



Fig. 3: Extruded WPC-profiles,
Source: Extruwod, Austria

Global Trends in Wood-Plastic Composites (WPC)

by

Asta Eder

Asta Eder Composites Consulting, Vienna, Austria

Michael Carus

nova-Institut, Hürth, Germany

Global overview

Generally, there are four main factors that make the use of natural fibres and wood in plastics attractive: (1) they enhance specific properties e.g. stiffness and thermal behaviour (2) they reduce the price of the material (3) they heavily improve the bio-based share and (4) they are better recyclable when compared to glass fibres. When compared with glass fibre, wood fibre offers a weight reduction for the composite, which can be an important factor in transport costs.

After more than 30 years of market development, in 2010 global wood-plastic composite production reached 1.5 million extruded tonnes, which would mean, with an average wood share of 50%, 750,000 tonnes of wood - which is still only a fragment of the total timber market. WPC is predominantly extruded worldwide to hollow or solid decking boards and is predominately replacing tropical wood. The oldest market can be found in North America where a few big companies make the running.

Global production of WPC, and the forecast

Today's major production growth rates of WPC can be found in the Chinese WPC-extrusion (25% p.a.) and also Chinese domestic demand for WPC is growing. China's WPC industry is the second largest in the world after the United States. According to the forecast (Fig. 1) China will reach 33% of the global WPC production in 2015, following the USA, which produces almost half of the total global market share. After China, South East Asia, Russia, South America and India are rapidly emerging WPC markets.

Decking continues to be the most common field of application for WPCs, also in Europe, where sales of solid profiles are rising compared to hollow ones, but injection moulded decking tiles are also produced. In Europe the WPC decking market has reached the mature stage, which means lower growth rates for the companies involved. This development is driving producers to look for new areas of application. Initially this was in the field of garden fencing and siding.

There have been several research attempts to produce WPC window and door frames, or parts thereof, however the bending pressures on the frames and doors are such that WPC is not successful when applying the current production technology, this will change soon as there are companies, that stand on the edge to the commercialisation. There are still a lot of areas where WPC could expand its share in the non-structural area, such as staircase pillars, balcony pillars, floor tiles, wall trim and customized technical profiles (Fig. 3).

Materials and Prices

Worldwide it is predominately PE and PVC that are used in WPC production, but PP is also of importance, especially in Europe (mainly in injection moulding). Most WPC compounders are located in Germany. The prices of WPC and natural fibre granulates vary enormously and the figures provided by the manufactures range between 1.0 €/kg and up to 4 €/kg. Beologic, the largest manufacturer of WPC granulates in Europe, offers prices from 1.10 to 1.60 €/kg. Soft wood is globally the first choice as a fibre source for WPC, although also rice husks play a role, especially in China. Wood prices differ from 0.2 - 0.4€/kg, depending on the quality and the region. If wood is mixed with more expensive biopolymers the reduction of the composite price can be remarkable and the wood always enhances the biobased share. In addition a special cellulose based compound has recently been offered by paper companies such as UPM-Kymmene and Mondipacking. These are based on pulp and have relatively low fibre shares of 20-50%. In the extrusion process fibre shares of up to 80% have been reached, in injection moulding typical fibre shares of 30-40% can be used.

WPC fields of application

The trend in wood-plastic composites seems to point in a direction where not only wood, but various natural fibres and also different kinds of polymers are used. Apart from technical mouldings wood-plastic composites have also recently been



Fig. 2: WPC Garden fencing, Source: Megawood, Germany



Fig. 4: Construction planks made from WPC, Source: Megawood

used to produce for example horse riding obstacles, stairs (Fig. 4) shoe soles and walking sticks, consumer goods and household electronics, using different production methods, mainly injection moulding. Also new production methods are being developed, for example the extrusion of wide boards with or without foaming.

