# Market Update for the **Advanced Materials Sector**

## Issue 2: Growth in Uncertain Times

**Half Year Review**
Autumn 2022

Future Materials Group

## Finding growth in uncertain times

If 'unprecedented' has been the most-used word in news and commentaries about the events of the past two years, 'uncertain' seems likely to succeed it for this year and next.

The post-pandemic economic rebound is fading across several regions, but supply chains remain disordered as the world's major production centres continue to grapple with labour and raw materials shortages. In China, the difficulty is compounded by restrictions on movement as a nationwide 'zero-COVID' policy limits factory output.

In late-February, these difficulties were exacerbated by Russia's invasion of Ukraine. Exports from both nations to the rest of the world fell sharply, sending prices to new records and boosting inflation to its highest rate for over 40 years. In June, the World Bank warned of the risk of stagflation as elevated energy prices threaten to persist while, simultaneously, consumer demand and business investment fall away.

The net effect is a growing likelihood of a recession. Federal Reserve chairman Jay Powell has acknowledged that efforts to quell inflation could provoke a recession, saying: "It's not our intended outcome at all, but it's certainly a possibility."

Despite these headwinds, advanced materials firms are finding opportunities for growth. At Cabot Corporation, CEO Sean Keohane noted: "Our Performance Chemicals portfolio benefits from attractive industry structure and is poised for growth, driven by new products and underpinned by the compelling macro tailwinds of a changing mobility landscape, an increasing focus on sustainability, and the trend of becoming an ever more connected world through digitalisation".

Mr Keohane has good reason for optimism, but companies must remain vigilant about their positioning in the value chain and about their portfolio of technologies if they are to adapt successfully to the new environment. If these priorities are met, companies can find new opportunities – not just to weather the storm but to thrive as they emerge on the other side.

This edition of FMG's market update explores some of the key uncertainties with which advanced materials firms - indeed, all businesses - are dealing. Our Financial Review section on page 3 analyses how companies have performed financially during the uncertainty of the first half of 2022. Our Market Commentary starting on page 8 examines inflationary uncertainty and how advanced materials businesses are responding. The next article looks more closely at their strategies in response to a recession. Using the example of batteries, the third article details how supply chain uncertainty is driving changes in the market and in the sector's geographic landscape.

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## Defining 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 FMG, 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*

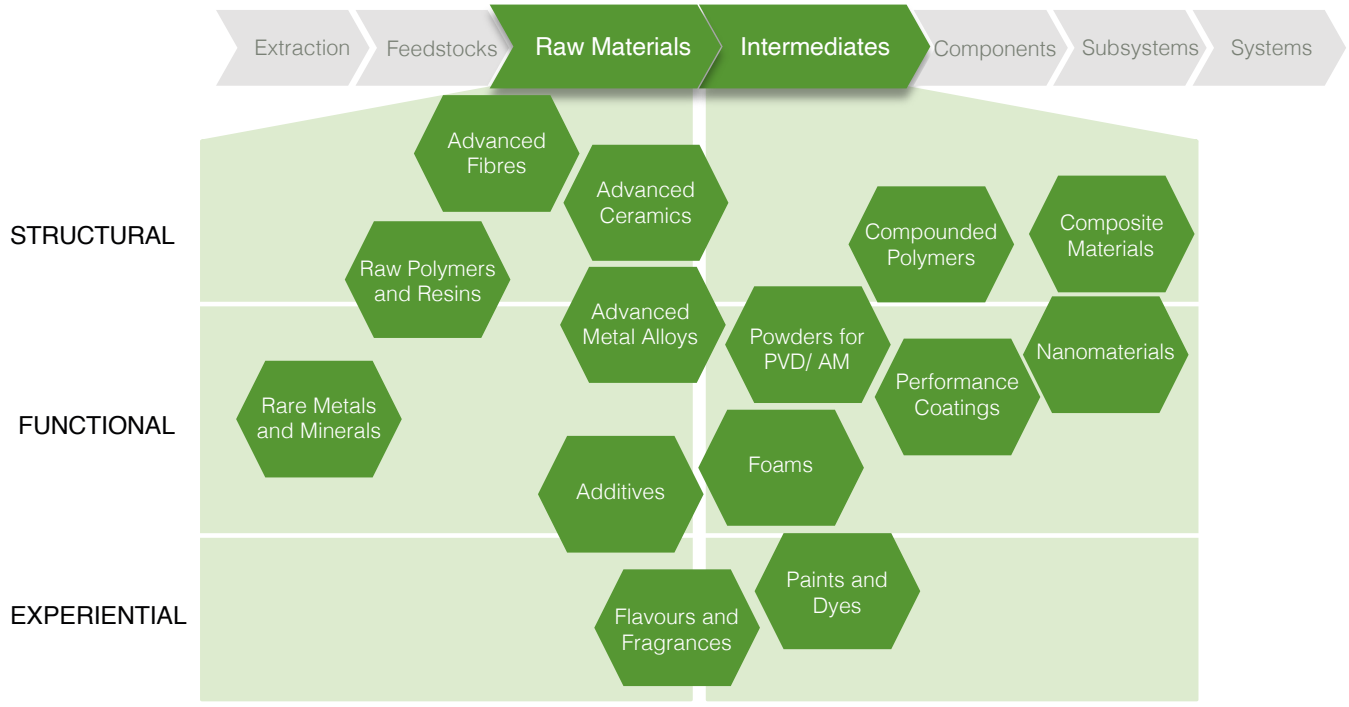
The above criteria capture a breadth of advanced materials, ranging from spherical metal powders for the additive manufacturing industry to specialised flavour additives for the nutrition industry. We can further analyse this sector and derive insight by applying a variety of lenses, such as exploring 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. First, these companies can often derive higher margins and are less asset intensive than their commodity chemical counterparts. As a result, advanced materials companies are typically traded at a premium in financial markets. Finally, 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, FMG has created a database of approximately 150 publicly traded companies which helps quantify and analyse financial trends. As our focus lies with materials producers, we focus on raw material and intermediates producers, rather than upstream feedstock suppliers and downstream component manufacturers. The companies selected all have commercial production capacity as opposed to pure R&D firms. The chart below shows a small selection of different materials and functionality within our focus area of the value chain.

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 definition and analysis will continue to evolve with the industry.

