Automotive Developments and Implications for the Chemical Industry in China

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In the last few decades, changes in the global automotive industry have been constant but fairly incremental. However, this is likely to change now. The two main drivers for the change are the need for much more environmentally friendly cars in the face of global warming, and the ever-increasing power of IT which in the longer term should allow for self-driving cars.

One major consequence of the above is the shift towards electric and hybrid cars, a shift that is strongly supported by the Chinese government – this has turned China into the biggest market for such vehicles. This trend will of course have major implications for the chemical industry, first and foremost in the area of battery technology and materials but also in many other areas. However, in this paper we would like to focus on some of the other upcoming changes which – while not directly related to electric vehicles – will also have a direct and substantial impact on the chemical industry as a major supplier to the automotive industry.

First of all, there is a strong need for weight reduction of cars as emission standards are getting stricter across the globe, and will keep tightening further (see Fig. 1).

According to an industry rule of thumb, a 10% reduction in vehicle mass leads to a 5-7% reduction in fuel consumption and thus in carbon dioxide emissions. That means that vehicles will get more 200 to 300 kg lighter in order to meet the tightened standards. While this reduction cannot be achieved solely by increasing the share of plastics in cars, studies have shown that the use of plastics is a cost-effective way of reducing vehicle weight compared to other weight-reduction approaches such as using Aluminum/Magnesium or switching to a smaller, lighter turbocharged engine. Increased introduction of plastics into cars can reduce the weight of cars by about 100 kg, and results in a cost of about US$24 for each gain of 1% in fuel efficiency. So even without the spread of electric vehicles, tightened emission standards should increase the demand for plastics that support weight reduction of light vehicles. Ironically, an additional demand may come from the switch to hybrid vehicles as the resultant increase in battery capacity will add approximately 9% in vehicle weight, resulting in an even greater need for weight reduction elsewhere.

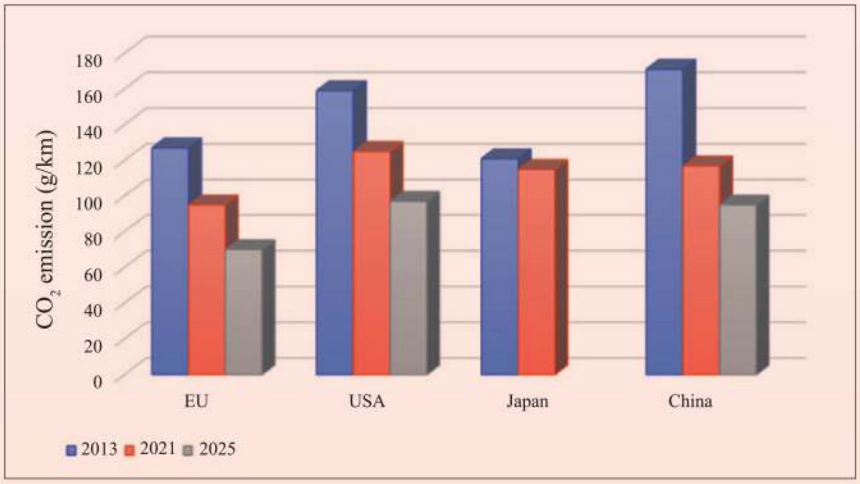

Fig. 1: Emission standards for light vehicles in different regions

How about the materials used in light vehicles in the future? A major general trend is to use composite materials. These can have different advantages. For example, the use of natural fiber composites in bolsters dramatically reduces the green house impact of this part compared to using ABS. Another important advantage is that via multiple layers of different polymers, very differentiated properties can be achieved, with for example the surface layer providing the desired texture and a foam layer from another material (e.g., PU) improving, e.g., the acoustic properties.

For the chemicals suppliers the use of such multilayered materials means an increased need for high-quality lamination processes and adhesives – this may even mean that the switch to water-based adhesives (which is heavily supported by the Chinese government in coatings) may require significant research to improve their adhesive propensity and processing cycle times as current water-based adhesives do not quite reach the properties of solvent-based ones.

