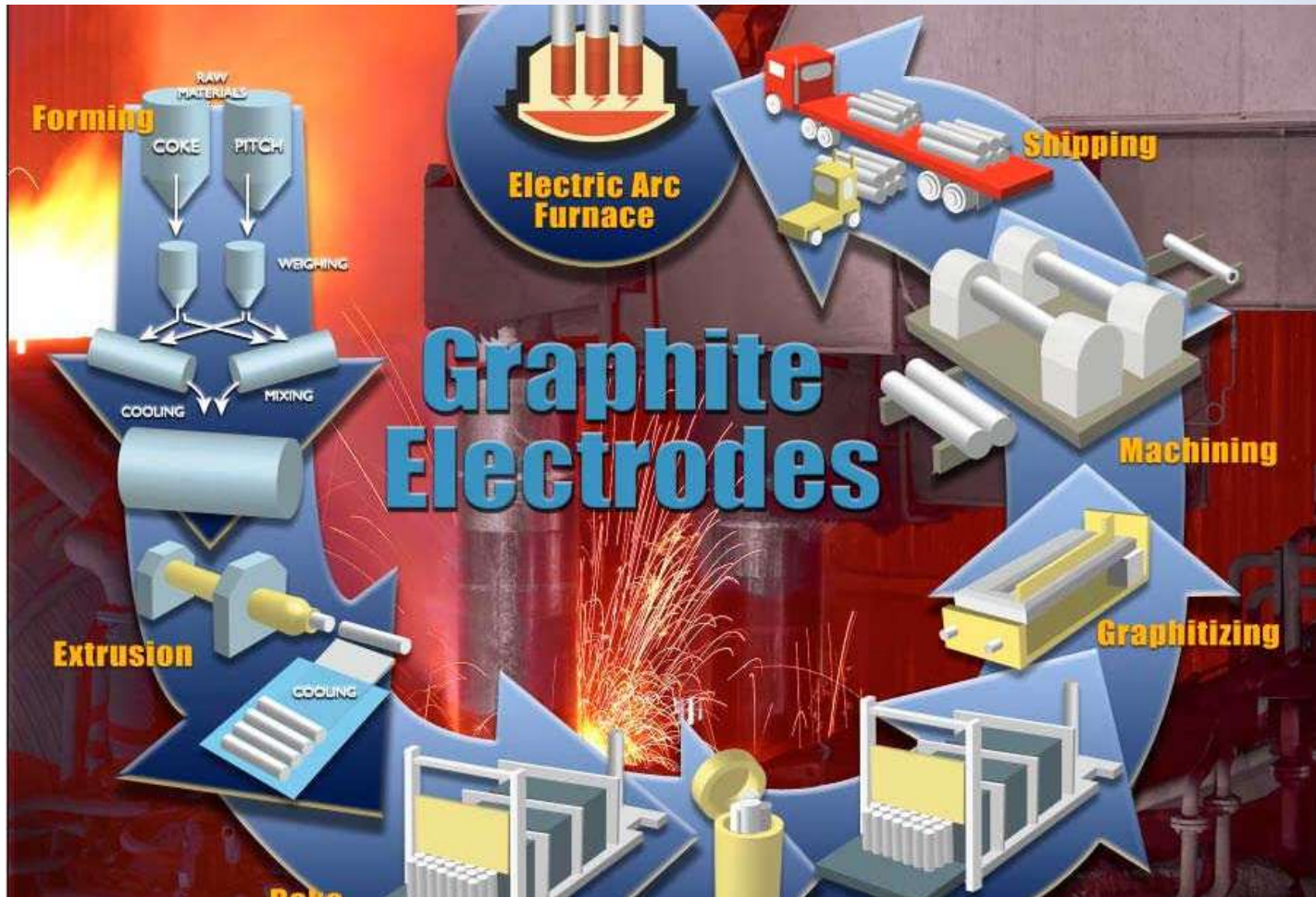
Synthetic Graphite & Carbon Electrodes



Graphite Electrodes



Synthetic Graphite & Carbon Electrodes



Graphite electrode process diagram

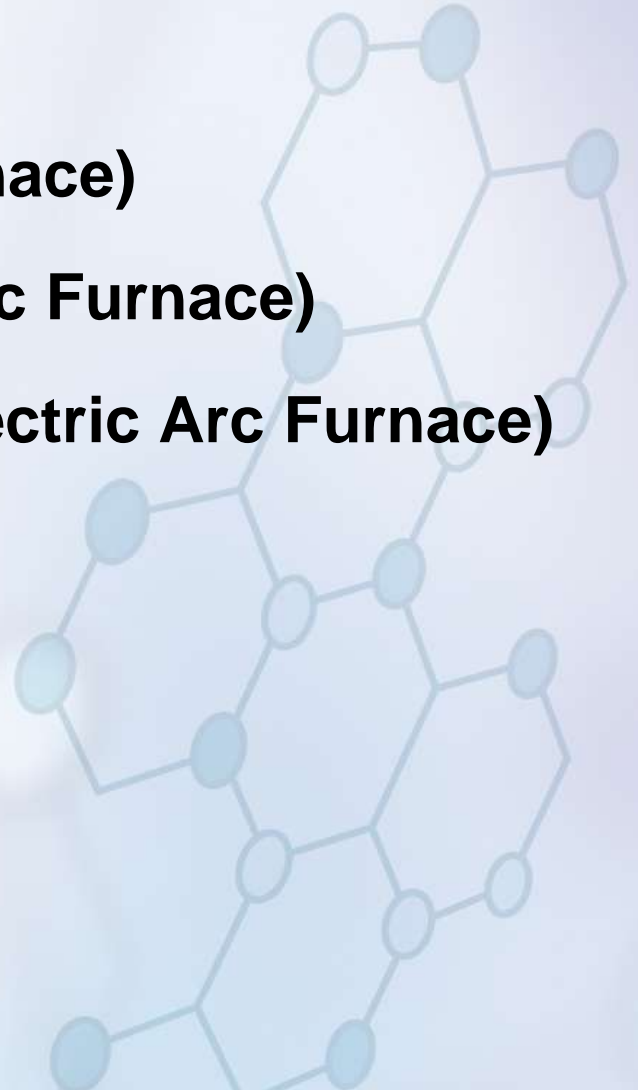
Synthetic Graphite & Carbon Electrodes

Major Market Applications

Steel Mills (Electric Arc Furnace)

Iron Foundries (Electric Arc Furnace)

Ferro Alloy Smelters (Electric Arc Furnace)



Carbon Fibers

Carbon Fibers –

(sometimes referred to as Graphite Fibers)

