

Composites: materials of the future

Part 2: Market and market developments

Market

For three decades, the composites industry has witnessed steady growth, thanks notably to general economic development and the increased market penetration of this material in key markets, such as the construction, wind energy, aeronautics and automobile sectors. However, in parallel to the economic downturn experienced in user sectors, this market also witnessed a recession between 2008-2009.. The market then picked up again in 2010 and has, on the whole, recovered, at least in certain regions of the world.

Composites benefit from larger markets in the most economically developed countries (the USA and Europe). They are well located there, and competition with aluminium, steel or technical polymers having stabilised (and depending on the price of materials). However, in the aeronautics sector, they are continuing to replace other materials in new applications.

In emerging countries, the situation is somewhat different and the market follows the curve of economic development; here growth is larger.

China has been left relatively untouched by the recession in the composites sector and is continuing to draw on this growth. In 2010, its production represented 28% of global production, the largest share. In the same year, the USA represented in excess of 22% of global production, and Europe represented 20%. The rest of the world produces 29% of composites.

The impact of the crisis was vastly different from one sector to another. The transportation, aeronautics and construction sectors have suffered whilst the wind energy production sector witnessed strong growth of 30%/annum between 2007 and 2009, growth which was supported by recommendations in favour of renewable energies.

Analysts are banking, for the 5 years ahead, on growth of 6%/annum in values (5% in volumes), with thermoplastic matrix composites witnessing faster growth (8%/annum) than thermo hardening composites.



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Fibreglass reinforced composites

In volumes, composites remain largely dominated (85%) by fibreglass, despite the large increase in carbon fibres and natural fibres.

Date published by AVK on fibreglass composites in Europe provide an overview of this industry.

Implementation processes

The reduction in supply in the automobile industry has led to a reduction in the production of SMC (Sheet Moulding Compounds). The electricity/electronics sector has seen slight growth in Europe, which has had a direct effect on the sale of BMC (Bulk Moulding Compounds), a much used technique in this sector.

Both the SMC/BMC techniques enable series production, which represent one quarter of composites manufactured in Europe.

Open moulding techniques (hand lay-up and projection) are continuing to develop a little slower than other techniques. This is affecting small companies and/or those companies which produce single parts or series parties with little use of automation. This sector now only represents 23% of composites.

The production of wind turbine blades is often outsourced to other regions, but the demand for longer blades could represent an opportunity for carbon fibre composites.

Shipping construction has suffered from a fall in demand in Western Europe. This industry widely uses open moulding techniques, but automation is still progressing.

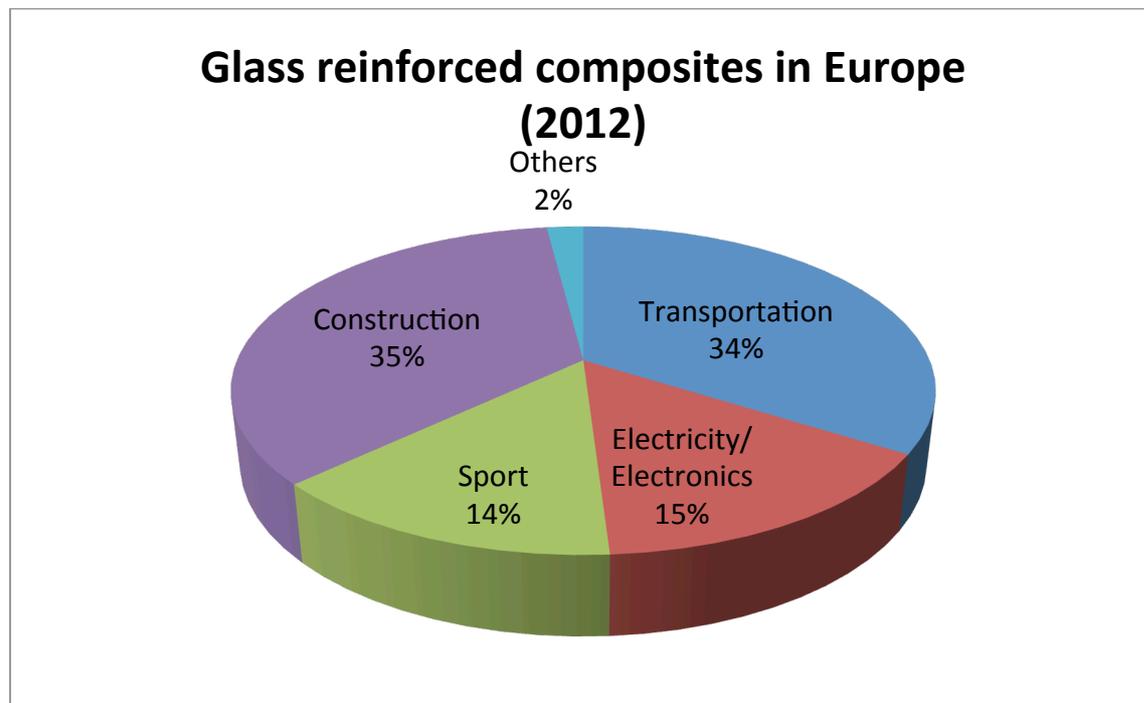
Closed moulding techniques – such as RTM, Resin Transfer Moulding, infusion – have held up better, notably because they replace open moulding techniques and are aimed at smaller series than SMC/BMC. This sector is developing much more quickly than others, at a rate of 13% per annum; in Europe it represents 10% of the entire market. The technique has been improved and developed widely, notably for quicker production of large series in the automobile sector.

