Future Materials Group

Market Update for the Advanced Materials Sector

Autumn 2024

Future Materials Group continues to monitor the advanced material space and the strong influences exercised by broad economic trends, evolving end markets, and shifting supply chain dynamics. This market update offers an analysis of the industry's current state, providing insights into key financial and strategic developments over the past year.

Foreword

This issue begins with a financial review, examining how the industry has responded to market pressures, including the stabilisation of inventory levels and shifts in profitability across geographies. We also look at the advanced material M&A activity over the last 12 months, and some themes around private equity investment in the sector. Following this, we have two more detailed articles. In the first article, with inflation now easing, we examine how select advanced material companies are adjusting their market strategies to navigate the post-inflationary landscape and position themselves for future growth. The second article provides commentary on the carbon fibre market, an essential advanced material used in industries such as aerospace and renewable energy, where structural changes to the industry are creating new competitive opportunities.

As you explore these topics, you'll see how companies are not only responding to immediate economic pressures but are also laying the groundwork for long-term value creation.

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How does Future Materials Group define the advanced materials sector?

Creating a concise yet meaningful industry segmentation is a challenging task. Advanced materials, in particular, can have different definitions to different observers which can shift over time.

At Future Materials Group, we prefer a broad definition of advanced materials that captures a variety of technologies. In general, advanced materials tend to have the following properties:

Advanced materials possess intrinsic properties that offer an advantage to the end-product or to the manufacturing process

Advanced materials are often highly differentiated and contain considerable intellectual property

The advanced materials market is often restricted by high barriers to entry created by complex processes and technical expertise

The above criteria create a wide breadth of advanced materials, ranging from spherical metal powders for the additive manufacturing industry to specialised flavour additives for the nutrition industry. We can further analyse this sector and derive insight by applying a variety of lenses, such as exploring the underlying chemistry of the material, the functionality the material offers, the position in the value chain and the end market it serves. These lenses provide insight into

how companies develop their strategies and how investors value them.

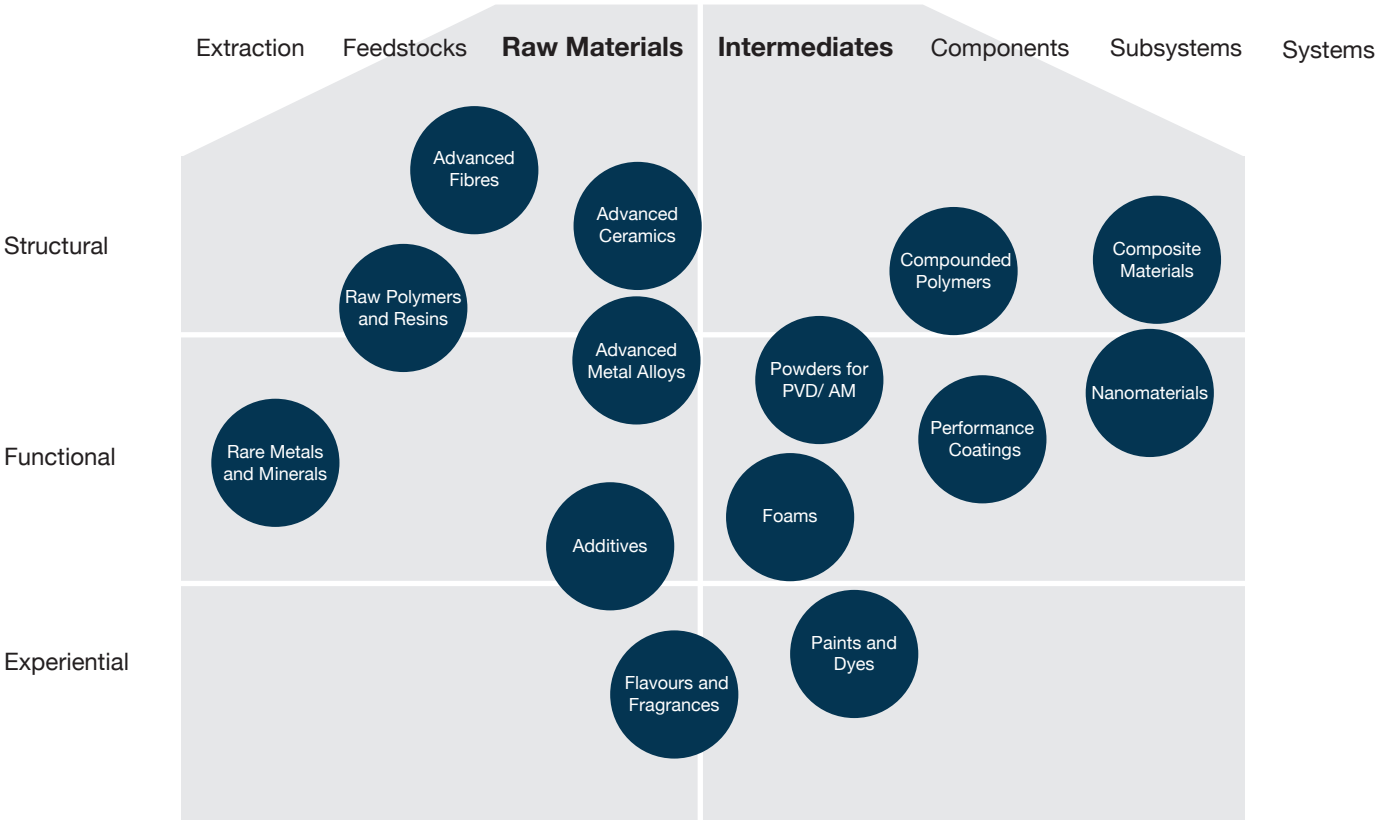
When analysing the market in this manner several commonalities emerge among advanced material companies. Advanced materials producers can often derive higher margins and are less asset intensive than their commodity chemical counterparts. As a result, advanced materials firms are typically traded at a premium in financial markets. Given the long development cycles for advanced materials, many companies use acquisitions to drive innovation and protect against commoditisation.