### Landscape of select advanced materials



# Financial Review

## M&A activity sees a slight decline in the first half of 2022

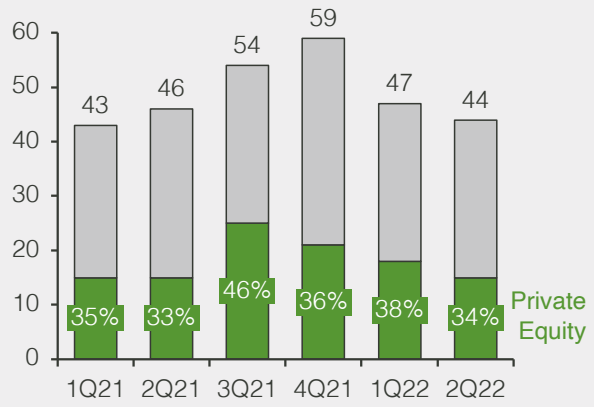
Among advanced materials companies tracked by FMG, there was a small drop in M&A compared with the end of 2021 but activity remained at the level seen in the first half of that year (see chart below). This is in line with worldwide figures, which show that the number of deals decreased in early-2022 on economic and geopolitical concerns.

Nonetheless, the market still seems active. Private equity (PE) funds remain engaged with the sector, recording a consistent share of deals. Add-on acquisitions comprised 63% of PE deals so far in 2022, with most of these occurring in the second quarter and slightly fewer in the first.

Adhesives companies remained an important element, representing 13% of the deals we tracked in 2021 and 11% in 2022. As shown on page 6, the sector is commanding high valuation multiples on the back of its attractive growth prospects, relatively high margins and strong customer lock-in.

### M&A activity sees slight decline in first half of 2022

Deals in the Advanced Material Sector




Source: Pitchbook, FMG Analysis

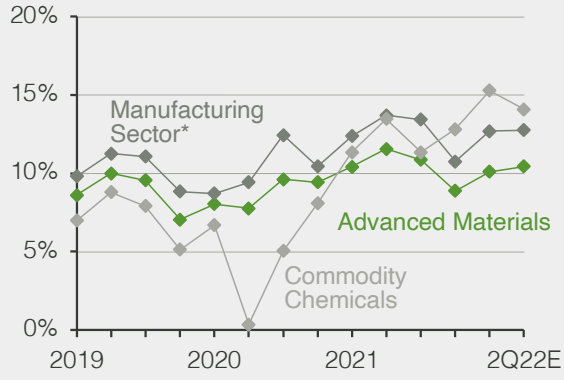
## Advanced materials producers remain resilient despite volatility

Overall, the advanced materials industry has demonstrated stability in the face of dynamic economic challenges. As seen in the graph to the right, following a small decline at the end of 2021, margins on earnings before interest and taxation (EBIT) have recovered over the first half of this year. The decline was accompanied by a simultaneous setback for gross margins (see article on inflation on page 9), likely to have been caused by price inflation in raw materials before many companies were able to raise prices.

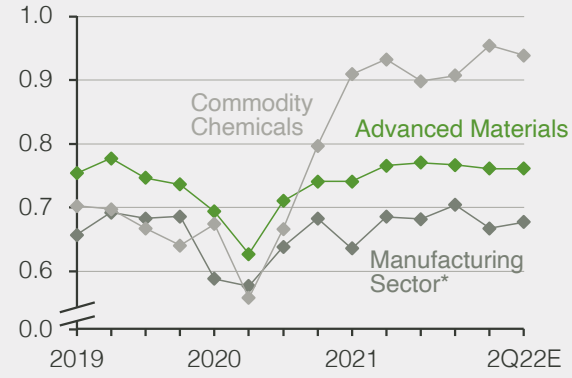
Commodity chemical companies, on the other hand, have seen a sharp increase in profits following the post-pandemic recovery. As shown by the asset turnover graph below, much of the rise stems from increased revenues due to higher prices – total assets tends to be relatively stable, so the increase in asset turnover is likely due to revenue increases. The effect has been strong enough to make commodity chemicals companies – normally more asset intensive than advanced materials – actually show a higher asset turnover. The cyclical nature of this group means that profits tend to fluctuate more with the business cycle. In contrast, advanced materials firms have shown much greater stability.

### Advance materials remain resilient against volatility

Median EBIT margin




Median asset turnover




*Global large- and mid-cap equities with NAICS classifications of 31-33
Source: Koyfin, Pitchbook, FMG Analysis

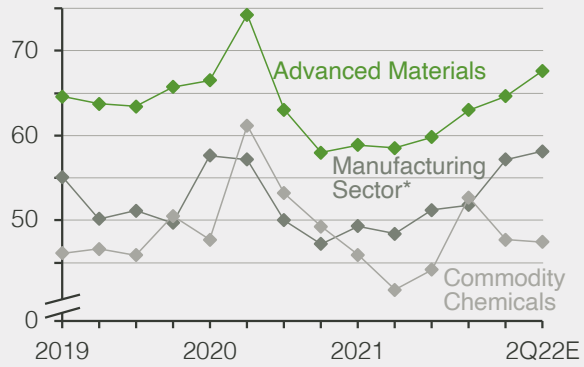
## Advanced materials firms see rise in inventory levels

Levels of both inventory and general working capital have risen in many business sectors over the last 18 months and, especially, since the beginning of this year. In the retail sector, for example, US-retailer Target Corp. announced in June that it would be posting aggressive price mark-downs in order to reduce inventories that had ballooned more than 36% above the levels seen in the same quarter of 2021. Yet higher inventories are not confined to just retailers; in the UK, the Office of National Statistics reported that 1Q22 saw the highest-ever increase in inventories, more than five times the previous record rate of quarterly increase.

Advanced materials also seem to have been affected by higher inventory levels. As the chart on the right shows, median inventory levels are now higher than pre-pandemic levels. Investors have been alerted to the upturn, with around half of our advanced materials cohort reporting that analysts have been asking them specifically about inventory levels in earnings calls over the first half of 2022. Much of the commentary on inventories centres on three points.

Inventory levels have now risen above pre-pandemic levels

Median days inventory




*Global large- and mid-cap equities with NAICS classifications of 31-33
Source: Koyfin, Pitchbook, FMG Analysis

First, the pandemic and resulting global supply chain problems lowered inventory levels significantly. Much of the increase seen in the last year may simply be restocking to normal levels.

