

GRAPHITE 101

POWERING THE CLEAN ENERGY TRANSITION

Introduction to the graphite market and associated opportunities



Q2-2023

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GRAPHITE 101 KEY TAKEAWAYS





Unprecedented growth in EV and energy storage solutions driving
 demand for lithium-ion batteries



Lithium-ion battery demand from grid storage applications to surpass traditional portables by 2024



Graphite is an essential input for lithium-ion batteries making up >95% of anode material across chemistries



Natural graphite provides a superior ESG profile and is expected to experience the highest growth of all battery materials



China dominates the current supply chain – OEMs are seeking diversity of supply; governments are showing willingness and committing financial levers to reduce reliance on Chinese production

INTRODUCTION TO GRAPHITE

+WHAT IS GRAPHITE?

Graphite is one of the most versatile non-metallic materials in the world

- » Graphite comes in the form of both natural and synthetic
 - Natural: one of the two forms of naturally occurring, pure carbon (along with diamonds)
 - Synthetic: manufactured by complex process of graphitizing petroleum coke at very high temperatures
- » Wide array of potential applications in many industries due to its unique and extraordinary qualities

Properties	Applications		
Excellent conductor of heat and electricity	Metallurgy	Electronic Uses	
 Highest natural strength and stiffness of any material 	 » High-temperature lubricants » Manufacturing molds & parts 	 » Alkaline & lithium batteries » Fuel cells » Lithium-ion batteries 	
Maintains strength and stability at over 3,600 °C	» Foundries / refractory bricks		
One of the lightest of all reinforcing agents	Technical Uses	Other	
Natural lubricant due to its greasy texture	» Flame retardants» Nuclear reactors	» Industrial lubricants» Paints	
Chemically inactive with high corrosion resistance	» Thermal diffusers	» Pencils	

Source: Battery Materials Review: "The Investor's Guide to Graphite" (April 14, 2020).

GRAPHITE MARKET

While the global graphite market has long been dominated by the steelmaking industry, batteries have recently become the main driver

> **2022E global annual graphite consumption** 3.3 MILLION TONNES

2022 Graphite Demand



Sources:

1) Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022

2) Benchmark Mineral Intelligence Flake Graphite Forecast Q2 2022

EMERGING GRAPHITE MARKETS

New technologies are at the center of the energy revolution and re-energizing the graphite industry

Source: Brandon Hill Capital; Dundee Capital Markets; Benchmark Mineral Intelligence; U.S. Geological Survey; U.S. Department of Energy; greencarreports.com.





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Electric vehicles ("EVs"), energy storage and portable devices expected to drive battery demand Significant investment into lithium-ion battery factories

- Up to 150kg or more of flake graphite required for one EV
- Expected to replace combustion engines \rightarrow more efficient conversion of fuel to energy Natural graphite \rightarrow key raw material
 - Avg. ~80kg graphite
- The jumbo and large flake graphite demand for heat dissipation foils will grow significantly with the roll-out of the 5G communication technology
- Used in various types of antennas providing high frequency and bandwidth
- A single layer of atoms in graphite → outstanding properties for multiple applications
 - World's thinnest and most conductive material
 - 200x stronger than steel; stretchable, transparent, flexible and impermeable



+ FORMS OF NATURAL GRAPHITE

There are three primary types of natural graphite with different qualities, processing techniques, and uses

» High-quality natural graphite is associated with high Carbon (C) content, few impurities and high crystallinity

- Higher quality graphite requires less processing (less costs) to remove impurities and has greater technological applications



Sources: Battery Materials Review: The Investor's Guide to Graphite (April 14, 2020) Industry sources.

+ GLOBAL SUPPLY OF FLAKE GRAPHITE

Over 90% of flake graphite is mined in China, Africa and Brazil; however, 100% of spherical graphite production used for anode material comes from China.



+ KEY FACTORS IN EVALUATING GRAPHITE PROJECTS

Not all graphite deposits are created equal; CAPEX, OPEX, IRR and bankability are heavily influenced by underlying attributes.