Continued manufacturing processes of panels are witnessing slight growth. Producers make wide use of automation for large volumes. Pultrusion, which has never been a large sector in Europe, has lost 8% essentially due to the slowdown in the construction and civil engineering sector.

Manufacture of tubes and tanks is slowing down and, therefore, centrifuge and filament rolling production techniques have been reduced.

Long fibre reinforced TPs (LFT) and GMT (Glass Mat Thermoplastics) have witnessed growth of 6% and are open towards new applications outside of the automobile sector.

The distribution of user sectors is relatively stable in time over Europe.



Transportation (automobile, rail, aeronautics) and construction (pipes, industrial buildings, wind turbine blades) each represent 1/3 of production. Electricity/electronics and sports and leisure are two other major user sectors. The latter is a sector which is consumer oriented and has strong potential for development.

Producers per country

Producers of composites in Europe stand at circa 10,000 companies representing a total of 100,000 Employees. However, as the majority of these stakeholders are SMEs, they are poorly distributed in statistical terms.

In light of the economic difficulties in Western Europe (Spain for instance) and the growth of certain regions such as Asia and the BRIC States, more generally, countries which export are faring much better than others. In 2012, largest growth was witnessed in Germany, the UK and Eastern Europe.

In Benelux, production moved from 42 kt in 2011 to 43 kt in 2012.

A certain decline has been observed in Scandinavia due to the difficulties in shipping construction (2/3 of production of composites in Finland) and in wind energy production.

Outsourcing production to India (SMC parts for instance) and the ordering of composites in China (for wind turbine blades for instance) are affecting European countries.

Carbon reinforced composites

Overall development

The global capacity for production of carbon fibres was 111, 785 tonnes in 2012. In 2016 it is set to reach 156,845 t and in 2020 set to reach 169,300t.

In relation to these nominal capacities, actual production only represents a part, evaluated at 60% in 2012, 68% in 2016 and 72% in 2020.

Demand was 47,220 t in 2012. It is set to reach 74,740t in 2016, and 102,460t in 2020. This over-capacity could lead to maintaining competitive prices.

Carbon fibre matrix composites are made 72% from epoxy.

User sectors

In 2012, demand reached 16% in the aeronautics sector, 62% in industry, with the remaining portion coming from other sectors (consumption).

According to some experts, the **automobile sector** is in the initial stage of mass and long term use of carbon fibres for production of structural and semi-structural components.

In the all electric BMW i3, the four door tourist vehicle which has just been released, the passenger unit is made from carbon composite of which fibres are produced in a plant specially constructed by BMW/SGL. This vehicle, set to be rolled out at 30,000

units per year, is a real change in the sector and its success (or failure) will certainly inspire other manufacturers.