Second, inflation and exchange rate fluctuations have increased the nominal value of inventory held. However, FMG has also seen a broader increase in 'days inventory' (defined as inventory over cost-of-goods-sold), indicating that the increase is not just inflation-based.

Finally, there has been a shift from just-in-time restocking to a security-of-supply approach. Macroeconomic concerns, such as supply chain difficulties and the Ukraine war, have led advanced material companies to hold more inventory than usual.

Often, investors become worried that rising inventories indicate declining demand or over-ordering due to bullwhip effects. While the evidence for this remains inconclusive, we expect that there will be tight scrutiny on inventory levels going forward.

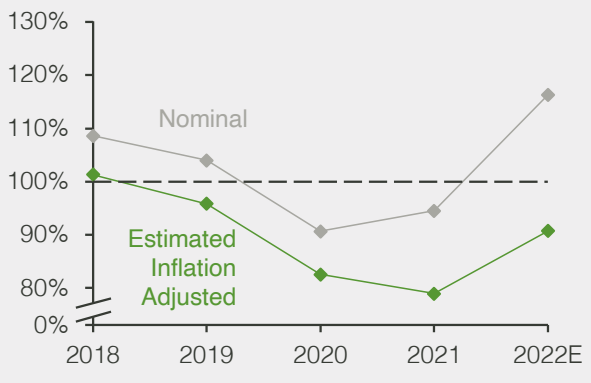
## Post-pandemic reinvestment ratios begin to stabilise

In terms of the ratio of CAPEX to D&A, reinvestment was lower in 2020 and 2021, as seen in the chart below. At first glance, however, there seems to have been a significant post-pandemic recovery in the first half of 2022. Given that the ratio tends to fall when companies are worried about the outlook, this stabilisation is broadly positive and shows that firms are continuing to invest in their businesses despite the uncertainties.

Nonetheless, current inflationary pressures create a challenge for businesses, with the replacement or capitalised maintenance of equipment costing more than the original items. One measure of inflation for the industrial market is the Producer Price Index (PPI), which tracks changes in input prices for manufacturers in the United States. Using PPI data for industrial machinery, FMG has produced a high-level estimate for the 'real' reinvestment ratio that accounts for inflation. While each business has its own spending profile and its depreciation policy, our estimate provides a rough

Nominal reinvestment ratios stabilise post-pandemic

Reinvestment ratio (CAPEX / Depreciation)




Source: Koyfin, Pitchbook, FMG Analysis

proxy for inflation-adjusted reinvestment levels.

On this basis, reinvestment is still below the rate needed to maintain fixed assets at current values in real terms. This is largely expected as corporate budgets are unlikely to have caught up with prevailing rates of inflation.

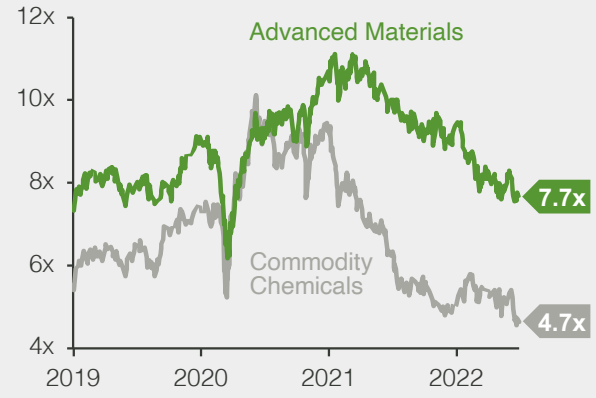
Historically, periods of low investment have been followed by sharp recoveries, so we may start to see nominal levels rise further as budgets adjust to inflationary trends.

## Advanced materials firms see valuations fall in broader market sell-off

Listed advance materials producers saw their market valuations retreat during the first half of the year, more-or-less in line with the overall market setback. Based on forward earnings before interest, tax, depreciation and amortisation (EBITDA) projections, valuation multiples also fell from their peak in early-2021 but still match pre-pandemic levels and remain above those for commodity chemicals (see figure below).

**Advanced materials multiples peaked in early 2021**

Median EV / EBITDA (next twelve months)



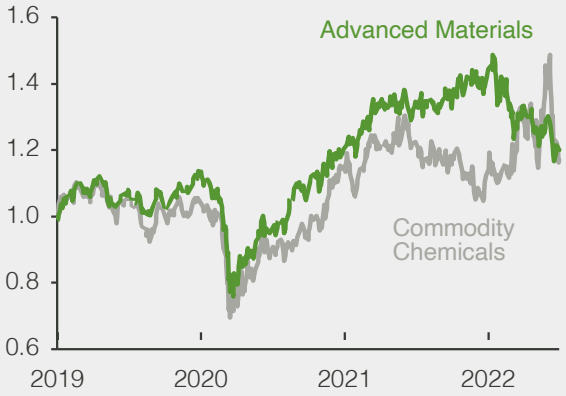

Source: Koyfin, Pitchbook, FMG Analysis

The charts to the right split the multiples into their constituent parts, mapping the changes in enterprise value (EV) and EBITDA. Changes in valuation ratios are driven by movements in either component.

For advanced materials, the decline in multiples appears to be driven by a combination of falling valuations and higher earnings forecasts. In contrast, commodity chemicals experienced a large increase in EBITDA with relatively flat valuations – lowering their overall multiple. This may signify that investors are concerned that the current increase in profits are temporary, given the cyclical nature of commodity chemicals.