	» Deposit Size: larger deposits allow for higher annual production over the life of the mine
	» Long Asset Life: the longer the mine can produce at consistent levels the more valuable it will be
	» Grade: higher ratio of graphite to ore results in higher yield in the mining process
Resourc	» Purity: higher purity is associated with premium in price and lower purification costs for value-added processing
	» Flake Size Distribution: well-distributed flake sizes across the deposit provides for diversity in saleable product into various markets, leading to profit optimization
	» Homogeneity: uniform ore across the entire deposit provides consistency in the product and mining process throughout the life of the mine
	» Infrastructure: proximity to essential infrastructure such as energy and transportation (roads, rail, seaports) is a key factor
Locatio	n » Mining Jurisdiction: stable political environment and reliable permitting; government legislation and grants heavily impact the economics of a planned mine
Personn	el » Expertise: graphite mining and processing is a highly complex endeavor requiring an expert team across multiple functions
	» Carbon and Environmental Footprint: proper tailings management; strict environmental protocols; minimum effect on water, air and wildlife; GHG reduction efforts; and traceability can provide trustworthy ESG credentials and market differentiator
ESG Prof	ile » Access to Low-Cost Renewable Energy: proximity to reliable and low-cost renewable energy sources minimizes carbon footprint and can enhance project economics
	» Community & Indigenous Engagement: support from the local community and partnership with First Nations allow for smoother operations

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+ VALUE-ADDED PROCESSING

Flake graphite requires a highly technical and power-intensive process to be transformed into anode active material



EACH STEP IS ENGINEERED TO ADD VALUE

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+ GRAPHITE PRICING CONSIDERATIONS

Pricing varies greatly based on market application, the degree of downstream processing, the product purity and, in the case of flake graphite, the size of the saleable product.

All current pricing is FOB China, markets are relatively opaque

Larger flake size and higher purity products are sold at a premium

Macro-economy impacts the typical traditional applications/markets such as Metallurgy, Automobile, Durable Goods, Industrial

As a general principle, greater processing leads to a greater market price

Vertical integration from mine to anode material provides for margin optimization and pricing flexibility

Applications

- » The largest, highest purity flakes sell for the highest prices and are most sought after for traditional graphite applications
- Smaller, high purity, flake graphite is ideal for battery anode production as it must be micronized and processed into spherical graphite, and ultimately spread thinly and uniformly during the lithium-ion battery manufacturing process

Supply Chain Localization

- » Recent legislation in North America and Europe are accelerating the development of a more localized supply chain
- » Localization and corresponding logistics are key drivers for graphite pricing
 - Beginning in 2023, U.S. customers are exposed to an import tariff of up to 25% on anode products coming from China
 - Since the vast majority of natural graphite suppliers are based in China, logistics costs and perceived geopolitical risk can also impact graphite prices relative to North American suppliers

Environmental Profile

» A lower carbon footprint should command a premium pricing, a "greenium"

+ SYNTHETIC GRAPHITE

While synthetic graphite has several high-quality product attributes, the manufacturing process is timeconsuming, energy-intensive, and expensive

- » Synthetic graphite manufacturing involves the transformation of calcined petroleum coke (an oil byproduct) and graphite scrap into graphitic carbon
- » Produced through the process of graphitization, a heat treatment which reorganizes the material at the atomic level
- » Traditionally used because it can achieve high grade/purity (~99.5%) and is more consistent than natural graphite
- » Input costs are heavily reliant on volatile price of petroleum-based precursors and energy costs associated with processing
- » Relative to natural graphite, synthetic graphite is more energy intensive, with a significant carbon footprint



+ SYNTHETIC GRAPHITE IS PRODUCED FROM NEEDLE COKE; SUPPLY IS CRUCIAL

Global Needle Coke Supply (2021)



Needle Coke Supply-Demand Forecast (Q3 2022)



Sources: Benchmark Mineral Intelligence Q3 2022, Benchmark Graphite week presentation, December 2021

MARKET DYNAMICS

+ FORECASTED FLAKE GRAPHITE DEMAND

Batteries are expected to drive substantial growth in demand in the coming years

Total Flake Graphite Demand Growth (2022 – 2030)



Source: Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022.