As for the polymers, the amount of PVC used is likely to decline due to environmental considerations. Instead, there will be a focus on performance plastics. In addition, as cars more and more become "computers on wheels", there will be greater focus on the Human-Machine-Interface (HMI), which will lead towards more extensive use of PMMA and PC due to the need for clarity and transparency in interior applications. A China-specific aspect is the need to further reduce volatile organic components (VOC) in materials used in the car interior, both because China has very tight standards and because car buyers are more sensitive to this issue than in most other countries.

Overall, the amount of plastics used in Chinese cars is likely to increase and approach the approximately 8.2% by weight that plastics now account for of the weight of an average US car. Of course, the size of the overall plastics demand in automotive does not only depend on the amount of plastics per car but also on the total number of cars produced. In recent months, car production has been stagnant or even declining slightly. On the other hand, the low number of cars per capita in China (about 170 per 1000 people compared to about 600 per 1000 for typical European countries and 900 per 1000 for the USA) hints that there still is an enormous potential for market expansion. However, this also depends on whether the current individual car ownership will still be the norm in the future.

There are reasons to think it may not, in particular the trends towards self-driving cars and car sharing. Many urban young professionals – particularly in Europe – nowadays no longer see the need to own their own car as their needs can be catered for more cost-effectively by renting or sharing cars. China is somewhat different in that owning a car still is a bit more of a status symbol than in Europe, but this may change as well.

Self-driving cars will arguably promote the switch to car sharing as it will make it much easier to access a car on demand. In that respect, the switch to self-driving cars will likely lead to a reduction in the overall number of vehicles produced. On the other hand, each shared car is likely to be utilized much more intensively than one owned by an individual. Consequently, requirements related to durability of interior and exterior will increase substantially, and with it the requirements for the materials used in producing the car.

As self-driving cars take over, supply chains will change as well. Currently the producers of electronic components supply to Tier 1 and Tier 2 suppliers of the OEMs. Given the vastly increased importance of electronics in self-driving cars (if a car is indeed a "computer on wheels", then the characteristics of this computer will indeed largely depend on the electronics therein), in the future electronics suppliers are likely to directly deal with the OEMs, and may themselves be supplied by the current Tier 1 and Tier 2 suppliers (see Fig. 2).

Producers of chemical materials thus might be delegated to positions far away from the OEMs – unless they start cooperating with electronics suppliers at an early stage and become their direct suppliers. Those chemical producers solely relying on their good contacts to current Tier 1 suppliers may well get left behind.

Finally, a look at the industry structure in China`s automotive segment. Compared to other countries, there is a large number of car makers (in 2017, there were 76 Chinese OEMs), and many of them are loss making. Consolidation of the industry is almost inevitable. It is likely that this consolidation will also favor the bigger, more consolidated materials producers supplying the industry. Chemical companies should therefore thoroughly consider expanding their offerings to the automotive industry, ideally expanding from individual materials to complete solutions. ■

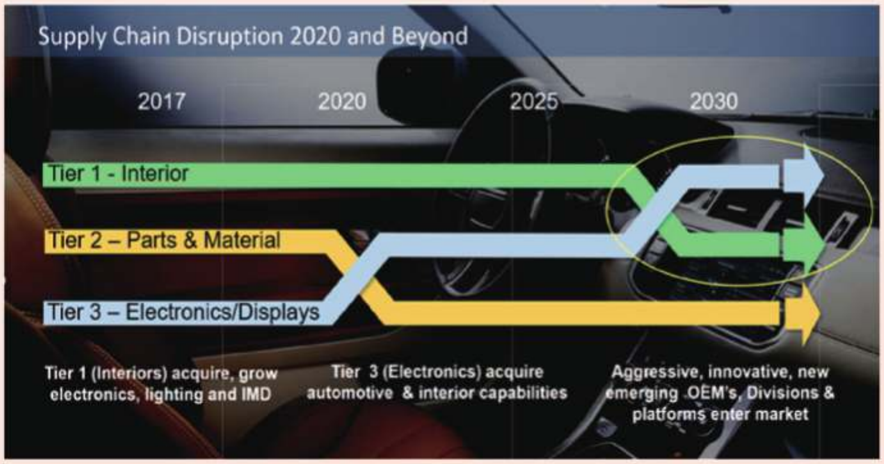

Fig. 2: Supply Chain Disruption as a consequence of self-driving cars