To monitor financial metrics within the industry, Future Materials Group has created a database of approximately 175 publicly-traded companies that helps quantify and analyse financial trends. As our focus lies with the materials industry, we focus on raw material and intermediates producers, rather than upstream feedstocks suppliers and downstream component manufacturers. The companies selected all have commercial production capacity as opposed to pure R&D firms. The chart on the next page shows a small selection of different materials, functionality and value chain position.

Any definition of the advanced materials market is inherently dynamic as material technologies evolve over time. As some materials may shift towards commoditisation, new materials are constantly being engineered. Consequently, FMG's analysis with continue to evolve with the industry.

In our latest report, we have refreshed our lists of public companies in both the advanced material and commodity chemical sectors. As a result, you may notice small changes in the data versus our prior reports.

Landscape of select advanced materials



Financial Review

Market Commentary

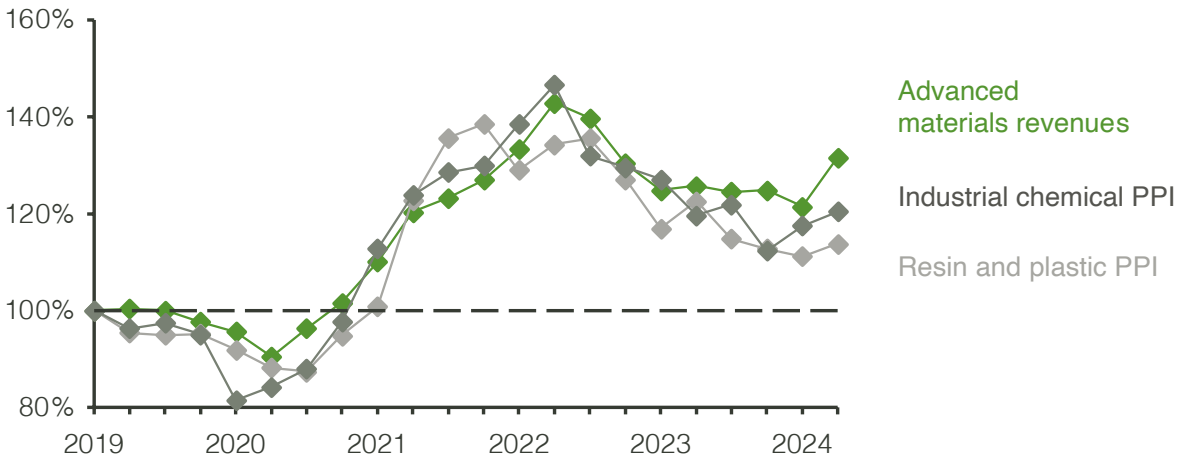
Financial Review

Revenues have been soft in the past year, largely in line with chemical pricing

Within our cohort of publicly traded advanced materials companies, revenues saw a decline throughout 2023 followed by a small increase at the start of 2024. Companies reported a variety of reasons for the decline in revenue, including weaker demand in certain end markets and destocking from customers. Moreover, the advanced material revenues generally follow a similar trajectory to that of the wider industrial chemicals and plastic PPIs (Producer Price Indices), however during 2023, it experiences a lesser decline. This could be interpreted as advanced materials having a slightly better pricing resilience in the industry.

Advanced material revenues have largely followed general pricing trends for industrial chemicals

Revenue and PPI (indexed to Q1 2019)



Note: PPI stands for Producer Price Index
Source: Koyfin, FMG Analysis

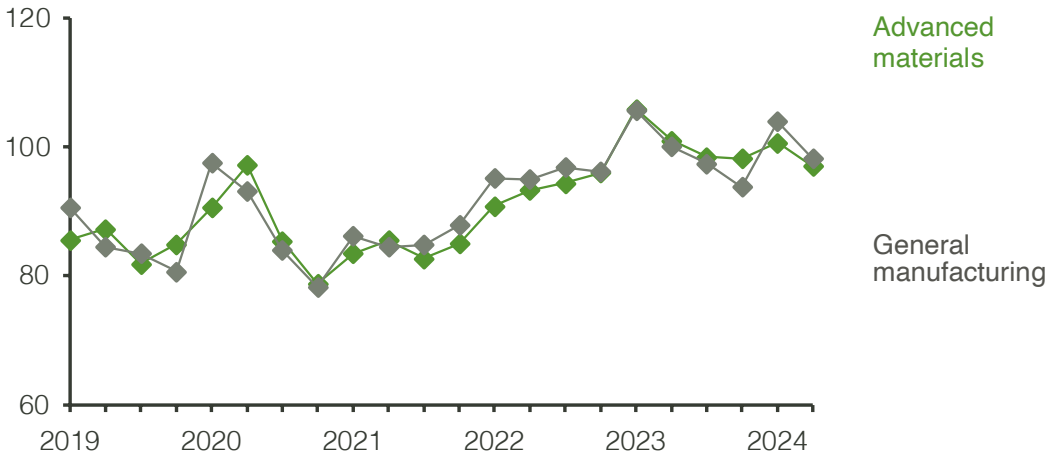
Inventory levels stabilise

Inventory levels, defined in days inventory (relative to cost of goods sold), rose consistently through 2021 and 2022. Throughout 2023, inventory levels appear to have stabilised with median levels hovering around 100 days.