**The Second Largest Market
estimated to be:**

**USD \$4.0 Billion - 31%
of the Worldwide Graphite Market**



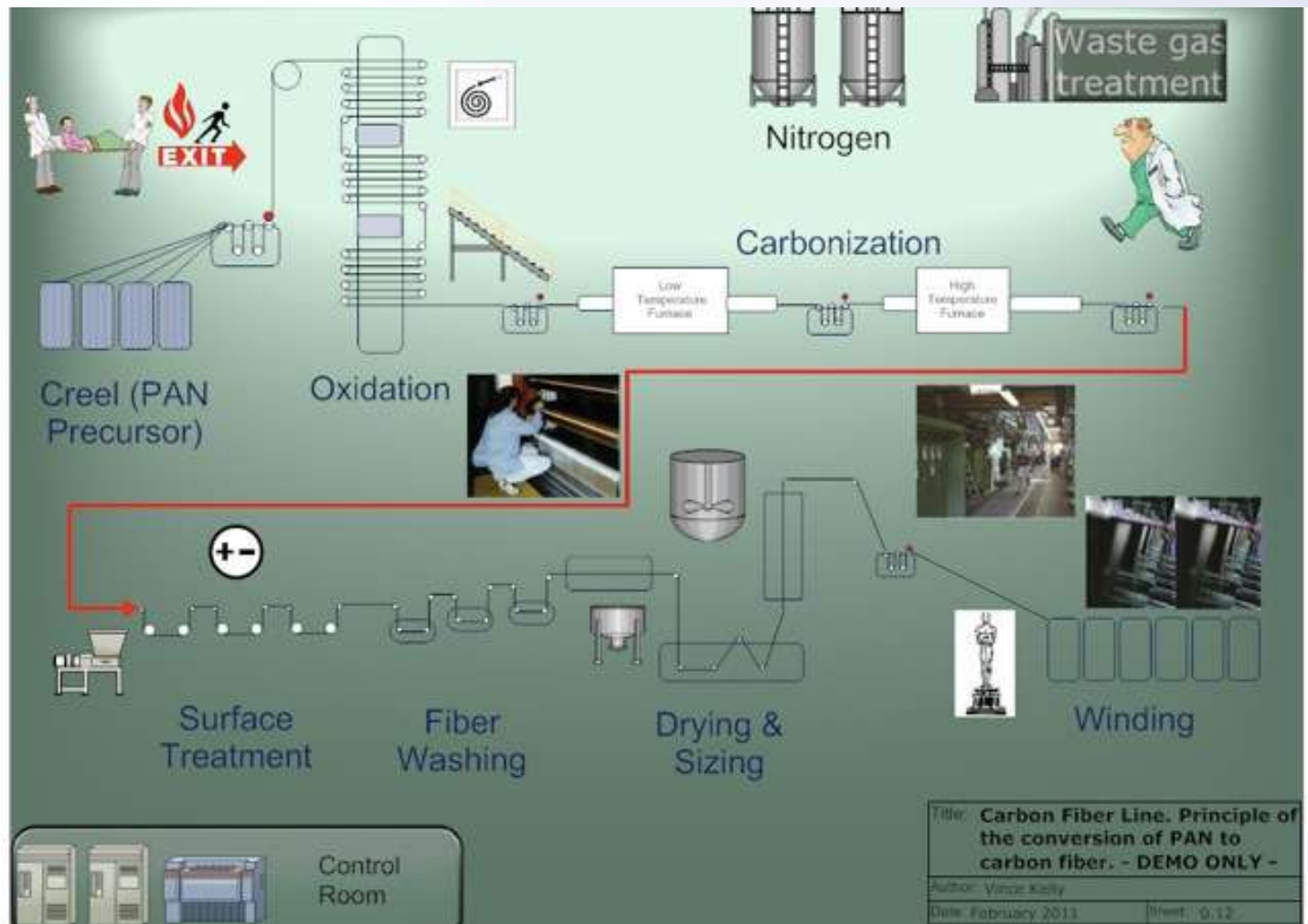
Carbon Fibers

Major Worldwide Manufacturers

- **Blue Star**
- **Cytec**
- **Formosa Plastics Group**
- **Hexcel**
- **Mitsubishi Rayon**
- **SGL Carbon, AB**
- **Toho Tenax Group**
- **Toray Carbon**
- **Zoltek**



Carbon Fibers



Carbon Fiber process diagram

Carbon Fibers



Carbon Fiber manufacturing facility

Carbon Fibers

Market Applications

- **Aircraft**
- **Automotive**
- **Energy Storage**
- **Friction Materials**
- **Off Shore Drilling**
- **Plastics**
- **Sporting Goods**
- **Wind Energy**



Synthetic Specialty Graphite Shapes

Synthetic Graphite Shapes

Market is estimated to be:

USD \$1.0 Billion – 8.0%

Of the worldwide Graphite Market



Synthetic Specialty Graphite

Key Worldwide Manufacturers

(excludes China)

- GrafTech International Ltd
- Graphite India
- Ibiden Co., Ltd
- Mersen Group
- Poco Graphite, Inc.
- SEC Carbon, Ltd.
- SGL Carbon Group
- Toyo Tanso Co., Ltd.



