

FOOTWEAR TECHNOLOGY: DESMA QUADWRAP

Desma's latest concept, the Quadwrap, uses direct injection technology to make the whole shoe, meaning manpower expenditure per pair is reduced by 90%.

Injection of imagination

Footwear machinery supplier Desma has unveiled a concept for making shoes that reduces the number of workers needed per pair by 90%. The Quadwrap athletic shoe uses four layers of polyurethane injected around a textile sock, made on a new version of its Amir machinery. Instead of a typical shift of 200 workers that can produce 1,200 athletic shoes in an eight hour shift, the same number of Quadwraps could be made in 24 hours with a bare minimum of workers, according to the German company.

"More than 90% of shoes are made on large assembly lines where hundreds of people put

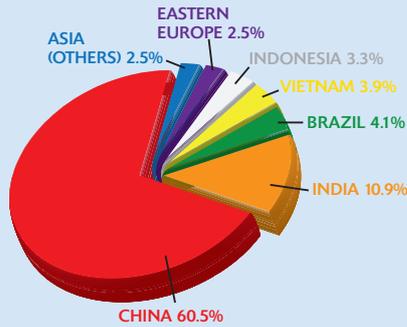
the pieces together by stitching and cementing," says Desma's technology manager, Karsten Stobener. "However, we're facing rising labour costs in shoe-producing regions, as well as complex materials and components. Manual assembly by cementing is becoming more restricted in terms of volatile organic compounds (VOCs), calling for new adhesives and processing procedures. In addition, short-term changes in production schedules are often uneconomical. It can take eight weeks from order to delivery for consumer markets in the US or Europe, and so producers and retailers are unable to alter volumes and colours in response to changing demand."



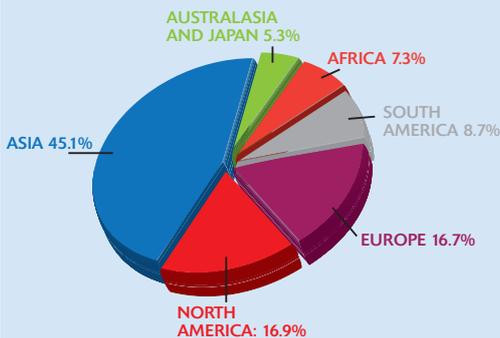
Integrated design using polyurethanes could greatly simplify footwear production.

 Desma

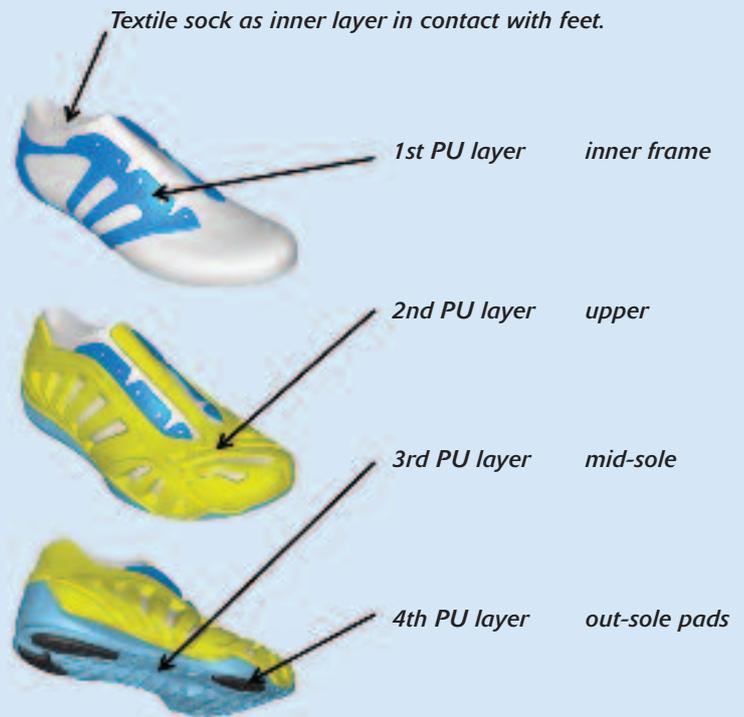
Footwear production, 2013



World consumption, 2013



A new approach to shoe design



The development, which Desma worked on for a year with chemical company Bayer MaterialScience, offers a solution, says Mr Stobener. “We have transferred the concept of direct injection technology to the whole shoe, so there are no prefabricated parts and no manual cementing and it can be made on one machine.”