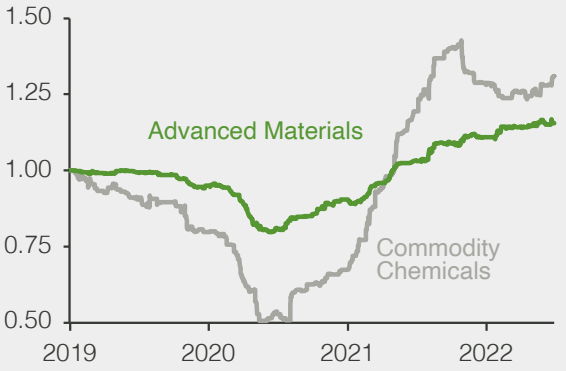
**Advanced materials EVs began to decline in 2022**

Median EV indexed to 01 Jan 2019




**Analyst expectations of EBITDAs have continued to rise in 2022**

Median EBITDA (next twelve months) indexed to 01 Jan 2019



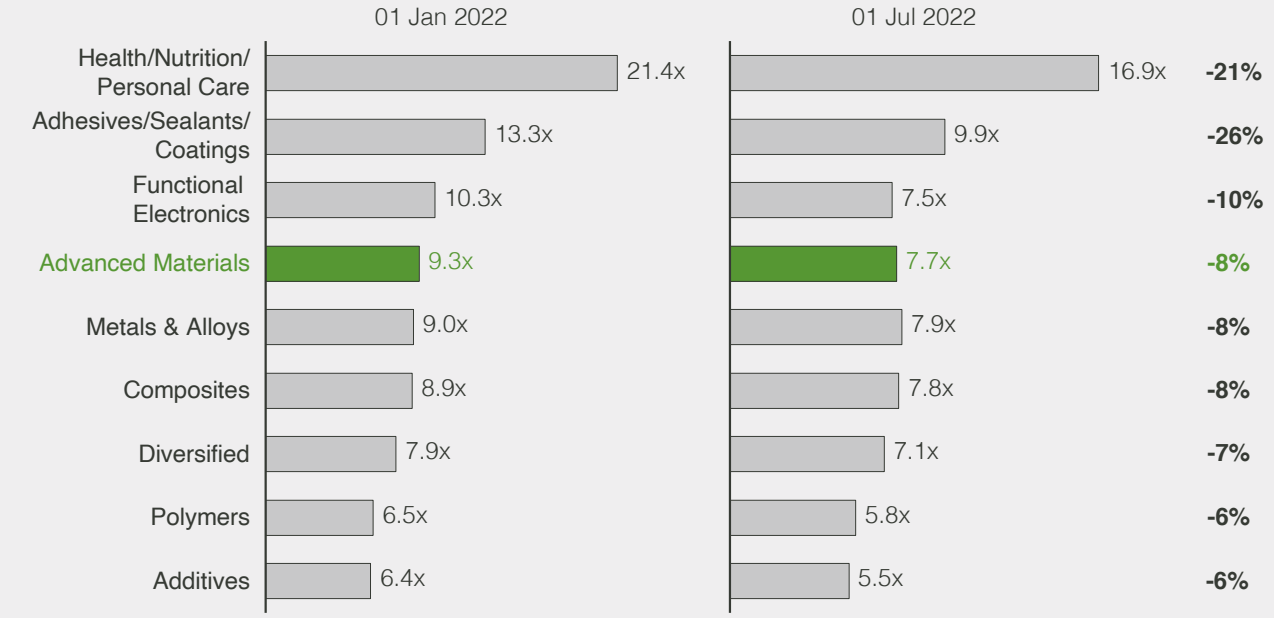

Source: Koyfin, Pitchbook, FMG Analysis

Our analysis of the sub-sectors in advanced materials (see chart on page 7) reveals that the decline has not been uniform. The two best performers in terms of earnings - health, nutrition, and personal care, along with adhesives, sealants, and coatings – have witnessed the largest fall but also retain the highest multiples.

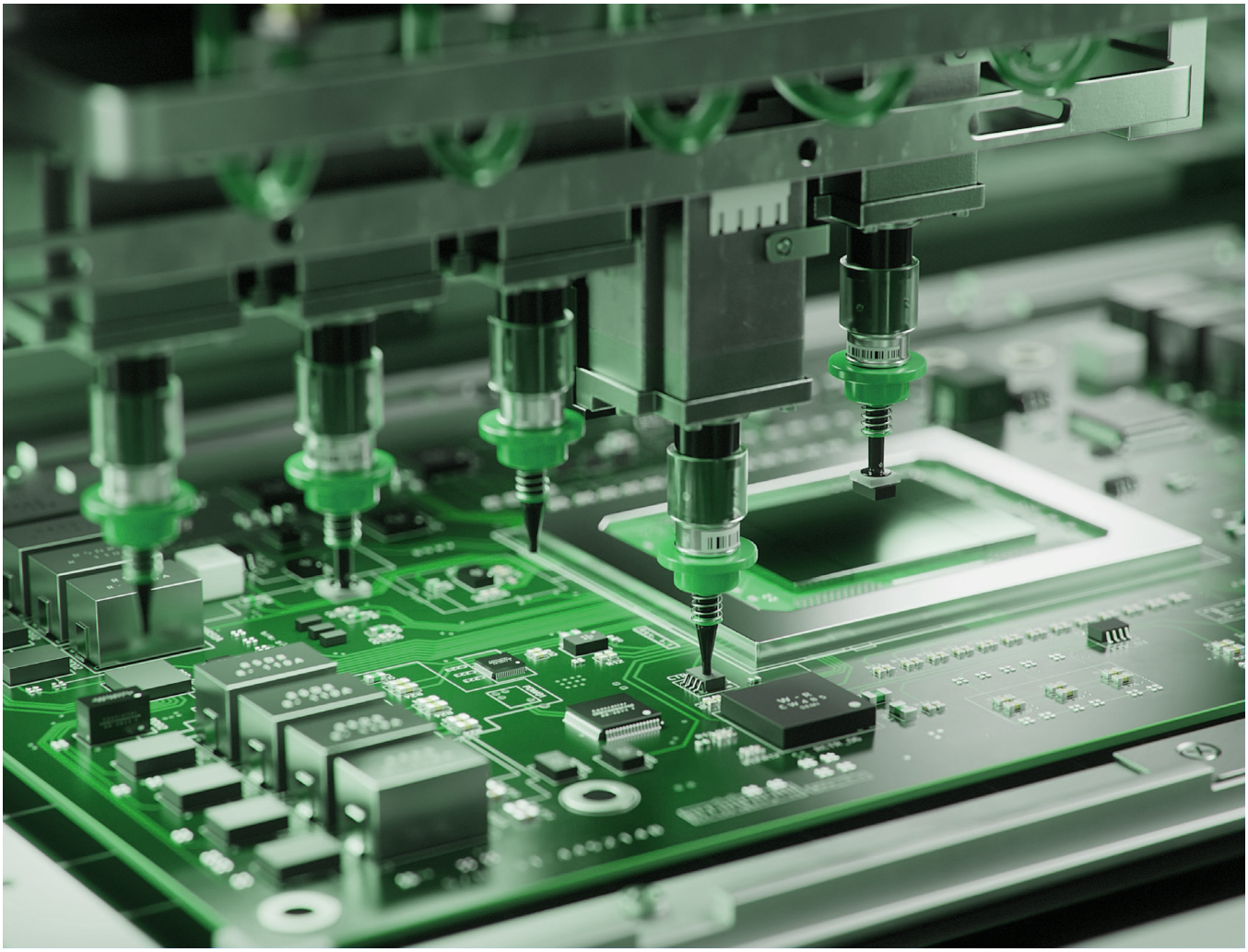
As always, there was significant variation across the listed cohort, with geographical factors and the companies' particular exposures to various end-markets also playing a part in the valuations.

