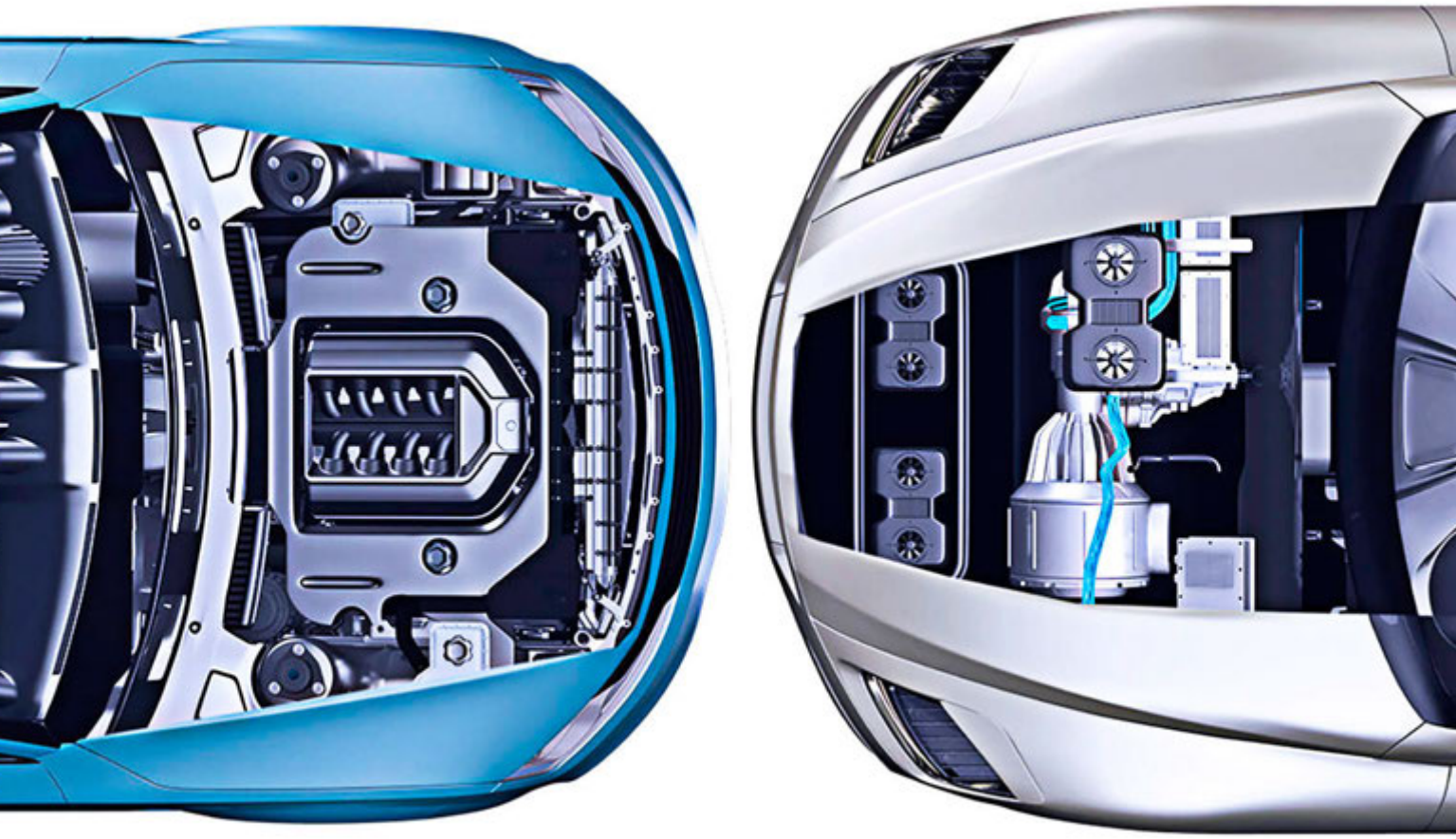


NEW TRENDS AND OPPORTUNITIES ON THE ROAD TO ELECTROMOBILITY

The advent of the electric powertrain has reset the automotive manufacturing landscape, essentially putting everyone back on the same starting line. Article by Marposs.

The automotive and transportation market has been experiencing an epochal transition in recent years that will lead to a complete revision of the mobility concept. The implementation on the vehicle fleet of this transition driving principles—Autonomous, Connected, Electric, Shared (ACES)—is proceeding decisively, albeit at different speeds. While on the one hand, real solutions for fully autonomous driving have to be considered still a future goal, the spread of electric vehicles (EVs) is seeing a growing trend and must therefore be considered a reality to deal with.

