Chemicals Practice

What the future of mobility holds for chemical players

Chemical companies will be affected by disruption in the automotive industry. Those expecting to flourish in the next normal must meet the changes head-on and respond to three key trends.

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The future of mobility looms large for chemical companies. Historically, automotive has been a significant end industry for chemicals, accounting for more than 10 percent of overall sales, with significantly higher shares for specific substances. However, uncertainty in the automotive market has increased dramatically over the past decade.

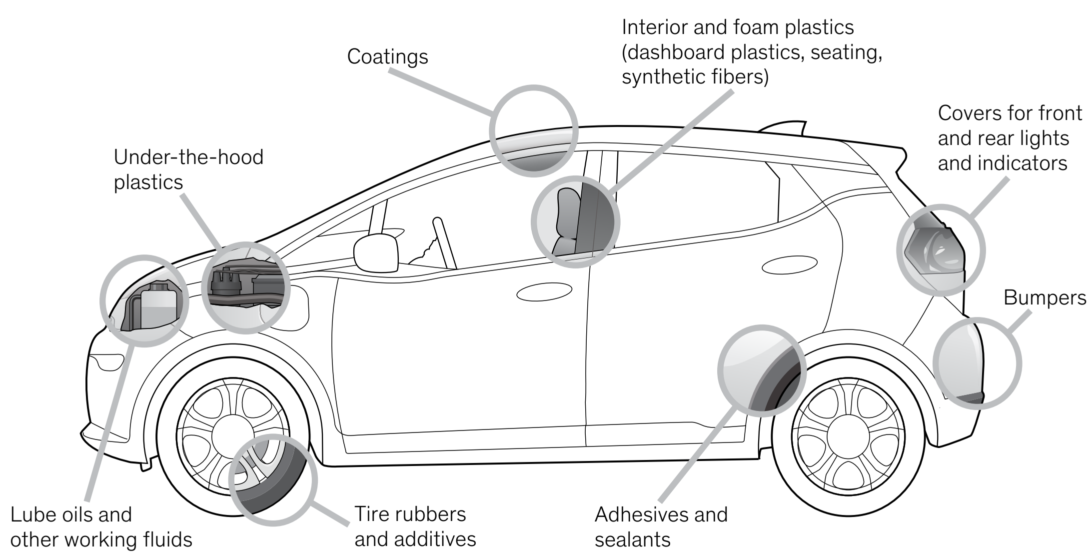
Even before the COVID-19 crisis, many chemical companies felt the pressure of decreasing auto sales (90 million light vehicles[1] were sold globally in 2019 while approximately 94 million were sold the previous year) and declining automotive industry profit margins (from 7 percent in 2017 to 6 percent in 2019). These numbers are the result of several factors, including fluctuating import tariffs, rising research and development expenses and regulatory costs, and the slowdown of the North American and Chinese auto markets. In response to COVID-19, industry profit margins are expected to drop significantly in 2020 and beyond. Further complicating matters, OEMs are likely to face intensifying disruptions in coming years, requiring chemical players to adapt their business models to changing markets.

Much of this turbulence will be the result of the emergence of autonomous driving, connected cars, electric vehicles, and shared mobility (ACES).[2] The auto industry is also grappling with increased scrutiny on sustainability and changing customer expectations. These forces could cause an unforeseen transformation affecting the entire value chain, including companies that supply chemicals for many of the automotive applications found in modern cars (Exhibit 1).

Nevertheless, our research suggests that chemical companies will be—on average—much less affected by the future of mobility than automotive

Exhibit 1

The automotive industry relies on chemical companies to produce important applications.



[1] The term “light vehicles” refers to cars, vans, and sport utility vehicles.
[2] For more on ACES and the future of mobility, see Timo Möller, Asutosh Padhi, Dickon Pinner, and Andreas Tschiesner, “The future of mobility is at our doorstep,” December 19, 2019, McKinsey.com.

companies themselves. Despite technological advances in electrification and connectivity, chemical components and automotive applications are not likely to be fundamentally reinvented. Some chemical players, depending on their portfolios, could even benefit from industry disruption. Those expecting to flourish in the next normal must respond to changes in the materials and automotive markets, pursue new value-chain opportunities, and remain agile to stay competitive.