Synthetic Specialty Graphite



Synthetic Specialty Graphite Pieces

Synthetic Specialty Graphite

Market Applications

- **Solar**
- **Electronics**
- **Industrial Diamonds**
- **Chemical Processing**
- **Nuclear**
- **Glass**
- **Extrusion**
- **Furnace Parts**
- **Battery**



Natural & Synthetic Graphite Powder

**Worldwide “Graphite” Market
Is estimated to be:**

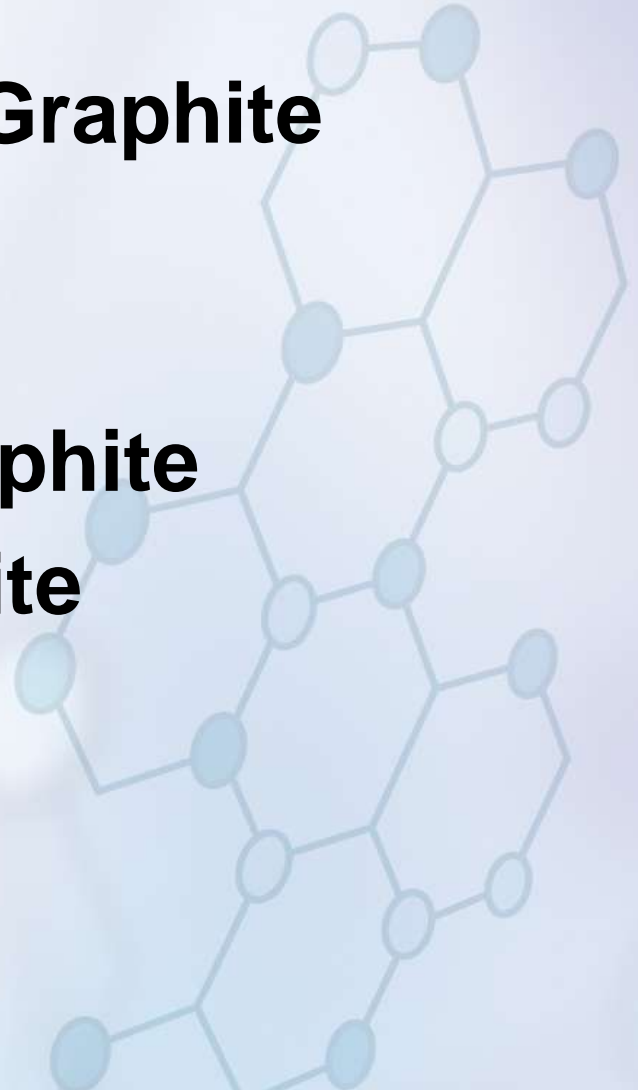
**USD \$1.0 Billion – 8.0%
Of the world-wide Graphite Market**