The electrification process is involving a radical revolution in a market such as that of automotive, which was by now consolidated, with well-known and long-established rules and players. The processes of continuous innovation of the traditional powertrain technology, aimed at improving performance and reducing the environmental impact, still moved within the context of technologies related to the internal combustion engine (ICE). The entry of new players into this market was, therefore, conditioned by the ability to bridge huge technological gaps compared to the car OEMs already on the market.

But the advent of the electric powertrain has reset this situation, essentially putting everyone back on the same starting line.

This condition has, first of all, opened the door to new industrial realities, which had never previously worked for the automotive market, but which could possibly boast previous skills in the design and production of strategic components of the electric powertrain, such as electric motors, batteries, or fuel cells.

New Opportunities

It is no coincidence that the best-selling brand on the electric vehicle market today—Tesla—was born as a BEV manufacturer rather than a conversion from existing ICE technologies. Similarly, leading companies in the market for the production of lithium-ion battery cells,

intended for portable applications or for stationary storage, have seen new opportunities open up with access to the automotive market.

On the other hand, companies that traditionally worked in the automotive market, car OEMs and Tier 1 suppliers, have had to face the need to convert not only their product but also their production facilities towards new technologies.

This situation has favored the Tier1, which were already operating in the supply of components similar to those used in the electric powertrain, evidently facilitated in the transition. Moreover, the need of car OEMs to quickly present themselves to the market with hybrid or full electric solutions initially tipped the scales towards the use of external supply of the main components.

However, this is a transitory condition and hardly sustainable for auto OEMs in the long term, as it excessively shifts the costs of the car to the "buy" side. In fact, all the major car manufacturers are, therefore, gearing up to become more vertically integrated for what concerns the manufacturing of the powertrain, including the electric drive unit, but also of the battery that is the ultimate challenge, even for the big players.

Addressing the Challenges

This complex scenario is rapidly evolving, but must deal with pre-existing technical and production realities. In fact, it is normal to expect to find new teams of specialists in these technologies within the R&D and prototyping departments. But it is equally frequent that production environments instead see the reconversion to EV projects of personnel coming from long term experience in the ICE world.

On the other hand, specialised companies in the EV sector, not coming from the automotive sector, are now facing for the first time the production problems and quality standards typical of the automotive world.

In one way or another, there are skills or experience gaps in the field that will take years to fill.

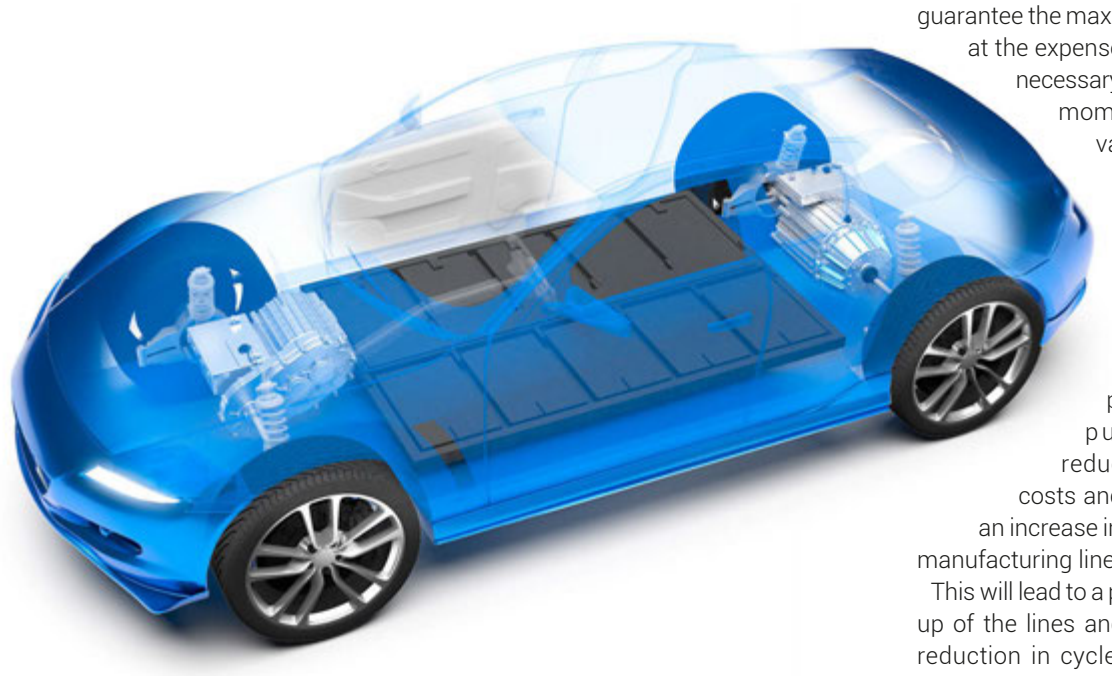
It is in this scenario that companies, like Marposs, are called to offer products and solutions dedicated to quality and process control in the automotive sector.