Partnerships between OEM and suppliers of composites and/or fibres are increasing :

- BMW and SGL Group
- GM and Teijin
- Daimler and Toray
- Toyota and Toho Tenax
- Audi and Voith GmbH
- Evonik and partners of CAMIMSA
- HIVOCOM in the framework of FP7...



Sesto Elemento Lamborghini

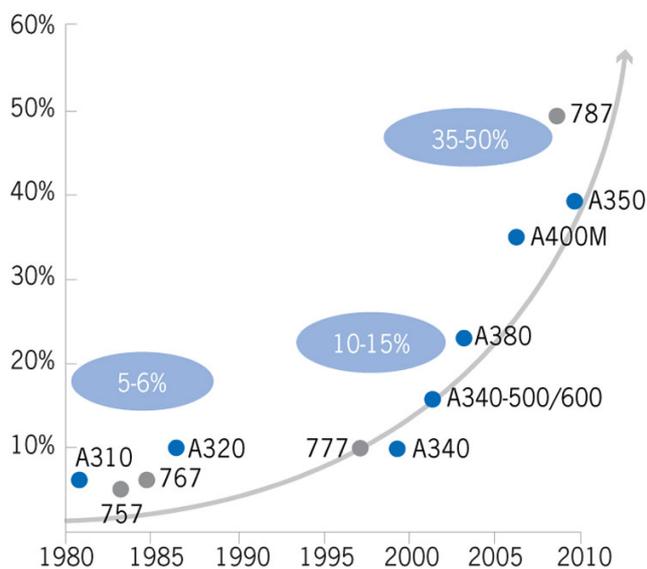
The future of carbon fibre is more uncertain in the **wind energy production** sector. It is primarily used in production of large blades. However, strategies are changing (orientation towards offshore wind farms) as well as policies (subsidies). Wind energy production shall however retain its leading position in user sectors in years to come.

The commercial **aeronautics** sector continues to be the highest user of high modulus carbon fibres. With the Boeing 787 and the Airbus A350 XWB, a large share of the market is covered, and this industry is witnessing growth. Structures producing commercial aircraft consume 4,717t of composites (2012) of which 85% are carbon composites. Composites are additionally used in wings, tail planes and other components of aircraft such as the Bombardier CSeries, the Irkut MS-21 and the COMAC C919.

Carbon fibre is widely used in military aircraft such as the F-35 Lightning II by Lockheed Martin, the Airbus A400M, the Embraer t C-390, the Eurofighter EF-2000 and the Northrop Grumman-4 RQ Global Hawk drone.

The **aeronautics sector** remains, however, a factor of uncertainty in the development of carbon markets. In this regard, for instance, the F-35 Lightning II which has a fully composite shell has witnessed delays and was over budget leading to the withdrawal of several orders.

Aircraft composite content over time



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For many experts, the issue of the use of carbon fibres in mass applications such as the automobile sector is still open.

Prospects

Amongst the outline for the 4-5 years ahead, expectations are as follows:

- The growth of the Asian market (6% per annum in China - 10% per annum according to other analyses -, with 67% in the construction sector and 45% in the automobile sector). The share of BRIC States will move from 22% to 29% in 2013, with China at the moment representing 23% of the total global market share. The freeing up and privatisation of the industry, and massive foreign investment combined with low costs are factors in this growth. It should be added further that these countries in currently being supplied, and that the demand for piping and cisterns, an automobile construction, etc. is large.

The rapid development of China and India will lead to the emergence of new stakeholders: in China, Jushi, CPIC, Taishan for fibreglass, Suzlon in India, Goldwind and Sinovel in China for wind energy production, Xieno Automobile, Yahoia Dazhong Advanced Materials for the automobile sector etc. This impetus will be undertaken in parallel with the implantation of automated technologies, still rather under used in Asia.

- The growth of the wind energy production market, supported by increased research into renewable energy sources.
- The continuous efforts in the aeronautical sector to develop lighter aircrafts using composites representing 10-15% of commercial planes.
- In 2013, the price of raw materials is set to fall (due to over supplies) concerning fibreglass and carbon fibres, but to increase for resins (in relation to the price of oil).

This article forms part of a series of technical articles aimed at industrial manufacturers wishing to increase their knowledge of the field of composite materials. It was produced within the Composites project (www.pluscomposites.eu).

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