During the period of intense supply chain disruption following the pandemic, higher inventory levels remained a tool for managing persistent shortages. However, despite many of these supply chain issues now resolved, inventory levels have not fallen. It remains to be seen if this is the new normal for advanced material supply chains or if these levels will lower after a period of rebalancing. This will depend on companies' view on supply chain risks and how quickly the memory of supply shortages fade. FMG notes that wider manufacturing inventory levels follow a similar trajectory, suggesting this is a wider supply chain issue and not unique to the advanced materials end markets.

Advanced materials inventory levels have stabilised, but have not fallen back to historic levels

Days inventory



Source: Koyfin, FMG Analysis

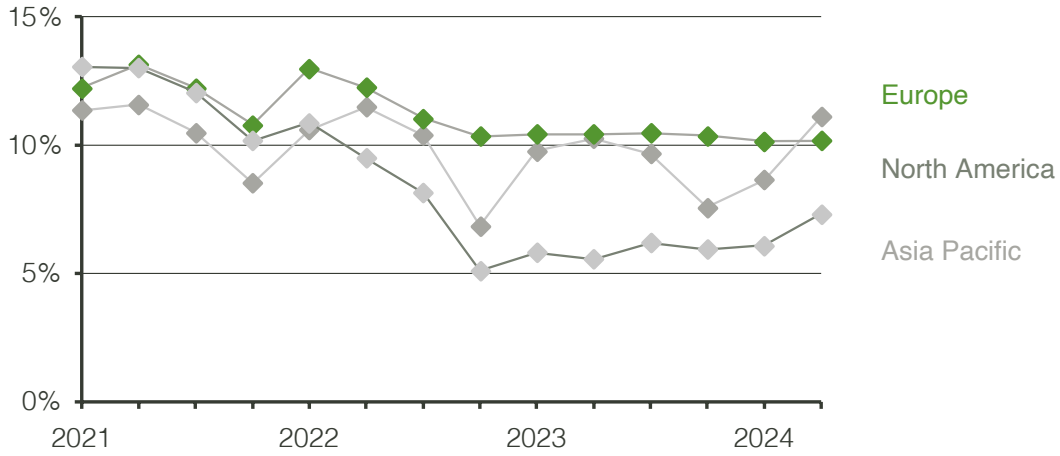
EBIT levels decline in Asia, remain stable elsewhere

EBIT levels have remained relatively stable for European and North American advanced material companies over the last 12 months, with some slight fluctuation in North American profit levels.

Advanced materials companies in Asia have, on average, faced lower profitability levels over the past two years. Weak demand in the region, trade barriers, and overcapacity of certain products are likely contributors to the performance.

Asia-Pacific is performing below Europe and North America

EBIT margin



Source: Koyfin, FMG Analysis

Advanced material valuation multiples see an increase

Valuation multiples saw an increase over the past twelve months. FMG's analysis considers EBITDA multiples (enterprise value divided by EBITDA) using analyst estimates of the next-twelve-months (NTM) EBITDA levels. The increase in valuation multiples is primarily due to a slight decrease in EBITDA levels while valuations have remained relatively constant. Current EV/EBITDA multiples are 9.4x for our advanced material cohort. This value remains largely in line with average multiples globally across all industries according to analysis from Pitchbook across M&A deals.

Across our advanced material subsectors, valuation levels remained stable over the first half of 2024. Health, nutrition and personal care continues to remain the highest valued segment across advanced materials company. Shorter value chains, strong customer lock-in and attractive margins in this sector are strong drivers of higher valuation. Valuation multiples in composites performed the worst amongst all the subsectors, primarily as a result of falling EVs, especially from Hexcel, Gurit and Schweiter Technologies (3A Composites). These companies are facing challenges in their respective end markets, notably in aerospace and wind energy.