The automotive industry is in turmoil

From 2009 to 2018, the global automotive industry experienced an unprecedented period of uninterrupted growth, including record profits. This trend reversed in 2019—and the decline has only accelerated since COVID-19. While the downturn caused by the coronavirus is expected to ease in the mid-term, increasingly strict city-level regulations on private car ownership and the growth of shared modes of transportation are expected to adversely affect automotive sales in the long-term. Our business-as-usual scenario suggests only modest growth in light vehicle sales. However, given the policy changes to limit private car ownership expected in major cities around the world, 2030 global sales could be comparable to today's levels in a more muted scenario.

New customers and competitors are causing the larger automotive ecosystem to become increasingly dynamic. Take, for example, electric vehicles (EVs), which are significantly less complex than internal combustion engine (ICE) vehicles and therefore easier for new entrants to produce. Tesla is certainly the most prominent example of a new "pure player" EV OEM; even electronics company Sony recently presented an EV concept. In addition, China has experienced an explosion of EV start-ups, and now counts around 500 registered EV manufacturers. While it is unlikely that more than a handful of these new entities will survive, their sheer number demonstrates the speed at which new players have entered the OEM market. The same is true for mobility services: companies such as Didi Chuxing, Uber, and Waymo have proven fierce competition for existing mobility providers (such as taxis) and the new mobility services launched by traditional OEMs.

These more recent entrants in the automotive market affect chemical companies in three ways. First, existing OEMs and Tier 0.5 or Tier 1.0 suppliers could struggle, affecting lower-tier companies. Second, new customers could enter the market, including EV OEMs or mobility start-ups, and fleet customers that require special features for their vehicles. Third, even where customers stay the same, the changes in the market may open a window of opportunity to establish partnerships that were not previously possible.

On this last point, many OEMs are searching for partners to invest in, as seen in the EV-battery joint ventures between Tesla and Panasonic, Volkswagen and Northvolt, and GM and LG Chem. OEMs are also opening the doors to new suppliers for components such as battery materials for EVs and interiors and exteriors for shared mobility.

Mobility disruptions will not disrupt the chemical industry at large, but specific products could be affected

While ACES disruptions drive major changes in the automotive industry, their impact on chemicals is less pronounced than might be expected. Among the four disruptions—autonomous driving, connected cars, electric vehicles, and shared mobility—electrification will likely have the biggest impact on chemical players.

The main ACES trend: Electric vehicles

Overall, EVs are not fundamentally different from ICE vehicles—with the exception, of course, of their powertrains. Electric motors produce much less heat than ICEs and therefore allow for different combinations of materials. In particular, electric motors require fewer super-engineering plastics[3] compared to commodity plastics, such as polypropylene. They also do not require engine-related chemicals, such as emission catalysts, fuel additives, and lubricants. While these chemicals face a diminishing market, battery-related chemicals for the anode, cathode, electrolyte, and separator markets could post double-digit annual growth rates. Overall, the bets of the chemical industry have been hedged, but specific product groups—and ultimately, individual chemical companies—are highly exposed to these changes.