## The Heath, Nutrition and Personal Care sector continues to command high multiples

Median EV / EBITDA (next twelve months) multiples




Source: Koyfin, Pitchbook, FMG Analysis



# Market Commentary

## Preserving margins in inflationary times

While debate continues about whether the current upsurge in inflation will prove temporary or not, its effects on advanced materials companies are unquestionably real and significant. Many point to three main sources of cost pressure: raw materials, energy, and transport. Of these, raw materials are often cited as the largest contributor of cost increases.

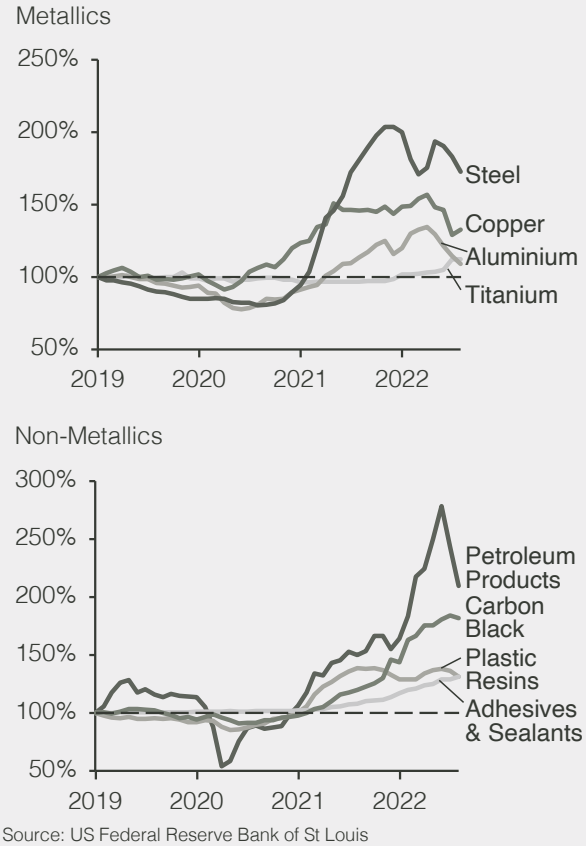
### Resilience, despite increasing cost pressures

The figure below shows the Producer Price Index (PPI) for a selection of commodities used by advanced materials firms. Reflecting the diverse underlying causes of inflation, price increases have not been uniform across those commodities. While some, such as steel and petroleum products, have seen prices surge, others, such as titanium, have been less affected.

Broadly speaking, materials that are most affected tend to have at least one of the following qualities: those highly exposed to energy markets (either through use of petroleum as a raw material or use of highly energy-intensive processing); or those that are up the value chain where commodity costs tend to have a higher share of total material value.

**Price increases have not been uniform across commodities**

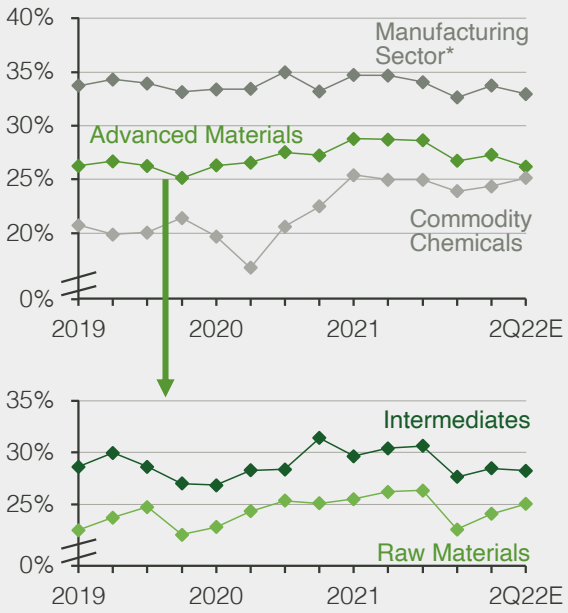
Producer price index for select commodities
*Indexed to Jan 2019*




Source: US Federal Reserve Bank of St Louis

**Advanced material companies' gross margin have remained relatively stable throughout 1H22**

Median gross margin




*Global large- and mid-cap equities with NAICS classifications of 31-33
Source: Koyfin, Pitchbook, FMG Analysis

As a group, the public companies in FMG's advanced materials classification appear to have adapted well to rising prices and their gross margins have remained relatively stable throughout 1H22 (as seen in the figure below). We found that a fifth were actually able to increase margins by over 200 basis points from 2Q19 levels.

### Impact of value chain position

Conventional wisdom has it that the chemical and material producers closest to commodity markets find it easier to pass on costs to their customers than companies further removed. For those furthest up the value chain, their cost base tends to be more directly driven by commodities prices than by the expenses of additional processing. Commodities costs tend to be more visible to these firms' customers and are similar across competitors. Hence, customers have little alternative than to pay the higher prices.

For advanced materials manufacturers, however, the financial results are more nuanced. If we split the listed-companies group into, on one side, those further up

the value chain (labelled 'raw materials' and comprising about a third of the group) and, on the other, those further down the value chain ('intermediate materials'), we can track the changes in gross margins across the cohort which are displayed in the bottom half of figure on the right side of page 9.

Starting in 4Q21, the raw materials group experienced a faster and steeper drop in margins than the intermediates group. The magnitude of the fall has been driven largely by base effects (raw materials typically have lower gross margins). Although producers were able to pass on cost increases and raise gross profits in absolute terms, they could not maintain their full percentage margins, which fell.