Production

The shoes are made on one rotary table injection-moulding machine with two mould sets per size for left and right feet. The shoe’s inner frame is directly moulded onto a carrier fabric pulled over a last while the outsole pads are produced in the second mould and the mid-sole added onto it in the same mould. The last with the inner frame on is transferred into the second mould and the upper layer is injected into the cavity between frame, carrier fabric and sole. This joins all four layers together without any cementing. The process is completed by demoulding, flash trimming, inserting an insole and threading the laces.

“A traditional design is made up of more than 20 parts, sometimes up to 60, and uses 360 manual operations to complete,” says Mr Stobener. “This might mean 80 minutes of man time per pair, depending on the design. With Quadwrap technology it’s less than three minutes per pair.”

The four polyurethane layers are produced

using two low-pressure injectors and one micro-casting head mounted to a six-axis robot. One robot sprays release agent into the open moulds while a second moves lasts between moulds and the manually operated lasting/de-lasting station. The machine can be operated by a single employee who lasts the carrier fabric and de-lasts the moulded shoes.

“For each layer, properties such as shore hardness, colour or density can be adjusted through variation of the component mixing ratio as well as the addition of colours or agents,” adds Mr Stobener. “These additives are dosed into the liquid polyurethane directly in the mixing head of the injection machine.” The integrated additive dosing system can handle up to six additives or agents and the colour can be changed from shot to shot. “You have full control, from the liquid raw material to the finished products – your suppliers are just the raw material producers and the sock producers.”

Output is estimated at about 330 pairs per eight hour shift with a 24-station machine. While this is considerably less than a traditional assembly line, manpower expenditure per pair is reduced to about three minutes, a more than 90% reduction compared with traditional processing. “The benefits are that production costs are almost independent of labour costs. You could establish a cost-competitive process close to consumers, even in a high-wage country.”

Reshoring

This supports the idea of reshoring, or moving production closer to the customer – a trend Desma sees as important in the coming years.

“By 2020, China’s wages will be higher than those in cheaper European countries,” says Christian Decker, Desma’s CEO. Rising wages will mean new generations of spenders; it will be “no longer just the production powerhouse but an important consumer market and we must recognise this”.

Sales of Desma’s automation solutions have increased 20% in the last two years, and are expected to rise by a similar amount over the next two.

“We want to show what is possible,” adds Mr Decker. “You don’t need to ship materials to Asia and can avoid the long lead times and so on, you can be flexible. We are talking with US brands who are extending facilities in the Dominican Republic and Puerto Rico, because NAFTA (North American Free Trade Agreement) means it’s quite easy to ship from there to the US.”

But it is not just Western companies that are keen: in 2013, China installed more automation solutions than Japan, the former leader for this kind of production. “The Chinese are starting to invest money in equipment; some are thinking about lean production. There will come a point when there will be a total rethinking of existing processes, and we have already discussed this with some producers,” says Mr Decker.



Desma managing directors Klaus Freese and Christian Decker.



Recycling

In the Quadwrap process, cementing - and therefore VOCs from adhesives - are avoided. Making the shoe from just one material family will also improve end-of-life options. “When you take 20 different materials, recycling is almost impossible,” says Mr Stobener. “This is not an issue today, but it could be in the future.”

In terms of economics, he puts the cost per pair at between €7 and €10, depending on the construction. “We are not selling this design, but the concept,” he stresses. “We want to inspire companies to think of their own design.”



The Desma House Fair 2014 in Achim northern Germany.