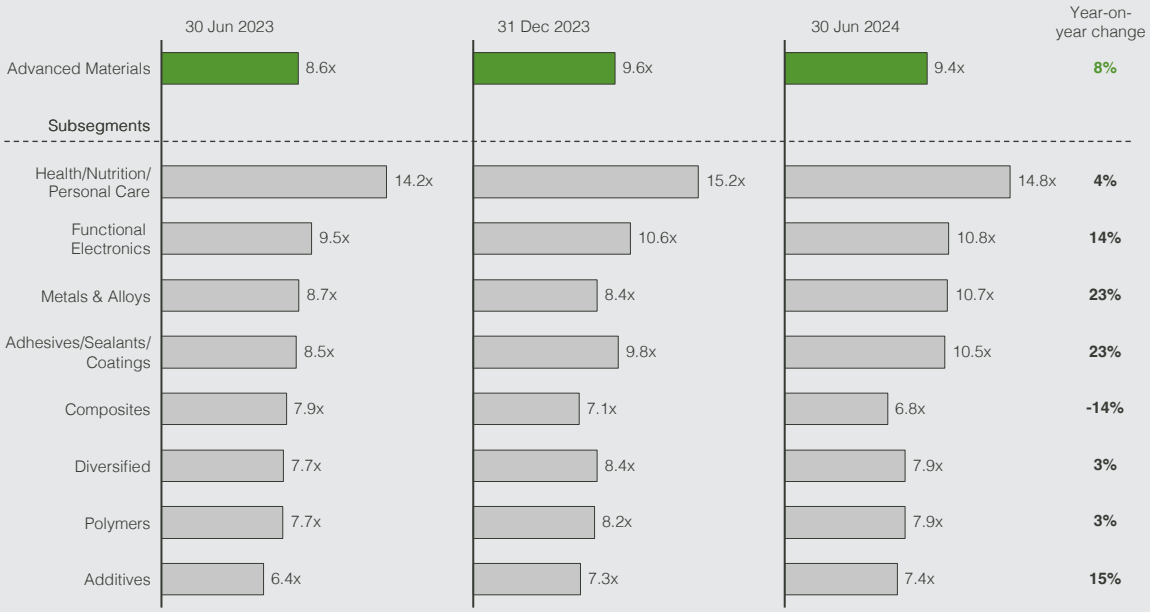
Advanced materials multiples have been gradually increasing over the last year

Forward-looking EBITDA multiples (NTM)

Source: Koyfin, FMG Analysis

Valuation multiples for advanced materials companies have remained steady over the first half of 2024

Median EV / EBITDA (next twelve months) multiples



Source: Koyfin, FMG Analysis

M&A activity has remained stable in the first half of 2024

Advanced materials M&A activity in the first half of 2024 remained broadly comparable to the previous year, with an increase from 1Q24 to 2Q24. Going forward, deal activity in advanced materials appears high. For example, FMG has currently identified 13 deals that are announced / in progress since the beginning of 2024.

The uptick in 2Q24 goes against global M&A trends which saw the continuation of the decline since 4Q23. This could indicate increased activity in the advanced materials space, although it should be noted that the sample size of advanced material deals is small.

In the first half of 2024, private equity deals made up 34% of the total advanced materials deals, up from 31% in 2023. This proportion is broadly in line with the wider global M&A market, however globally it is trending downwards rather than upwards.

PE investment in the last six quarters saw increased level of investment in the building and construction (B&C) end market. Key products manufactured by the target companies serving the B&C end market includes technical textiles, sealants, functional films, adhesives, coatings, resins and additives. This supports FMG's view that the B&C market is a key growth area due to the adoption of advanced materials driven by trends such as sustainability and productivity, and it being a market that is increasingly open to innovation.

Two large private equity deals were completed in the advanced materials space in 4Q23. The first one was KKR's acquisition of Chase, a US-based global manufacturer of protective materials such as adhesives, sealants, additives and industrial tapes for high-reliability applications, helping KKR expand its exposure in the specialty chemicals space. The other deal related to TJC's acquisition of Delrin, Dupont's division which manufactures acetal resins for high-load mechanical applications, allowing TJC to align with the high-growth end markets such as automotive and electronics.

Corporate investment saw increased activity on electronic materials with products such as semiconductor chips and technology, wafers, advanced ceramics, special electronic adhesives, electronic chemicals, battery or silicon materials, polyimide films being common across various target companies. This theme was observed primarily among target companies headquartered in Asia. Since the beginning of 2023, there have been four notable corporate deals related to electronic materials (please see graphic below for further details).

ARKEMA

Arkema acquires PI Advanced Materials and Polytec PT
PI Advanced Materials is a South Korean company manufacturing polyimide films for the advanced electronics and electric mobility markets. Polytec PT is a German company specialised in adhesives for batteries and electronics. The company stated that both deals aligned well with Arkema's strategy to growth within the identified advanced electronics and e-mobility submarkets driven by sustainable megatrends.