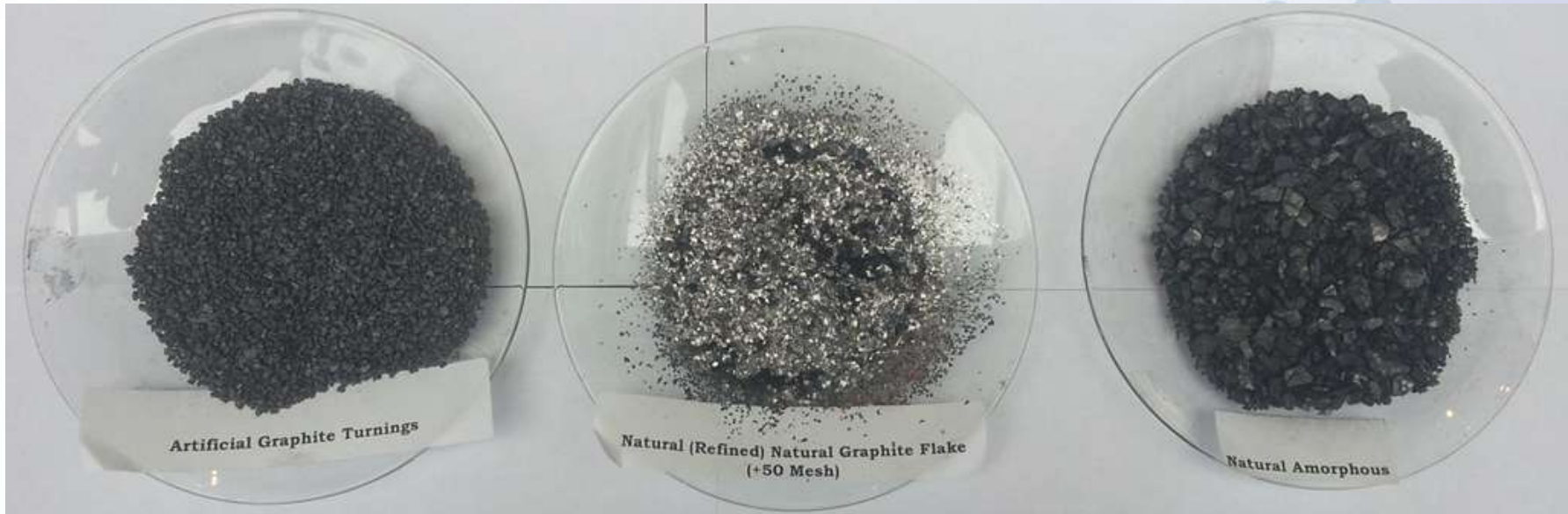
Natural & Synthetic Graphite Powder

Types

- **Natural Microcrystalline Graphite (Amorphous)**
- **Natural Flake Graphite**
- **Secondary Synthetic Graphite**
- **Primary Synthetic Graphite**