The picture is made even more complex by the very nature of the key components of this transition.

From a purely mechanical point of view, an electric powertrain has a much lower level of complexity than an ICE. On the other hand, in order to guarantee quality and reliability, other parameters become relevant, such as electrical and magnetic quantities. In the case of batteries and fuel cells, compliance with extremely restrictive safety conditions plays a fundamental role, which can only be satisfied by means of controls that enter into the substance of the electro-chemical behavior of the system.

With these premises, it is practically impossible to bring the topic of quality control back to the field of pure metrology. It is necessary to develop transversal skills to problems that no longer include only measurement, but also inspection and testing of different and heterogeneous parameters, that are often interconnected to determine the functional behavior of the component.

Furthermore, the main characteristics of these components and the peculiarity of the processes with which they are produced require the use of different technological solutions, even in cases where purely dimensional checks are required. Continuous flow processes (e.g. R2R for batteries and fuel cells) are often used on extremely sensitive and delicate materials. Non-contact technologies are, therefore, becoming increasingly widespread, both for measurement and for inspection



and NDT. It is essential to be able to propose a wide range of technologies, because in many cases the solution to the measurement problem can only be achieved by combining different techniques.

Rapidly Evolving

The EV market presents a very dynamic and rapidly evolving scenario; but it is still a sector that is taking its first steps when compared to the tradition of the automotive world. The number of electric models (HEV, PHEV and BEV) that will be placed on the market in the coming years is rapidly expanding, but the traveling fleet is still extremely limited.

The universally recognised quality standards for the production of ICE vehicles were the result of a progressive fine-tuning operation that has been able to make use of more than a century of laboratory experiments, design and production experiences crossed with the field feedback from a vast fleet traveling in the most diverse environmental and use conditions.

This breadth of field evidence is not yet available for EVs, and laboratory simulations can only partially compensate. This is a condition that we must carefully consider, and whose effects we see every day in addressing the issues of quality and process control on components of the electric powertrain.

The high dynamism of the EV market, the strong competitive tension and the drive for continuous innovation—just think of the multiple generations of new types of Li-ion batteries, to be produced in exponentially greater quantities, already planned for the next few years—also involve other particularly significant aspects for companies that, like Marposs, propose themselves to play a leading role in quality and process control in the world of electro-mobility.

The typical timing for the launch of a new car model on the market is progressively shortening. This entails the need to be involved in the definition of control and measurement solutions in a very early stage of the project, often when the project itself is not yet fully consolidated, with an even greater need to operate in concurrent engineering mode than what was already required for ICE projects.

The proliferation of models in the face of still low sales volumes, albeit rapidly growing, and the need to collect experience and data, also involves the demand for measurement, inspection and testing solutions that are able to guarantee the maximum flexibility, even at the expense of the cycle time, if necessary, which is seen at the moment as a secondary variable.

But growth in sales volumes with the spread of EV on the market, together with the progressive reduction of subsidy policies, will naturally push towards the reduction of production costs and, therefore, towards an increase in the efficiency of the manufacturing lines.

This will lead to a progressive speeding up of the lines and consequently to a reduction in cycle times, even in the measurement and testing operations. On the other hand, investments in process control along the entire line will be intensified in order to reduce the scraps percentage on the finished product. In some areas of the EV powertrain production, OEE (overall equipment effectiveness) might not compare yet with the traditional standards, but this must change.

In this context, there will be more and more space for companies that have developed experience in quality and process control in the automotive sector, and that have been able to transfer it to the typical problems of electric powertrain components. For this purpose, it will be essential to know how to adapt to the rapid innovations that will characterise the EV sector in the coming years, presenting himself on the market with continuous updates of the available technologies and application solutions dedicated not only to measurement in the strict sense, but more generally to inspection, control of new processes, and execution of functional tests.