FUJIFILM

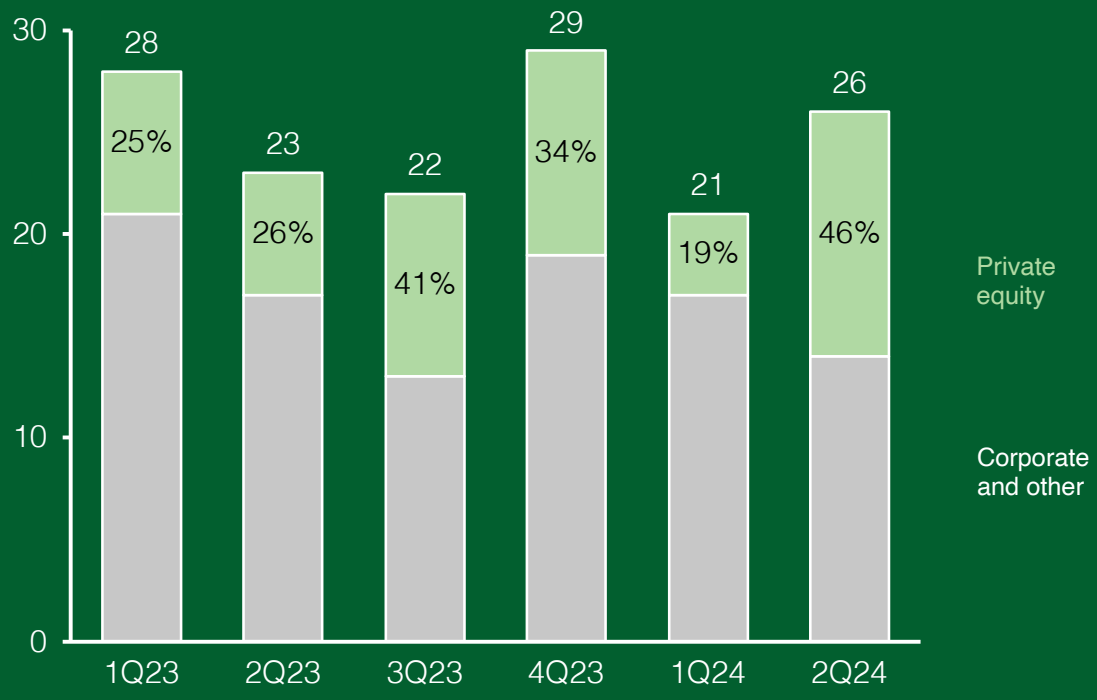
Fujifilm acquires CMC Materials KMG Corporation
CMC Materials KMG Corporation was Entegris' electronic chemicals business, which rebranded as Fujifilm Electronic Materials Process Chemicals following the acquisition. The goal of the acquisition was to strengthen Fujifilm's positioning in the semiconductor industry while also broadening its product portfolio in electronic materials.

JIC

Japan Investment Corporation acquires JSR
JSR is a Japanese chip materials maker. This investment supports Japan's national goal to strengthen its domestic semiconductor supply chain given increasing geopolitical tensions and concerns about supply chain disruptions.

Advanced materials M&A activity remained stable in 1H24 compared to the previous year

Number of deals in advanced materials sector*



*FMG counts deals upon completion, rather than announcement. 1Q23 and 2Q23 figures have been restated since Issue 4

Source: Pitchbook, FMG Analysis

Market Commentary

As inflation slows, advanced material companies seek to reclaim value

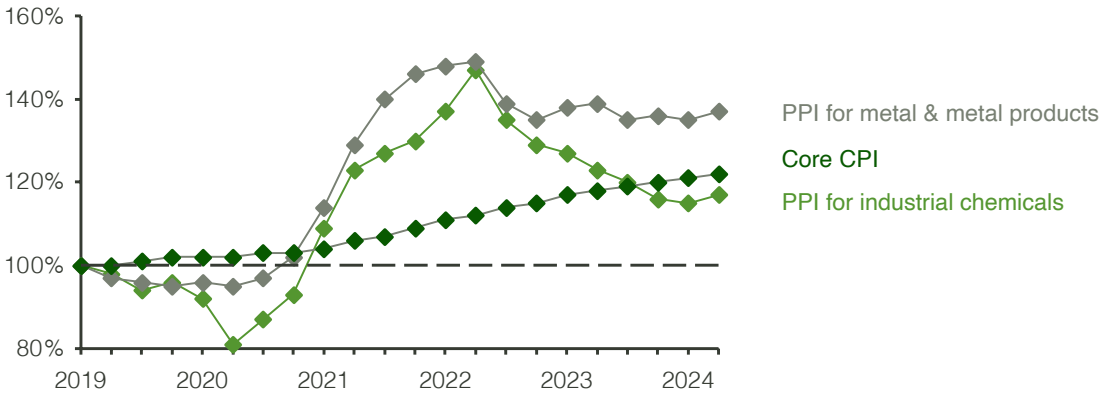
Much of the raw material inflation seen in the advanced material sector slowed or reversed in 2023. Since then, companies have seen revenue growth slow and continued pressure on margins.

In our previous market update, Issue 2 published in Autumn 2022, we examined how inflation was impacting the advanced materials and specialty chemicals sectors. At that time, companies grappled with rising raw material prices and adopted strategies to preserve margins amid uncertain market conditions. Today, that landscape has shifted. While inflation peaked and eventually halted, the effects of rising costs are still reverberating across the industry. As companies adjust to a more stable raw materials environment, they face new challenges, such as weakened demand, persistent labour cost increases, and higher interest rates. The key challenge for companies in this environment is to reclaim value within the supply chain and reignite growth in this post-inflationary landscape.

Raw material inflation slows – along with revenue

As reported in the previous market update, inflation for raw materials surged in 2022 across multiple segments. As the chart below illustrates, much of that inflation halted in 2023 and – in some cases – even reversed. In contrast, the core Consumer Price Index (CPI) continued to rise after inflation peaked in 2022 as the market adapted to price increases, higher labour costs and rising interest rates. Many advanced material companies found their price for input materials had stabilised, however other costs continued to rise.