Timing also played a part, with some companies suffering temporary margin declines due to delays between the onset of rising input costs and taking action on their own prices. In these cases, contractual arrangements can be either an asset or a liability for a materials producer. In general, companies with better contractual flexibility have been less affected as they could more quickly pass on price increases.

Intermediate materials producers, on the other hand, experienced a smaller initial decline in margins but still remain about 200 basis points below 2021 levels. This group has also seen wider variation in margin preservation. In areas where demand remained strong, companies generally retained good pricing power given the specialty nature of their products; in areas where demand has softened, such as mass-market automotive, several companies struggled.

### The companies and markets most susceptible to inflation

For advanced materials companies struggling with inflation, challenges tend to arise from three sources:

First, some cannot increase prices to customers due to a weak position in the value chain. This often occurs when the end-market is relatively concentrated and has thin margins already.

Second, inflation can make substitutes more economical. This tends to occur when the cost pressures are unevenly distributed and customers can, therefore, reformulate their products to take advantage.

Third, inflationary pressures are also not distributed evenly between competitors. For example, energy prices often vary between different countries and that can affect competitiveness.

In addition to advanced materials companies, entire end-market can be more susceptible to inflationary pressures. Those end-markets most affected tend to be those constrained already by thin margins, making it difficult to pass on input prices, and/or those with long lead times because of the delay between sale and final delivery of the product.

The wind energy sector, for example, has been hit forcefully on both supply and demand. Wind turbines are heavy users of both steel and petroleum-derived composites. Additionally, hefty shipping costs are encountered because large offshore turbines cannot be transported by land. In an interview with *Dagens Industri*, Henrik Andersson, CEO of Vestas, stated in August: "The wind turbines that we deliver today were ordered two or three years ago when the projections were completely different. We cannot possibly compensate for what is happening now" [FMG translation].

### Consequences for advanced materials

In response to rising inflation, we see companies taking both tactical and strategic steps.

Tactically, they are reformulating products to reduce the impact of costlier inputs. They are also negotiating greater contractual flexibility, without fixed prices, and developing internal procedures to manage diverse and rapid price increases more effectively. Finally, they are diversifying their customer base, for example, by seeking customers wishing to reformulate their own products.

Strategically, companies are evaluating both their existing portfolio and their capital spending in order to react to inflationary exposure. How companies respond depends on their positioning and level of power within the value chain.

For those with significant end-market exposure, divestment may allow companies to refocus on the portions of their portfolio that can absorb price increases. Other companies may look to acquisition to gain a more diversified customer base or consolidate their position in the market. Over time, inflation may also cause companies to re-evaluate make-or-buy decisions – vertical integration, for example, can improve security of resources and cost efficiencies. Ultimately, these decisions are about increasing power within the value chain. As we have seen with the wind energy market, focusing on high-growth areas is not enough in this economic environment; companies are seeking out areas where they can also maintain pricing power and manage cost increases.

## Advanced materials companies respond to recession risks

Stock markets fell in the first nine months of 2022, with the S&P 500 losing 24.8%, and posting its worst first-half performance since 1970. The German DAX and the Dow Jones were similarly affected, declining -24.4% and -21.0%, respectively.

Despite some recovery in July, investors are concerned about higher interest rates and the risk of recession. Several banks and macroeconomic research firms are forecasting recessions in the near-term, with fears of stagflation (high inflation and low growth) being raised.

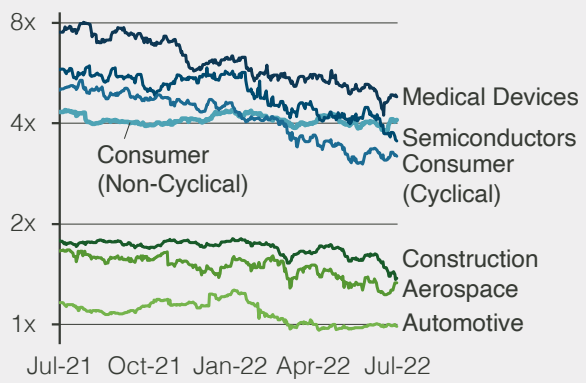
The advanced materials sector has not been immune to such concerns. In our cohort of 150 publicly-traded producers, FMG found the term 'recession' was used 139 times in earnings calls from January to August, compared to just 22 instances for all of 2021. Clearly, the investment community needs to measure how resistant businesses are to recession and what steps are being taken to prepare for that outcome.

### Investor reactions to recessionary periods

During recessionary periods, investors tend to shift from growth stocks to lower-risk investments. The chart below shows how this trend has been reflected over the last 12 months in shrinking forward Enterprise Value (EV)-to-sales ratios for companies in a range of sectors that use advanced materials.

Non-cyclical sectors experienced less of a decline in valuations compared to other sectors

Median EV / Sales (next twelve months)




Source: Koyfin, Pitchbook, FMG Analysis

The chart shows that, although most sectors experienced a decline in valuations during this period, non-cyclical consumer goods (largely, consumer staples) were less affected. Being in constant demand, those products are less dependent on business cycles. In contrast, as the Federal Reserve raised US interest rates, growth-oriented companies, for which elevated market valuations are based on expectations of fast-rising earnings, were downgraded substantially.

For advanced materials companies, the risk of impending recession raises concerns about where their exposure lies. Often, unlike the categories in the chart to the right, their products do not fit neatly into defined end-markets. Many advanced materials serve a variety of end-markets, and some companies may have little information on the final end-use applications. For others, sales of high-value materials may be focused on technology growth areas, where market valuations have been the worst affected. Hence, we see several companies performing risk analyses to determine the sensitivity of their customers to the business cycle.

### Three developments that recession could foster

Should a recession occur, it could drive three trends among producers of advanced materials.

First - and somewhat counterintuitively - some materials producers may find opportunities to improve margins in a downturn. Several companies with rising input costs are still seeing sold-out demand and have, therefore, been able to raise prices. Should a shallow recession occur, producers may not see a dramatic softening of demand, but would likely experience an easing of commodity prices. In that case, they could maintain or even improve margins while maintaining steady demand.

