Composite solutions for the transportation market

A look at the history of the bus and truck market in Brazil leads us to reflect on the best way to step up the use of composite solutions in that market. Individual differences from country to country and in the technology available prompt questions about suitable processes.

Gilmar Lima,
director,
MVC Solutions in Plastics

MVC Solutions in Plastics belongs to the Brazilian group Marcopolo, one of the world's largest bus body manufacturers. Set up 18 years ago, MVC has 750 employees and manufactures 12,000 tonnes of thermoplastics and thermosets a year. The company's main markets include the automotive and civil construction segments. MVC offers its customers comprehensive customized solutions up to the final product, including design, project, materials and process definition, testing and approval.

MVC's main focuses aren't the processes, but the solutions for its client's needs and demands. That is why it has highly diversified processes, such as RTM Light, integrated, soft, vacuum forming, VFC Light, extrusion (thermoset and thermoplastics) and polyurethane injection. In some processes MVC doesn't act directly, but develops strategic alliances to supply the market, always with the most competitive solution in sight. These strategic alliances help MVC to keep up on the latest technology. Its most important alliance so far is the one it has maintained for ten years with French technology centre Pôle de Plasturgie de l'Est. (Another strategy is to have a group of suppliers working on different aspects of each specific solution, assuming they not only have competitive prices but also add value and technology to the products.)

A short history of composites in the transportation market

With respect to composite solutions for the transportation market, Marcopolo's own history with composites can be considered as a representative case that can give an indication of the state of this market 50 years ago, currently and, hypothetically, in the future.

In 1949, the company was called Nicola and used no composite products. Its vehicles were heavy, with little design flexibility.

In 1958, Marcopolo made its first timid attempts to lower weight, switching to fibreglass (as reinforced plastic was known in Brazil at the time) for some components. In 1968, composites accounted for

2% of the cost of a vehicle. Processes were manual (hand lay-up and spray-up).

The proportion of composites used in bus bodies grew slowly but steadily once the company, used to working with steel, got past the first barriers. By 1973, composites accounted for 6% of the body's total cost and by 1983, 12%. At that time, the main factors limiting faster growth were process (manual only), raw-material quality, the lack of specialized professionals with the level of skills needed to work with these processes and materials, and the lack of technical knowledge, given that all engineering courses were focused on steel.

Though the necessary technology, processes, materials and professionals were sometimes lacking, the use of composites increased starting in 1985, due to growing volumes in both the domestic and the foreign markets, the need to reduce weight, and greater project and design flexibility. The continued use of manual processes raised further environmental and cost challenges, however, and this prompted Marcopolo to search out new technologies and solutions to minimize the problems. The first one was vacuum bag moulding, used to manufacture roofs. This involved an automated process to cut the fibreglass, then vacuum moulding and compacting the materials under a plastic film. In spite of the limitations of the process (a long cycle and the need to import the plastic film), it constituted a significant advance that pushed the proportion of composites in the bus body up to 16% by 1992. At the same time, the transportation market in Brazil was starting to develop, especially the truck market. There was pressure to use safer, faster processes that wasted less. The large

industrial players – Mercedes Benz, Volvo, Scania, Ford and Volkswagen – had new quality requirements, such as ISO 9000, and would no longer accept manual processes. Composite-processing industries in Brazil had to find alternatives to raise the quality level of their processes. In this way, the use of SMC and RTM began to develop in Brazil for the first time, changing concepts and work approaches. In the specific case of buses, however, we still had an investment feasibility problem. Due to the small number of models and vehicle standardization in the truck industry, it is feasible to invest heavily in RTM and SMC for developing components, but this is not so for buses.
In 1995, Marcopolo was already producing a high number of units per day – but many different components were needed for the different models, because its buses were almost fully customized for each individual customer. For instance, there were more than ten models for bumpers. Using high-pressure RTM was almost impossible because of cost and the need to change models constantly. Despite these difficulties, Marcopolo decided to develop more standardized products using this technology. As long as there were no solutions for small-scale production, the road was clear in Brazil's bus body segment for vacuum-formed thermoplastics to develop.

Breaking the last barrier

In 1996, Marcopolo was already processing some 3,000 tons of plastics a year, but manual processes still predominated. In 2000, the low-pressure RTM process was developed. The process was called "RTM Light", because of a change in the concept of polyester resin injection that significantly reduced tooling investments. This removed the last barrier. By 1996, the proportion of composites and plastics used in Marcopolo's bus bodies was 22%, representing approximately 8,000 tonnes per year. This was distributed among the different processes as shown in Figure 1 (comparison between 1996 and 2006).