Inflation for materials peaked in Q2 2022
(indexed to Q1 2019)

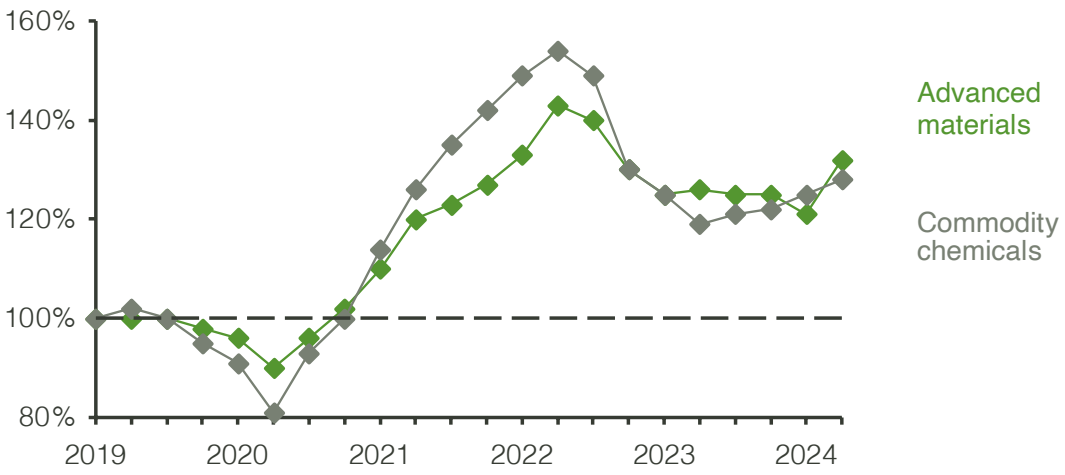


Notes: PPI stands for Producer Price Index; CPI stands for Consumer Price Index
Source: Koyfin, FMG Analysis

The chart below displays revenues for advanced materials companies and commodity chemical companies during the same period. The shape of the revenue curve tends to match the general shape of the producer price indices in the previous chart. In fact, for many advanced material companies, much of the growth over the past few years has been price driven, with a smaller impact from volume growth. As inflation slowed, so did the revenue growth of these companies.

Advanced materials revenues have declined since 2022, but showed an upturn in 2Q 2024

Revenue (indexed to Q1 2019)



Source: Koyfin, FMG Analysis

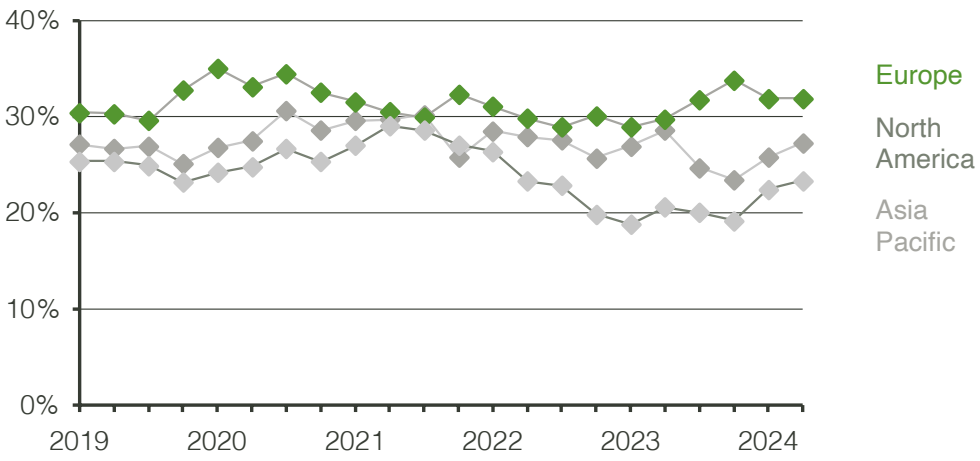
This environment creates a challenge for advanced materials companies. Factors such as overcapacity in the chemicals sector and destocking by customers have contributed to weak sales. Sectors like smartphones and automotive, which rely heavily on advanced materials, have experienced sluggish demand, while aerospace is recovering slowly from the pandemic-driven slowdown.

Gross margins see recovery in Europe and North America

The sluggish demand along with persistently higher prices has placed pressure on companies' gross margins. The next chart displays gross margins from publicly traded advanced material companies across three different geographies. Each geography has a slightly different dynamic: Europe has remained relatively stable, which is impressive given the reliance of European supply chains on natural gas as a raw material input. North America saw some pressure in 2022 and 2023 but appears to be recovering to pre-pandemic levels. Meanwhile, gross margins in Asia appear poor, driven by both weak demand in the region and overcapacity in certain industries.

Asia-Pacific is performing below Europe and North America

Gross margin



Source: Koyfin, FMG Analysis

Reclaiming value and re-igniting growth

Amid these headwinds, advanced materials companies are exploring new strategies to reclaim value and position themselves for future growth. Given the long-cycle nature of the advanced material sector, many of these strategies will already have been in place across the industry. However, our research suggests a near- to medium-term focus on the following strategies:

Portfolio transformation: shifting focus to high-growth markets

One of the most significant trends in the advanced materials sector is the shift away from commodity products toward niche, higher-margin markets. Solvay's recent separation into two entities—Solvay and Syensqo—exemplifies this shift. While Solvay continues to focus on more mature, commodity-based businesses, Syensqo is targeting the high-growth, innovation-driven specialty chemicals market. This strategic move allows each company to sharpen its focus and pursue tailored growth initiatives. Arkema, another industry leader, has undergone a transformation over the past decade, with specialty materials now comprising 90% of its portfolio, most of which was achieved through M&A. Now that the portfolio has been focused towards specialties, the company is primarily looking to accelerate growth organically, although they are still making select acquisitions. Additionally, the company is focusing heavily on submarkets such as electric mobility and advanced electronics, where demand is expected to grow rapidly in the coming years. For example, Arkema have made investments in next-generation battery materials which align well with both the focus submarkets and the sustainability megatrends.