+ EMERGING FLAKE GRAPHITE SUPPLY SHORTAGE

Flake graphite demand is currently exceeding global supply and estimated to be over 1.2 million tonnes in 2030

- » Significant supply shortages emerging as EV demand ramps up new production needed to come online to meet the strong growth
- » This supply-demand imbalance is expected to result in upward pressure in pricing for battery grade graphite



BENCHMARK "This is the first year that battery anode demand will overtake demand from the refractory and foundry industries. It is also the first year we expect a structural deficit for the graphite industry in the gigafactory era, with new supply now needed to meet rapidly rising near-term demand"¹

Source: Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022.

(1) Benchmark Mineral Intelligence: "Flake Graphite Set to Enter First Deficit of Gigafactory Era" (September 23, 2022).



+ CHINA DOMINATES GRAPHITE SUPPLY

- » China accounts for an estimated 69% of synthetic graphite and 100% of chemical processing capacity, respectively
- » For graphite usage in lithium-ion batteries, China currently accounts for approximately 100% of spherical graphite production (both synthetic and natural), the key graphite precursor for battery anode production



Market Share by Country

Sources: U.S. Geological Survey, Mineral Commodity Summaries, January 2023 Benchmark Mineral Intelligence: China's Battery Supply Chain Dominance (October 2022)

+ THE WEST IS LAGGING ACROSS THE SUPPLY CHAIN

The West must step up investment across the entire supply chain to meet its ambitious cell manufacturing goals

- » While key battery minerals are produced in various regions globally, the majority of the supply chain flows through China, as it dominates downstream processing
- » China is currently a net exporter at stage 2 and 3, but is expected to soon become a net importer at every stage given their ambitious 2030 GWh goals
- » While lithium has received most of the attention due to large recent price increases, graphite is the most controlled battery material

	Stage 1: Graphite Extraction	Stage 2: Uncoated Spherical Graphite Processing	Stage 3: Battery Production	Stage 4: Electric Vehicle Production
*2	65%	100%	79%	59%
***** ***** *****	1%	0%	7%	26%
	0%	0%	7%	9%
ROW	34%	0%	7%	6%

Sources

U.S. Geological Survey, Mineral Commodity Summaries, January 2023 Benchmark Mineral Intelligence Dawn of the Energy Storage Era (June 2022). BMO: Fast-Charging our EV Forecasts; Raising Lithium Demand Forecasts Too

+ WESTERN SUPPLY CHAINS BEING DRIVEN BY POLICY

Electrification policy is expanding as legislative mandates aim to motivate localized supply chains with minimal carbon footprint



- Securing Critical Materials Executive Order deemed graphite critical
- » Inflation Reduction Act
 - \$369 billion total cost, largely aimed to subsidize clean energy revolution
 - \$7,500 tax credit for Electric Vehicles materials sourced mainly from Free-Trade Allies (China explicitly excluded)



- Declared graphite as critical mineral
- » Announced \$3.8 billion investment in critical materials to position Canada as a global supplier of choice and ensure its position in modern clean economy
- » Multiple provinces have announced initiatives to further mining and refining efforts



- » Declared graphite as critical mineral
- Green Deal
 - Requires new batteries have the lowest possible environmental impact while also being long-lasting, safe and reusable
 - Mandates a "battery passport" for all rechargeable industrial and EV batteries proving their carbon footprint by 2026
 - Lays the groundwork for a sustainable and independent EU battery value chain
- » Strategic partnership around critical mineral supply chains between Canada and the European Union

GRAPHITE FOR LITHIUM-ION BATTERIES

GRAPHITE IS FUNDAMENTAL TO EVERY BATTERY CHEMISTRY

Graphite's structure makes it the ideal mineral for the storage and transfer of lithium ions

- » The flow of lithium ions between the anode and cathode are what makes the batteries function
- » When charging, lithium ions are stored within the anode and await to be discharged when a circuit is completed (on demand)

While there are multiple cathode chemistries for lithium-ion batteries, graphite remains a constant across anodes



Source: Pallinghurst-Traxys battery analysis. %s represent the proportions of cathode and anode in each battery respectively. NCA batteries contain 2% aluminium (not shown).