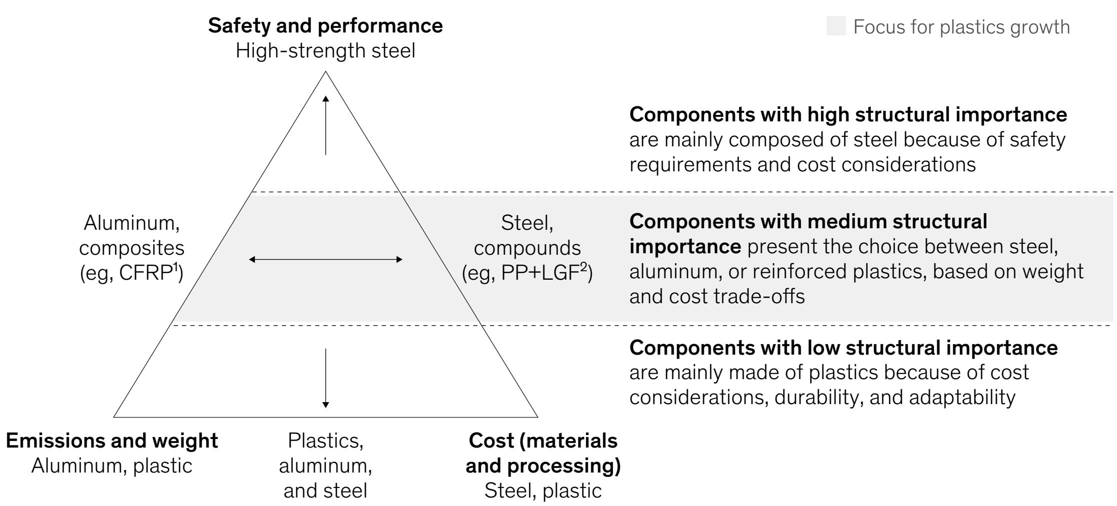
It has often been stated that EVs would increase the need for lightweight materials and parts, given the high weight of the battery pack and its range limitations. However, lower battery prices have made increasing battery capacity more cost effective than reducing vehicle weight. At present, materials choices are typically constrained by specific performance or safety requirements (Exhibit 2). Rather than switching to bodies made of carbon-fiber-reinforced plastic—as attempted by the BMW i3—a move back to steel from aluminum is feasible. The Tesla Model 3 provides a good example of this trend, as it is optimized for cost rather than weight. In fact, the body-in-white frame for the Model 3 is 165 pounds heavier but €80 cheaper in materials cost than for the Model S.[4] Similarly, the second generation of the Nissan Leaf reverted to conventional steel doors, while the new Volkswagen ID.3 features a body that contains a combination of steel and aluminum. In short, newer generations of EVs generally utilize the same materials as ICE vehicles, with all-steel bodies much more common than alternative materials, though this is independent of whether the EV is built on a native platform or on a conventional ICE platform.[5] While select components can also be optimized toward the requirements of EVs (such as suspension or tires built to withstand higher weight levels), there is no fundamental difference in the materials used.

While interiors have little effect on the powertrain of a vehicle, they have become increasingly important. Many OEMs cannot differentiate themselves through the electric drivetrain or the battery (relative to engine horsepower, torque, and drive dynamics) and therefore focus on uniquely designed interiors. Our

Exhibit 2

Materials choices are constrained by specific performance and safety requirements, creating the main trade-off between cost and weight.

Drivers of materials choices



[1]Carbon-fiber reinforced plastic.
[2]Polypropylene and long glass fiber reinforced compounds.

[3]The term “super-engineering plastics” refers to heat-resistant polyimide engineering plastics and forms.
[4]Excluding 119 pounds for wind screen. Weight of Model S adapted to Model 3 dimensions for direct comparison.
[5]For more on this topic, see Mauro Erriquez, Philip Schäfer, Dennis Schwedhelm, and Ting Wu, “How to drive winning battery-electric-vehicle design: Lessons from benchmarking ten Chinese models,” July 10, 2020, McKinsey.com.

2018 Future of Automotive Survey shows that more than 70 percent of executives believed personalized interiors have become more important. This could create opportunities for chemical companies that help OEMs create new features, including ambient lights, integrated displays, and panoramic roofs.

The other ACES trends: Connectivity, mobility solutions, and autonomy

Connectivity has limited material implications—the exceptions being an increased presence of vehicle displays and sensors that utilize materials such as LED screens, smart glass, liquid-crystal polymers, and other materials used for 5G-network penetration. As connectivity increases the functionality of electronics in vehicles, chemical players serving the electronics industry could be positively affected.

Shared mobility, currently based on conventional cars, will increasingly shift to purpose-built vehicles—and, later, purpose-built autonomous vehicles. Purpose-built vehicles use flexible design to offer mobility options tailored for personal preference or needs, and this adaptability could drive the reimagining of the automotive interior. For instance, seats will need to simultaneously be more flexible and sturdier to accommodate the differing needs of passengers in shared or autonomous cars. Materials must become more resistant, more hygienic, and easier to clean. In addition, surface materials may need to be able to change colors and patterns quickly to allow for customization for fleet owners.