Bespoke solutions: strengthening relationships across the supply chain

To reclaim value, advanced materials companies are increasingly focusing on providing customised solutions that offer tangible value and higher switching costs for customers. This approach often involves fostering closer relationships downstream in the supply chain, which can be challenging in industries with long and complex value chains. One example is Element Solutions, which in 2023

paid Entegris USD 200 million to cancel their distribution contract, allowing Element to gain direct access to semiconductor fabricators. This move led to a fourfold increase in the company's pipeline for that product, underscoring the value of direct relationships with end customers.

As companies look to differentiate themselves in a crowded market, customised solutions that address specific customer needs can help them secure long-term contracts and boost profitability.

Cost optimisation: staying ahead of rising costs

Cost pressures remain a major concern for advanced materials companies, particularly as labour and energy prices remain elevated. Leading companies are focusing on optimising their operations to maintain profitability in this challenging environment. Automation, new technologies, and even artificial intelligence are playing an increasingly important role in driving cost efficiencies.

Huntsman, for example, completed cost improvement initiatives (including opening global business services hubs in various regions to centralise business functions) that delivered over USD 280 million in annualised savings by the end of 2023. The company plans to further enhance its manufacturing cost efficiency and complete its European restructuring activities in 2024. Similarly, Albemarle realised over USD 300 million in productivity benefits in 2023 and has identified an additional USD 280 million in savings for 2024 through a combination of operational improvements and strategic sourcing initiatives.

Reclaiming value in a complex market

As the industry continues to evolve, the ability to adapt to the stabilised raw material costs and increasing labour and energy costs while addressing weak demand will be critical. Companies that can strike the right balance between these competing forces will be best positioned to reignite growth and create sustainable value in the years to come.

Successfully playing in a transforming industry: carbon fibre's changing landscape

The carbon fibre industry, long seen as a niche market supplying high-tech and high-value applications, is undergoing significant transformation. Traditionally dominated by a few established players, this sector is now experiencing a surge in production capacity driven by demand for energy transition technologies and other high-growth applications.

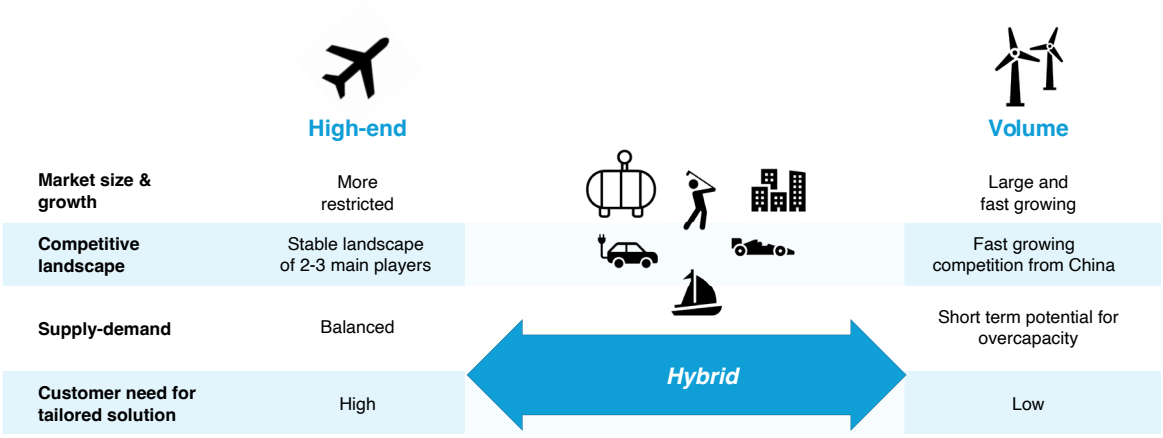
In 2005, carbon fibre demand stood at around 25,000 tonnes. Today, it has grown to approximately 150,000 tonnes, and projections suggest that it could reach 450,000 tonnes per annum by 2030, especially as wind power demand continues to expand at an expected compound annual growth rate (CAGR) of nearly 30%. While still small compared to commodity materials like steel (with 1.9 billion tonnes produced in 2023), the growth trajectory for carbon fibre clearly signals its transition into a fast-expanding industry.

This raises two essential questions: how is the carbon fibre industry transforming, and can manufacturers remain profitable as the market grows and diversifies?

Three key market segments

At FMG, we identify three distinct segments emerging within the carbon fibre market, each presenting unique opportunities and challenges. Producers are adopting different strategies to position themselves effectively within these segments, either specialising in high-end niches, targeting large-volume applications, or balancing both to focus on industrial niches.

The three market segments have different characteristics



Aerospace: high-end applications

At the top end of the carbon fibre market, aerospace continues to be a cornerstone application. The industry structure has seen limited changes despite demand increasing, driven by the adoption of composite-intensive aircraft such as Boeing's 787 and Airbus' A350. Only a handful of companies – such as Hexcel and Toray – continue to dominate this segment. These firms operate within a tightly controlled value chain to meet the aerospace sector's stringent requirements for safety, performance, and durability.