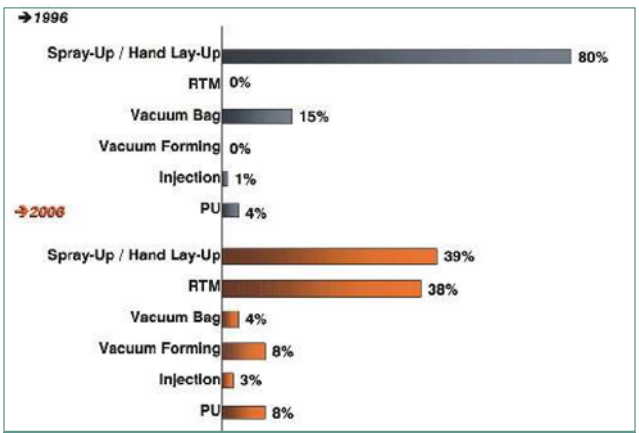


Fig.1: Comparison of distribution among processes between 1996 and 2006

There are now many components made of composites, such as bumpers, wheels, front and rear body panels, hoods, engine cradles, outer roof skins, and internal components such as dashboards and toilet modules. Although the market is increasingly competitive, these figures should continue to grow if creative solutions continue to be found and prices remain competitive. The main trends for use are in panels for external bodies, integrated bus roof modules that include inner and outer panels, and integrated floors made of composites. The aims are weight reduction, durability and thermal and acoustic comfort.

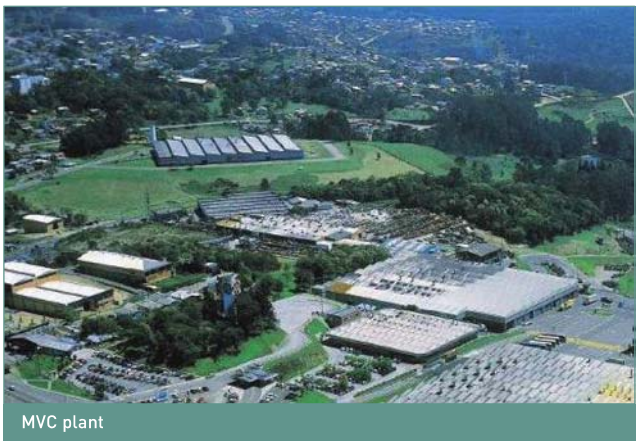
However, the great challenge for moulders such as MVC is to make costs feasible when the materials and technologies are already available for a 100%-composite body. Composites have certainly been crucial for creating bodies with more attractive, lightweight and aerodynamic designs, especially to make the present and future production volumes feasible. Marcopolo's new plants and developments will allow the company to produce around 20,000 tonnes of composites per year by 2009.

Asking the right questions

Regarding the growth of the transportation market, in Brazil and worldwide, the first question that comes to mind is which process will be capable of handling the new demand. But perhaps it is time to ask different questions. A veritable alphabet soup of processes, not to mention materials, exists worldwide – SMC, BMC, RTM, RRIM, LMR (DCPD), FFT, FPT, GMT, and countless more – and battles are fought to defend one or another in the composite market every day. Each has some advantage or

other, compared to the competition. This mix of processes and information is generating much confusion in the market and stifling creativity in finding simple, competitive alternatives. Customers define the processes they prefer, and there is a tendency to ordain the use of a single process in a sort of "globalization". In the case where a customer's supplier maintains that RTM Light and high-pressure RTM produce different products, it can take a lot of time to set them straight on the differences between the two processes: regardless of the purely technical aspects, the materials are the same. The only thing that differs is the injection technology and therefore, both products are alike. One may have better appearance and resistance than the other? Yes, but that depends on the moulder, the mould, the quality of the materials used, etc. Here again, the question is: "What process are you using?" That is a mistake. What really matters is what I, the customer, need and expect from the product. The questions that need to be asked are: What are the requirements? What level of tensile, impact or elongation resistance do I need? What type of surface? What life span is at stake? Is weight an important issue? What is the application? Where will it be used? What are the necessary investments? One question customers will surely ask is "What can we do when our supplier has only one single process?" The answer is simple: the supplier can (and should) seek out intelligent and strategic alliances. The "single process/unique material" view has doomed any number of high-technology processes and materials. There is no more room for products and components made with non-competitive materials and processes. Process is a consequence. We need to put aside the stereotype of a unique and irreplaceable process, because it kills our capacity for thought and creation and, even worse, squanders the opportunity to reduce costs and to produce a part using more than one process or material. In the highly competitive market we're living in, we cannot afford the luxury of using materials and processes that perform above the needs of the product. The world has changed, and so has the plastics market. Raw materials are constantly changing, and nanotechnology has new surprises for us every day. Because of the evolution of technology and materials, our "truths" are relative: yesterday's technical knowledge may not be valid tomorrow, i.e. the same large press required previously to manufacture a certain product might be obsolete today.

Being an expert means being always ready to go back to learn more. This is why we don't pretend to know which processes and materials will meet the composite demand in the transportation market; rather, we intend to open a discussion about the strategies that will add value and distinction to the market. One suggestion is to stop asking "Which process?" and start asking "What is your best solution for manufacturing my product?" ■



MVC plant

More information ...

The Marcopolo Group was set up 58 years ago. Its four core businesses are Urban and Road Buses, Comercial de Veículos Leves (Volare – Light Vehicles), the Moneo Bank, and Plastics (the MVC business). With a workforce of 11,000, Marcopolo manufactured 16,000 units in 2006, or 65 units per day. It has nine plants: three in Brazil, two in Russia, and one each in Mexico, Colombia, South Africa and Portugal. In 2007, it will build two more plants, including one in India. Marcopolo's share of the Brazilian market in 2006 was 44.9%.

More information: www.mvc-marcopolo.com.br