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+ BATTERY DEMAND GROWING EXPONENTIALLY

Demand for EVs, portable electronics and stationary applications are driving lithium-ion battery production capacity



Global EV Adoption and Vehicle Sales



Lithium-ion Battery Demand in GWh

Source: Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022.

RISE OF THE EV BATTERY GIGAFACTORIES

387 GIGAFACTORIES IN THE PIPELINE FOR A COMBINED CAPACITY OF ~8.6 TWh BY 2030

Substantial investment in lithium-ion battery gigafactories globally will lead to a surge in demand of graphite



Source: Benchmark Mineral Intelligence, May 2023

+ NATURAL vs SYNTHETIC GRAPHITE FOR ANODES

Lithium-ion battery anodes use a blend of natural and synthetic graphite due to their complementary relationship

- » Historically, natural flake graphite was not able to match the performance characteristics of synthetic graphite
- » Recent manufacturing breakthroughs have improved cycle life, energy density and product consistency of natural graphite while maintaining the significant relative cost advantage and improved environmental footprint
- » Current battery anodes use an approximate 43% natural / 57% synthetic blend, however, the blend is expected to trend towards 52% natural and 48% synthetic by 2030
- » When comparing <u>quality</u> natural and synthetic products of today, they are growing increasingly similar in properties

ТҮРЕ	ANODE PROFILE	INTENSITY	PROS	CONS
Natural Anode	» The preferred input material for producers outside China	1.2 kg/kWh	» Capacity	» Less consistent
	» Increasingly natural blends being used in EVs		» Cost	» Cycle life
			» ESG benefit	
Synthetic Anode	» The dominant anode technology in China today	1.2 kg/kWh	» Purity	» High cost
	» Typically blended with other carbon		» Life cycle	» Supply chain uncertainty
			» Particle size	» Capital Intensive
Q OSTO ₂				» Energy intensive

Source: Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022.

+ STRONG GROWTH IN DEMAND FOR NATURAL AND SYNTHETIC GRAPHITE IN LITHIUM-ION BATTERIES

Anode demand is the key driver of graphite consumption, whether derived from natural flake or synthetic material



Source: Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022.

(1) 2.1 tonnes of natural flake graphite for 1.0 tonne of anode material., on average, can depend of type of equipment, process and customer specifications

+ NATURAL GRAPHITE IS EXPECTED TO TAKE MARKET SHARE FROM SYNTHETIC THROUGH 2030

Expected shift toward natural graphite driven by superior ESG profile, lower cost and improving performance



Source: Benchmark Mineral Intelligence Flake Graphite Forecast Q4 2022.

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+ EMERGING ANODE TECHNOLOGIES

Emerging anode technologies are improving, yet are complex and many years from commercialization



"Silicon anode production currently occupies a 1% share of the global anode market by tonne (3% by MWh). Benchmark forecasts this to increase by around 300% by 2030 even though graphite is on course to maintain more than 90% market share until the mid-2030s"¹

Lithium Metal (Solid State)

Lithium metal technology replaces graphite with lithium in the anode to enhance performance and safety

- » Lower cost and more powerful electric vehicles by increasing the energy density and safety of current lithium-ion batteries
 - Lithium metal anodes can increase the battery cell's energy density by 2-3x
- » Supply of lithium metal is very limited
 - 5 GWh of solid-state battery production would exceed the current supply of lithium metal
- » Even once proven at scale, the economics are unlikely to compete with matured lithium-ion batteries

"The lithium industry is hesitant to expand capacity before solid state battery technology has been proven...ramping up battery-grade lithium metal production capacity before a technology is ready could yield enormous capital losses"²

Source: Benchmark Mineral Intelligence.

(1) Benchmark Mineral Intelligence: "Flake Graphite Set to Enter First Deficit of Gigafactory Era" (September 23, 2022).