This value chain relies on a range of highly specialised carbon fibre materials, such as unidirectional pre-impregnated tapes, which are designed for the specific needs of aerospace manufacturers. The high entry barriers in this segment, including long material qualification processes and rigid customer requirements, make it difficult for new entrants to compete.
By focusing on high-value sectors like aerospace, established manufacturers protect their margins through customer lock-in, as switching suppliers within complex aerospace programmes can be prohibitively expensive. Specialised manufacturers in this segment typically focus on continuous technological innovation and tailored services rather than competing on volume. This approach ensures that their position within the value chain remains secure, preserving profitability in the long term.

Large-volume applications: wind energy's growth potential

At the other end of the market spectrum, the demand for carbon fibre in wind turbine blades is driving significant growth. This demand is largely fuelled by the energy transition, where carbon fibre is essential for building lighter, stronger blades that enhance the efficiency of wind power generation. Carbon fibre demand for wind applications is expected to grow at a CAGR of 15-30% over the next five years.

In contrast to aerospace, buyers in this segment are highly cost-conscious, requiring consistent quality but with less emphasis on customisation. The carbon fibre products they seek are more standardised, and services beyond the basic product are minimal. Price and scale are the key drivers in this market, making it attractive to players who can deliver large volumes efficiently.
Leading companies such as Zoltek (a subsidiary of Toray) have invested heavily in scaling up production to serve this burgeoning demand. At the same time, new players have entered the market, particularly from China such as Jilin and Sinopec. These companies are competing aggressively on price, adding pressure to established players.

To succeed in this segment, companies must adopt a comprehensive strategy focused on operational efficiency, competitive pricing, and streamlined supply chain management. While innovation still plays a role, particularly in enhancing sustainability and reducing production costs, the primary challenge is achieving economies of scale. Firms that manage to optimise their operations will capture significant market share and profitability, while those that fail will struggle to remain competitive.

Middle ground: balancing niche and scale

Between the aerospace and large-volume wind energy segments lies a diverse range of industrial and consumer applications. In these markets, carbon fibre plays an important but often niche role. Applications range from high-performance automotive parts and pressure vessels to sports equipment. In these cases, carbon fibre's combination of strength and light weight is critical to performance.

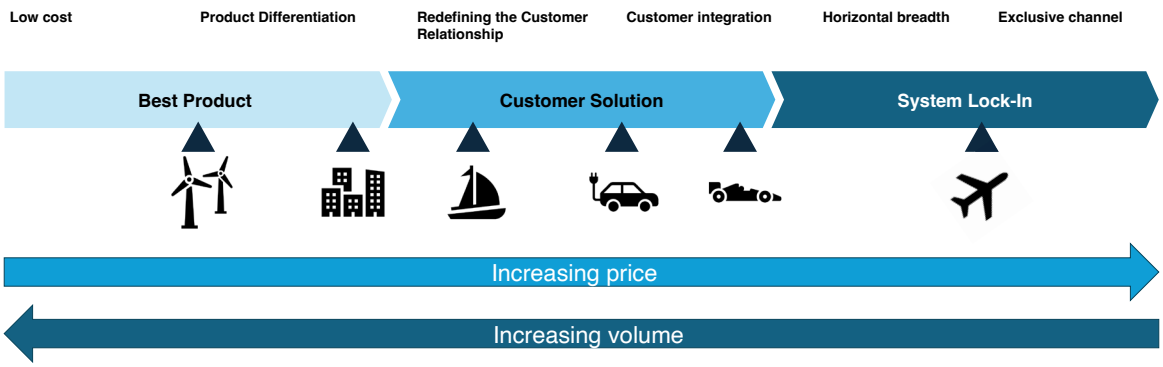
Unlike aerospace, where customer loyalty is strong, industrial and consumer markets are more fluid. Buyers in these segments often require tailored products but are willing to switch suppliers to find a better balance between cost and service. As a

result, manufacturers serving these markets must be more flexible in their approach.

Companies in this middle ground have adopted a hybrid business model that blends elements of both specialty and volume strategies. Mitsubishi Chemicals, for example, offers a wide variety of carbon fibre grades to target different industrial niches. However, despite this broad approach, the company has faced difficulties in establishing dominance in any one segment. Similar challenges have faced other international players who entered this market over the last decade.

The key challenge for firms in this segment is maintaining flexibility while ensuring profitability. They need to balance the demands of high-end, customised applications with the efficiency needed for larger-volume industrial orders. To achieve this, companies should segment their operations into distinct business units, each focused on a specific market segment. For example, Toray has pursued this strategy with varying degrees of success. The ability to balance this dual focus is crucial for players aiming to succeed in the middle market.

Customer needs and capabilities drive player strategies



Future outlook

The carbon fibre industry is at a critical juncture, with rapid growth and diversification reshaping the competitive landscape. Companies must carefully choose their strategic positioning, deciding whether to focus on high-end, low-volume sectors like aerospace, pursue large-volume applications such as wind energy, or straddle the central span through a hybrid approach.

Each strategy presents unique risks and opportunities. High-end players must continue investing in technology and innovation to maintain their margins, while volume-driven companies must remain vigilant about costs and operational efficiency. Meanwhile, firms targeting both high-end and industrial niches face the dual challenge of flexibility and focus.

Ultimately, the future of the carbon fibre industry will depend on how well companies can adapt their business models to meet the changing needs of their target markets. The demand for carbon fibre is set to continue rising, driven by the global energy transition and an increasing emphasis on lightweight, high-performance materials. Those companies that can align their strategies with the evolving market dynamics will not only survive but thrive in this rapidly transforming industry.

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