SGL Carbon, for example, noted in the company's Q1 earnings call that demand from their industries remains robust. CEO Torsten Derr commented, "The demand from the customer and also their desire to get the products to guarantee their production is apparently higher than the price sensitivity or price elasticity that we have. If you look simply at the markets where we are... all wind turbine producers are running flat out and they need carbon fibre. So our market is pretty healthy. You know about the chip crisis. And all chip manufacturers are running flat out. They need our graphite. So this is what I said at the very beginning, our markets are really running well. And everyone talks about recession, I cannot see it today in our order book."

Second, some producers could seek growth via material substitution rather than overall market growth. Although a particular end-market might stagnate, segments within it can often see innovation that creates substitution opportunities. In its 3Q22 call with investors, Ashland CEO Guillermo Novo highlighted the company's biodegradable products as a key growth area not just for new growth, but as a replacement for older technologies.

Compared to expanding a current market, substitution can be a difficult road to growth. It can be easy for producers to overestimate the benefits to the customer while underestimating the complexity of adoption. As a result, adoption of new materials often takes longer than producers anticipate.

Finally, M&A activity may increase as corporate divestment leads to buying opportunities for savvy materials firms. However, the current environment creates both headwinds and tailwinds for that prospect.

A desire to enhance balance sheets and focus on core capabilities will create tailwinds for M&A. For example, International Flavours & Fragrances, a speciality additives producer for the nutrition and personal care sector, announced in its annual strategy conference this June that it is considering a series of divestments to raise USD 1.5 – 1.7 billion and help reduce debt. The stated key criteria for deciding what to sell are return on capital and fit within the portfolio.

At the same time, higher interest rates and lower valuations create headwinds for M&A. Trinseo, for example, has paused the sale of their Styrenics business as they could not achieve their desired valuation. Nonetheless, recessionary concerns may encourage companies to buy cyclical businesses at a discount from other, less ambitious, sellers.

If anti-recessionary flexibility can be enhanced by synergies and adjacencies between buyers and their intended purchases, such as better product differentiation or expansion to more resilient markets, firms could take advantage of lower valuations and find unique opportunities they can carry through the business cycle.

So far in 2022, this type of divestment activity has been limited in the advanced materials sector (see financial review section on page 3), but market forces may lead to its emergence towards the end of the year.

## Electric vehicle manufacturing becomes increasingly localised

In July 2022, Northvolt received USD 1.1 billion to finance its expansion of battery cell manufacturing across Europe. The company has had a busy year, with its electric vehicle (EV) battery recycling joint venture with Hydrovolt beginning commercial operations in May. Together, these initiatives represent two important milestones in Northvolt's strategy, which CEO Peter Carlsson states is to "create a new battery industry in Europe … demonstrate how battery manufacturing can be undertaken sustainably … [and] build the world's greenest battery".

Northvolt is a relative newcomer to the industry, only delivering its first battery cells to customers in July 2020. Nonetheless, since its foundation in 2016, the firm has received nearly USD 8 billion in debt and equity financing.

Northvolt's strategy fits the wider trend of battery manufacturers looking to localise production. According to Goldman Sachs' report, Batteries: The Greenflation Challenge, the majority of current EV battery manufacturing is in Asia, with 92% of cathode capacity in China, Korea, and Japan. Some 71% of battery cell assembly occurs in China alone.

### The drive towards localisation

The trend towards localisation has several underlying causes. At its most basic level, batteries are difficult and expensive to transport around the world. Local production reduces the cost as well as the related pollutants, a critical consideration for many economies striving for net-zero carbon emissions by 2050.

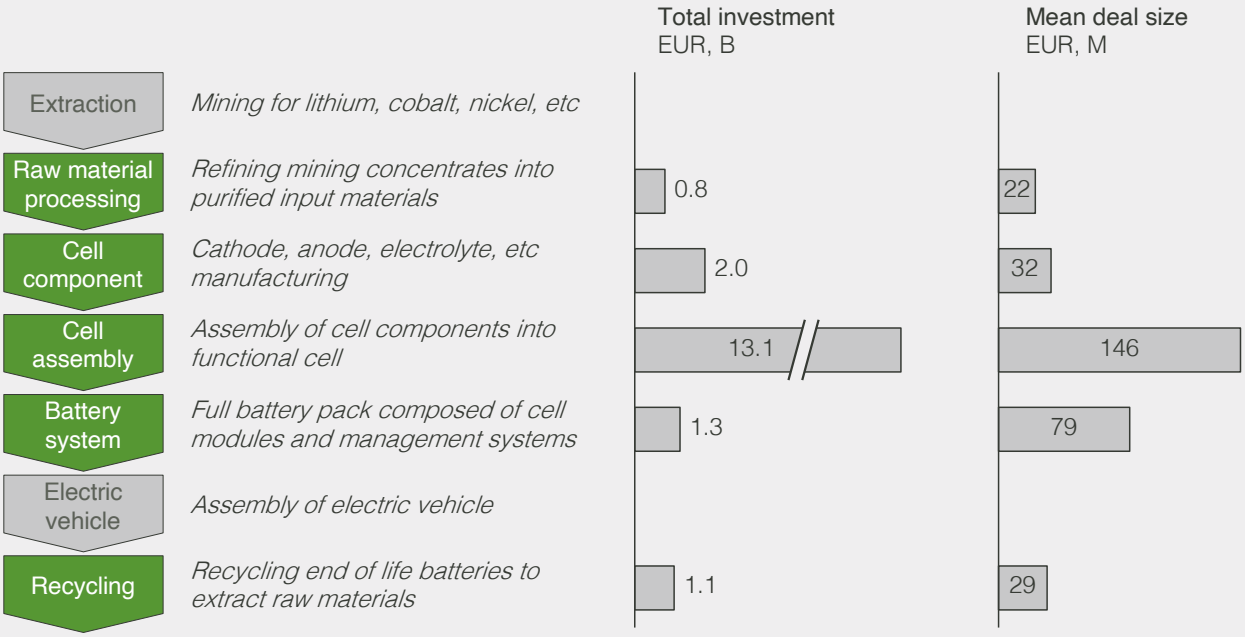
Localised production also provides countries with more supply chain security because it reduces the associated risks of trade disruptions and other barriers to the reliable delivery of EV batteries.

Lastly, having their own EV battery manufacturing is strategically important for some countries in terms of both meeting decarbonisation targets and maintaining their presence and competitive position in the automotive industry.