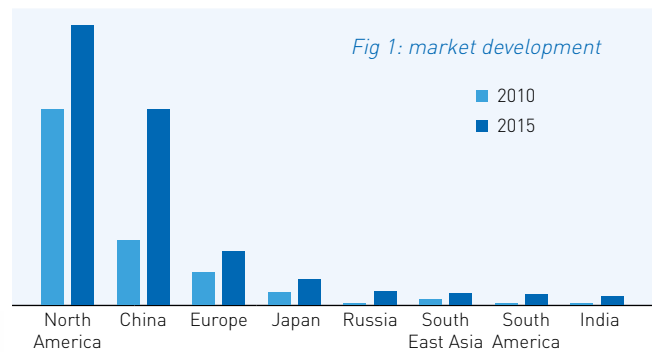
WPCs are neither a product of the woodworking industry nor of the plastics industry. This has the consequence that companies from *both sides* have a particular focus with regard to applications. Nevertheless, companies with a background in plastics seem to have more advantages due to their know-how of the production processes involved. Today the WPC material is still far from being fully understood as an alternative for both manufacturers and consumers. Big companies like IKEA, with their WPC products, will play a key role in bringing WPC material to the public eye. The first WPC Ellan and Ötga chairs were removed from the IKEA catalogue, but after two years a new model of a WPC chair has been introduced by IKEA (cf. fig. 5).

The use of bio-plastics has played a minor role in niche applications, as was shown by the company Tecnar from Germany, who for 15 years have used lignin or PLA as matrix polymers for WPC and natural fibres. One of the first ones to use a type of bio-polymer in WPC extrusion was the company Fasalex, who used starch as a part of the polymer matrix in door frames in Austria. Today the German company Ravensburger uses 100% bio-based compounds with the brand name Fasal, which is based on biopolymers and wood for injection moulded toy figures.

www.wpc-consulting.eu



Fig. 5: PS 2012 injection-moulded WPC chair, Source: IKEA 2013



	2010	2015	growth % p.a	global share in 2015
North America	900000	1300000	8	48%
China	300000	900000	25	33%
Europe	150000	250000	11	9%
Japan	60000	120000	15	4%
Russia	10000	70000	48	3%
South East Asia	30000	55000	13	2%
South America	10000	50000	38	2%
India	5000	40000	52	1%
Total	1450000	2695000	13	103%

Outdoor applications for WPC:

- Non-load-bearing/non-structural applications in the building sector, especially decking, siding, railings, window frame construction, porches and docks
- Wood in the garden: garden furniture, fences and other applications in the garden
- Noise barriers in street construction and sheet pilings for landscaping

Indoor applications for WPC

- Automotive engineering (interior trim), "under the hood" covering and parts exposed to less than 110°C
- Trucks and containers (e.g. loading platforms)
- Doors (frames and profiles), furniture parts (cupboard legs, kitchen cupboard frames etc.), chairs (e.g. PS 2012 by Ikea), window sills
- Boards as a replacement for MDF and particle board in areas of high humidity

Consumer goods and niche products:

- Musical instruments (E-guitar, clarinet, flute)
- Small parts (e.g. pencils, toys, games, kids' cups, high class packaging, lipstick)
- Pallets, edge protection for packaging
- Core pipes (e.g. for bolts of cloth)
- Household electronics (irons, vacuum cleaners)
- Frames

Markets for bio-based composites in Europe in 2012

The first study for bio-based composites in Europe will be released at the end of September 2013 and will be presented at the biggest European WPC conference in Cologne: www.wpc-kongress.de on 10th of December.

nova-Institut (Germany) and Asta Eder Composites Consulting (Austria) are working together on a comprehensive study which unites the wood/plastic composite and Natural Fibre Reinforced Plastics (NFRP) expertise of both associations.

The study aims to calculate the amount of WPC and NFRP that was produced by the European industry in 2012. To achieve a reliable data base for the industry, the study will be based on a survey of the WPC and NFRP industry. Interested parties can still join the survey: <http://bit.ly/12h7ihP>