Finally, autonomous technology will affect chemicals once full autonomy reaches a breakthrough point, necessitating completely new vehicle designs without drivers' seats, steering wheels, and other features common in conventional cars. (This breakthrough is not expected in the next decade.) In the long term, a fully autonomous and theoretically accident-free world could even enable cars made entirely of plastic, though safety regulations and requirements are unlikely to be relaxed in the foreseeable future. However, increased use of sensors to enable semiautonomous driving provides a significant and more near-term opportunity for chemical players.

An additional challenge: Sustainable plastics

Because fuel consumption constitutes around 65 to 80 percent of life-cycle carbon emissions for ICE vehicles, electrification has been at the forefront of sustainability efforts (Exhibit 3).

Steel, which makes up the bulk of a car's weight, is highly energy- and carbon-intensive. In fact, steel production emits 2.0 to 2.5 tons of CO_2 equivalent per ton of raw material. Some of these emissions can be abated—for example, by using recycled steel. Demand from the automotive industry could lead the way for carbon-free steel and drive part of a hydrogen-based fuel economy from which chemical companies could profit.

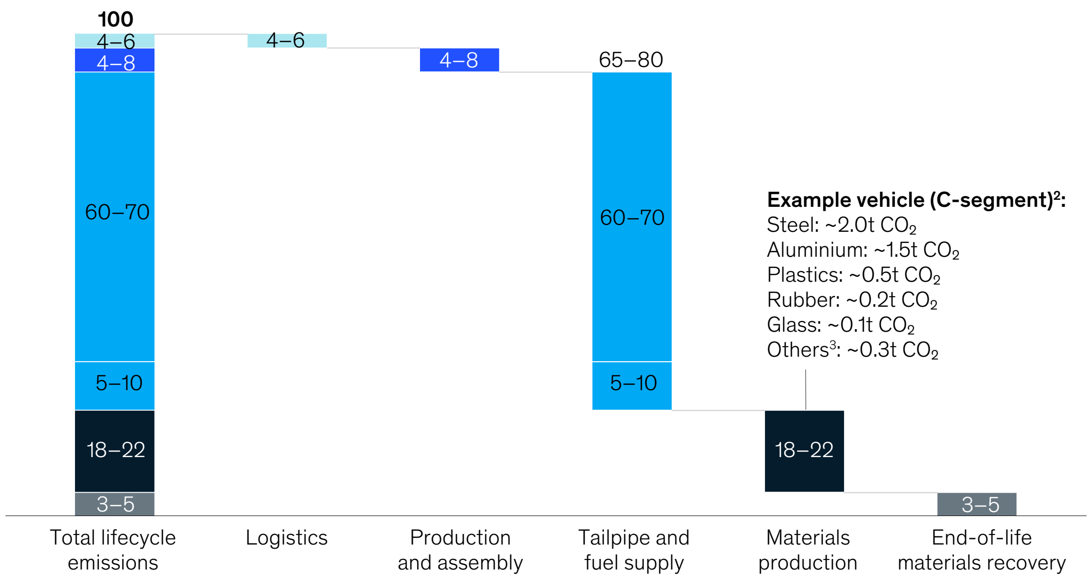
Virgin polymers have a carbon footprint of approximately 2.5 to 4.5 tons per ton of polymer produced—even higher than steel. However, their lighter weight means their contribution to the car's carbon footprint is less than that of steel. In addition, polymers can be used to achieve weight savings or directly increase the car's efficiency—for example, through higher-performance tires. In the case of conventional ICE vehicles, these efficiency gains can easily outweigh the process emissions of polymer production. For instance, a fuel-efficiency increase of only 1 percent offsets the process emissions of the plastics used in an ICE vehicle.

Nevertheless, polymers could be affected by the automotive industry's push for a greener image. Recycled polymers can decrease materials-related emissions by up to 75 percent, and the use of green materials such as natural fibers for reinforced plastic parts can further reduce emissions. Recent examples have shown that the industry is already engaging in driving this transition. Even if the actual environmental impact per vehicle is low compared with other levers, the switch to green materials may well have a negative impact on petrochemicals demand.