Natural & Synthetic Graphite Powder

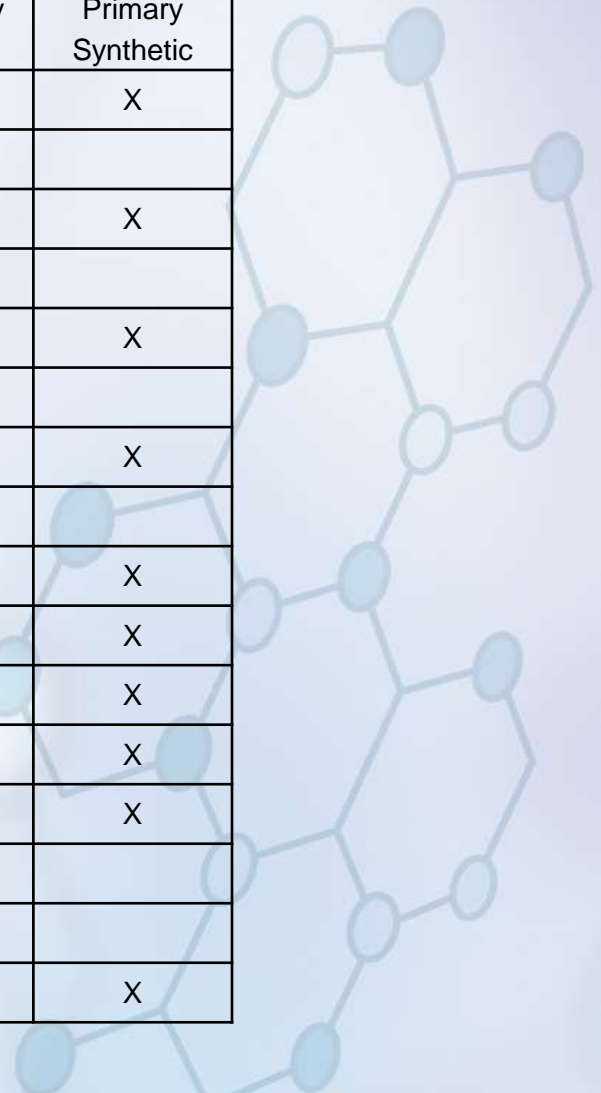


3 Types of Graphite Powder

Natural & Synthetic Graphite Powder

Major Worldwide Suppliers

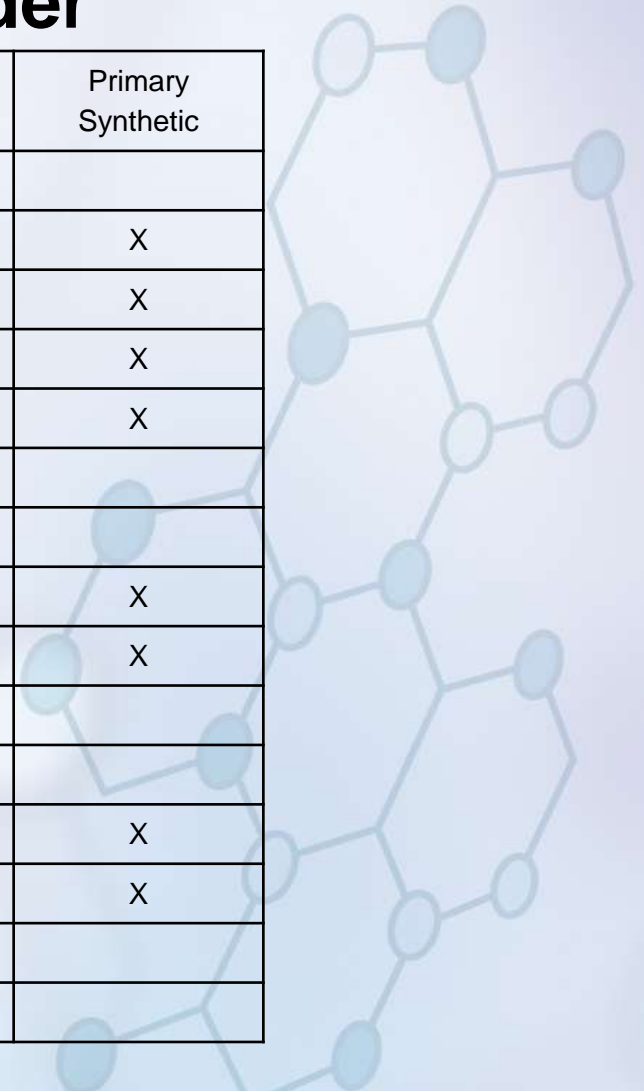
Supplier	Micro crystalline	Flake	Secondary Synthetic	Primary Synthetic
Asbury Graphite Mills, Inc	X	X	X	X
China Graphite Ltd		X		
Conoco Phillips				X
Grafitbergbau Kaisersberg , Gef.m.b H	X			
GrafTech International			X	X
Graphit Kropfmuhl, AG		X		
Hitachi Chemical Co., Ltd				X
Nacional De Grafito	X			
Nippon Carbon Co., Ltd				X
Nippon Graphite Industries, Ltd.	X	X	X	X
SEC Carbon Ltd				X
SGL Carbon Group			X	X
Showa Denko Carbon, Inc				X
Skaland Graphite AS		X		
Superior Graphite Co	X	X	X	
Timcal , Ltd. & Stratmin Graphite Div.		X		X



Natural & Synthetic Graphite Powder

Major Applications of the 4 types of Graphite Powder

Application	Micro crystalline	Flake	Secondary Synthetic	Primary Synthetic
Batteries				
• Alkaline & Zinc Carbon		X	X	X
• Li- Ion		X	X	X
Carbon Brush		X	X	X
Conductive Coating		X	X	X
Expandable Graphite		X		
Foundry Coating	X	X		
Friction Materials	X	X	X	X
Fuel Cells		X	X	X
Gaskets & Seals		X		
Pencils	X	X		
Plastics		X	X	X
Powder Metals		X		X
Refractory	X	X		
Steel & Iron (Carbon Additive)	X		X	



All Other Graphite Products

Market is estimated to be

USD \$1.5 Billion – 11%

Of the Worldwide Graphite Market



Other Major Graphite Products

- **Graphene**
- **Specialty Graphite Composites**
- **Graphite Felt**
- **Pyrolytic Graphite**



Thank you for your attention

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