(2) Benchmark Mineral Intelligence: "Solid State Needs Lithium Metal Production to Gear up to Meet Future Demand" (September 29, 2022).

POWERING THE ENERGY REVOLUTION

+ GLOBAL COMMITMENTS TO REVOLUTION

Global electrification commitments are precipitating imminent change

COUNTRIES	HIGHLIGHTS	OEMs	HIGHLIGHTS
	» New York State and California, new sales target of 100% zero emission by 2035 $^{ m 1}$	TISLA	» Goal of selling 20 million electric vehicles by 2030 ⁴ (<i>source Tesla</i>)
*	» Target to sell 100% zero-emission vehicles by 2040 ¹	gm	» 30 EV models and BEV production capacity of 1 million units in North America by 2025, plus carbon neutrality in 2040 ³
	» Germany aims to have 15 million EVs on the road by 2030 ²	Ford	» One-third of sales to be fully electric by 2026 and 50% by 2030, with all-electric sales in Europe by 2030 ³
**** **** ***	 » France to ban gasoline or diesel sales by 2040 ¹ » UK to ban new petrol and diesel cars by 2030 ¹ 	ΤΟΥΟΤΑ	» 3.5 million annual electric car sales by 2030 and the rollout of 30 BEV models ³
 Netherlands target to sell 100% zero emission by 2030¹ Denmark no new sales of petrol or diesel by 2030¹ Finland, ambition: 30% of ZEVs in new truck and bus sales by 2030, 100% by 2 Norway, ambition: 30% of ZEVs in new truck and bus sales by 2030, 100% by 	 Netherlands target to sell 100% zero emission by 2030¹ Denmark no new sales of petrol or diesel by 2030¹ Finland, ambition: 30% of ZEVs in new truck and bus sales by 2030, 100% by 2040.³ 	\bigotimes	$$ > All-electric vehicles to exceed 70% of European and 50% of Chinese and US sales by 2030, and by 2040 nearly 100% to be ZEVs^3
	$$ > Norway, ambition: 30% of ZEVs in new truck and bus sales by 2030, 100% by 2040. 3	(VOL.VO)	» Become a fully electric car company by 2030 ³
*2	» Aims for 100% of new car sales to be hybrid electric vehicles (HEV), plug-in electric	× ×	» All newly-launched vehicles will be fully electric from 2025 ³
	vehicles (PHEV) of battery-powered electric vehicles (BEV) by 20351		» 50% of vehicles sold to be fully electric by 2030 or earlier ³
۲	» Incentive for 30% EV new car sales by 2030 ³	RENAULT NISSAN MITSUBISHI	» Nissan-Renault-Mitsubishi plan to have 35 EV products, spread across five platforms, by 2030. ⁵ (source)
	» Aims for all new passenger cars to be hybrid or fully electric by 2035 ¹	HYUNDRI	» Plans to introduce 17 BEV models by 2030 to expand its EV offering. ⁶
Sources:	Market Consultant report prepared for Nouveau Monde Granhite. December 2022 3) Tesla		

3) International Energy Agency and <u>https://www.iea.org/reports/electric-vehicles</u>

4) Autoweek, January 2022

5) Korea daily news, March 2022

2) www.smaart-energy.com.

A SUSTAINABLE SOURCE OF BATTERY MATERIAL TO MEET RAPIDLY GROWING DEMAND



"Electrification of Everything" and electric vehicle (EV) adoption driving exponential demand growth for natural graphite anode material



North America's largest and most advanced operation providing a localized and carbon-neutral alternative to Chinese supply



Tier-1 operating jurisdiction, with access to exceptional infrastructure and lowcost hydroelectricity



De-risked development plan through ongoing operation of demonstration plants and ongoing stakeholder engagement



Scaled growth beyond that supported by vertically-integrated high-purity natural graphite operations



Committed to industry leading ESG principles, sustainable and carbon-neutral development



An experienced and diverse global team of 100+ professionals has been assembled to execute our vision



GREEN BATTERY MATERIALS TO POWER THE ENERGY REVOLUTION

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