Exhibit 3

The material footprint of total life-cycle emissions must be considered when manufacturing internal combustion engine (ICE) vehicles.

Total current lifecycle emissions of ICE-V,[1] %



[1] Refers to C-segment vehicles.
[2] Exact emissions will depend on the reference car and may be higher or lower, depending on additional considerations such as mining-related emissions, specific materials, or regional differences.
[3] Such as electronics and fluids, among others.
Source: NGVA; Expert interviews; McKinsey analysis

What chemicals companies need to do now

Chemical companies that want to meet industry disruption head-on and stay ahead of the curve will need to take decisive action to respond to three trends:

The materials may not change much, but the market does

Overall, mobility disruptions for the chemicals industry are relatively balanced, and the amount of chemicals needed per vehicle is unlikely to change much. Notably, we do not expect petrochemical volumes to be heavily affected by mobility disruptions. The plastic content of cars in particular is unlikely to increase significantly in the medium term. On the contrary, the sustainability revolution could present a risk for automotive plastics, even if we do not believe that this is warranted from an environmental perspective.

However, materials relevant for drivetrains will be affected on a larger scale. For individual companies, there are significant threats and opportunities that must be considered. As often is the case in the chemicals industry, a segment shift between chemical companies is more likely than an opportunity or threat for the industry as a whole. Therefore, individual players must carefully analyze their positions in the markets—for example, those with a large share of ICE-related powertrain chemicals versus those that can participate in the growing EV-battery market.

Apart from materials changes, the recent downturn of the automotive market (and the sluggish global growth outlook for light vehicles until 2030), the disruptions to the market situation, and the OEM ecosystem are likely to impact all chemical companies. It will remain important to have the right set of customers in the right regions (such as emerging Chinese OEMs). For many players, this will be even more important than considering portfolio changes related to mobility disruptions.

Changes in the ecosystem can create windows of opportunity
As the automotive sector transforms, a window of opportunity could open for materials companies that serve the changing needs of customers. For EV motors or future interiors, for instance, chemical players have the chance to cocreate new design and materials standards with OEMs.

Historically, it has been quite difficult for materials companies to become Tier 1 or even Tier 2 suppliers. The established automotive ecosystem can be described as a rigid pyramid. A few OEMs at the top are in direct contact with systems manufacturers. These systems manufacturers are then in direct contact with parts manufacturers that are in direct contact with materials manufacturers.

The potentially powerful role of chemical companies in the new value chain becomes most apparent in the EV space, particularly in the battery markets dominated by Northeast Asian companies, such as LG Chem. We also see specialized chemical companies entering direct relationships with OEMs to work on concept cars, such as the BASF–Daimler Smart forvision project, as well as partnering with purpose built vehicle start-ups and spin-offs on targeted materials for shared use.

Agility and competitiveness remain important
Apart from shifts between materials and players, overall volume and profit developments in the automotive industry look less than stellar. Sales volumes could well stagnate with tightening city-level regulation, affecting all supplier industries. Hence, chemical companies must remain agile enough to react—and potentially search for new areas of growth in adjacent markets (such as healthcare) if the downturn in the automotive market materializes.

At the same time, market uncertainty raises the question of which players will survive and thrive in the new normal, whether it be existing OEMs or new entrants. Chemical companies that hope to play it safe need to carefully consider their market positioning and actively manage their portfolio of customers and partners.

Finally, the automotive outlook keeps cost pressure in the industry high: a focus on more traditional topics such as functional excellence, procurement excellence, and digitalization is therefore necessary to remain competitive.

Much excitement exists in the chemicals industry around lightweight and ACES trends as well as the opportunities they can create. However, significant change in the automotive industry had already been in motion for some time. As with other industries, chemicals will have no choice but to adapt to the next normal. While new mobility disruptions will not fundamentally change the game for chemicals over the next decade, staying abreast of market changes and understanding how portfolios will be affected could be the difference between emerging as a leader or falling behind.

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