As a result, several countries have introduced new trade laws and agreements that define rules of origin and sourcing requirements specifically for battery packs and components. Examples include the United

## Private equity investment in battery manufacturing is concentrated in cell assemblers

Investment includes seed, venture capital and private equity 2017-2022*




*2022 data is up to 31 Jul 2022
Source: Pitchbook, FMG Analysis

States-Mexico-Canada Agreement, the EU-UK Trade and Cooperation Agreement, and the various Batteries Europe working groups.

This localisation of battery output is driving three major trends in the industry.

### Trend 1: As manufacturing shifts from multinational to national, opportunities arise to invest in new local champions

Investment is pouring in from industry incumbents that are setting up localised supply in new geographies. For example, the Chinese firm, Contemporary Amperex Technology Co., Limited (CATL), is investing EUR 7.34 billion in a 100 GWh battery plant in Hungary to serve the European market, the firm's second such facility in Europe.

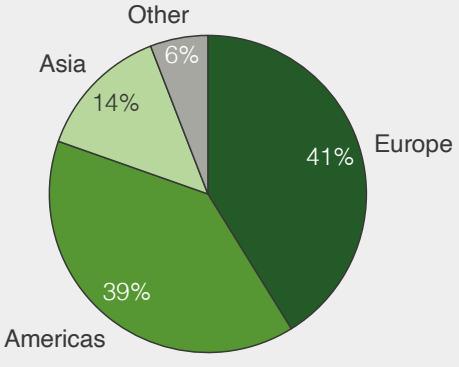
However, the desire for localised supply is also creating opportunities for new entrants. For example, Britishvolt has received investment (including UK government funding) to establish a gigafactory in northern England to serve as a hub for the British EV industry. In addition to government funding, these companies are also finding investment from venture capital, private equity and angel investors.

This investment is not evenly allocated across the value chain. As the chart below highlights, much of private equity and venture capital investment is focused on battery cell assembly while there has been less funding for processed materials and components. Further examination of battery cell assembly investment shows that this investment is predominantly occurring in the West (see chart below), where the market is more fragmented.

There are several reasons that private equity has focused on cell assembly. First, gigafactories require significant capital because they must be enormous to be competitive, with average capacity of tens of GWh.

## Private equity investment in cell assembly is focused in the West

Investment includes seed, venture capital and private equity 2017-2022*




*2022 data is up to 31 Jul 2022
Source: Pitchbook, FMG Analysis

Accordingly, larger investments are required than for other sectors in the chain.

Second, raw materials are generally easier to transport than cells; hence, there is less to be gained from localising their production. Third, many of the biggest material and component providers are large, diversified, incumbents because the capital intensity and procurement requirements tend to favour those dominant players.

That dominance leads to the second trend.

### Trend 2: Increasing vertical integration throughout the value chain

In EV battery supply chains, vertical integration has two main benefits. It increases producers' control over each link in the value chain, improving security when sourcing raw materials has become more challenging because of rising demand. It also gives a better grip on costs. That raises competitiveness, especially as EVs become more widely adopted and manufacturers aim to lower battery prices per kWh.

Johnson Matthey's divestment of its battery material business in May underscores this point, with CEO Liam Condon saying the reasons for the decision were "insufficient returns, increased commoditisation of battery materials, combined with the need for very high capital investments to remain competitive".

Johnson Matthey sold most of its battery materials business to EV Metals, a vertically integrated player. The buyer's CEO, Michael Naylor, believes his firm can commercialise the vendor's cathode active materials successfully due to its "integrated supply chain, which addresses the long-term market challenge of both surety of raw materials and the supply of processed materials."

As an extreme example of vertical integration, several producers are seeking to close the loop between end-of-life and production, which leads to the third trend.

### Trend 3: Security concerns over supply of raw materials drives adoption of recycling

Recycling provides direct access to raw materials, thereby increasing security of supply while also dealing with the problem of end-of-life batteries, a growing concern for both governments and manufacturers. It also supports localisation of the supply chain through reduced reliance on materials that, in most cases, are mined from overseas locations.

Furthermore, metals used in EV batteries are often extracted from areas that raise ESG concerns. Cobalt mining in the DRC is associated with child labour, while lithium extraction in South America exacerbates the scarcity of fresh water supplies. The use of recycled materials avoids the risks surrounding extraction altogether.

Northvolt, for example, is making headway on a commitment to mitigate the risks associated with its current supplies by sourcing 50% of materials from recycling by 2030. That is why the May 2022 opening in Norway of Hydrovolt, its joint-venture recycling plant, is an important step for its green battery strategy. Commitment to that strategy was made apparent in November 2021, when Northvolt produced a battery cell made entirely from recycled nickel, cobalt, and manganese.

### Implications for advanced material producers

These changes in the market have the potential to alter the landscape for several advanced materials producers, even if they only indirectly serve the EV battery industry.

Innovation in materials still has potential to alter the status quo for supply chains. For example, cathodes that use fewer critical materials such as cobalt, or increased recycling efficiency, could change the power dynamics within the market. Companies serving this sector should keep an eye on technology developments and understand how they might affect demand for their products.

Advanced materials companies are adapting their investment plans to a shifting geographical footprint. While Asia will continue to dominate the EV battery market for some time, materials producers could miss opportunities if they concentrate their efforts only in that region.

Finally, advanced materials producers are finding ways to build supply chain security into their value proposition; reliable access to resources is essential to the industry. These attributes look beyond the pure performance and price characteristics of their materials. Less reliance on critical resources, better ESG credentials by localising production, and eliminating sources with human rights concerns – these properties will be even more critical as supply chains continue to localise.

## About FMG

Future Materials Group is an independent strategic growth advisory firm, specialising in the advanced materials and high value manufacturing sectors. Working globally, the company helps businesses at all stages of their development, from start-up to maturity, to create and increase value through rapid yet manageable growth.

Our advisory work is entrepreneurial, with unparalleled insight into markets, technologies, and trends that span our three practice areas: Strategic Growth, Mergers & Acquisitions, and Growth Finance. Trusted by business owners, boards of directors, and senior executives to define the right strategic priorities for growth, Future Materials Group delivers innovative strategies and solutions to make lasting and meaningful impact.

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