



Guimarães-based safety shoe manufacturer AMF is a pioneer of the new assembly system. CREDIT: AMF

A new shoe production method

Three companies, Huntsman Polyurethanes, DESMA and Simplicity Works have developed new technology that they say has the potential to bring about “the biggest change to footwear assembly in 40 years”.

Huntsman and machinery developer DESMA have worked with Spanish company Simplicity Works, a developer of bonding technology, to come up with a new shoe production method. They have created what they call a highly automated, cost-effective way of bonding together two-dimensional components to form a seamless, three-dimensional upper. Simplicity Works says its patent-protected 3D bonding technology is a world-first. Requiring no stitching and no lasting, the process connects all pieces of a shoe simultaneously, in just a few seconds.

Transformation

When news of the new development came to light towards the end of 2018, Huntsman Polyurethanes described it as “the biggest change to footwear assembly in 40 years” and said it has the potential to transform shoe production

After six years’ hard work, partners Simplicity Works, DESMA and Huntsman Polyurethane have perfected a new footwear construction method. They are convinced the idea can bring about the most meaningful change the footwear industry has seen in four decades.

worldwide. Requiring no stitching and no lasting, the process connects all pieces of a shoe simultaneously in seconds. Faster and cheaper than conventional footwear manufacturing techniques, the companies say the new technology can be customised and is already proving popular with a number of shoe companies.

Jigsaw puzzles

The bonding technology combines a proprietary 3D mould designed by Simplicity Works with a specially designed, injectable material from Huntsman Polyurethanes and a new DESMA injection-moulding machine. Individual upper components go into the mould in a similar way to the pieces in a jigsaw puzzle, with slots separated by narrow channels. A counter mould then presses each piece into place. It is into the network of channels between these components that the new polyurethane (PU) from Huntsman is injected, and the end result is a shoe upper, held together by a flexible, polyurethane skeleton.

Suitable for creating all kinds of shoes, and compatible with different synthetic and natural materials (including leather), the technology can help companies move shoe production away from countries with lower labour costs to production centres closer to consumer markets. With no seams to stitch, the overall production process is less labour-intensive and this reduces overheads. Material costs are also lower as there is less waste. With no knitting or stitching lines, and no overlapping material, shoes have fewer friction and pressure points. Shoes made in this way will behave "more like a pair of socks", according to the technology providers.

Shoe sector shake-up

The launch of Simplicity Works' 3D Bonding process is the result of six years' work for the three partners. Simplicity Works chief executive, and the inventor of the 3D bonding technology, Adrián Hernández, explains: "Our three teams have pooled their knowledge and expertise to create a process with the potential to shake up the shoe sector. The timing could not be better. Currently, an estimated 80% of European footwear imports come from low-cost countries. Faced with rising costs in these territories, many footwear companies are looking to move production back to Europe. Our technology enables them to do that."

DESMA co-managing director, Christian Decker, says his company is "delighted" to be involved in this project, because it will give footwear producers a means of making "highly sophisticated footwear in high labour cost countries in a more economic way."



Simplicity Works chief executive, Adrián Hernández, invented the 3D bonding system at the core of the new process, which he says has the potential "to shake up the shoe sector".

CREDIT: SIMPLICITY WORKS

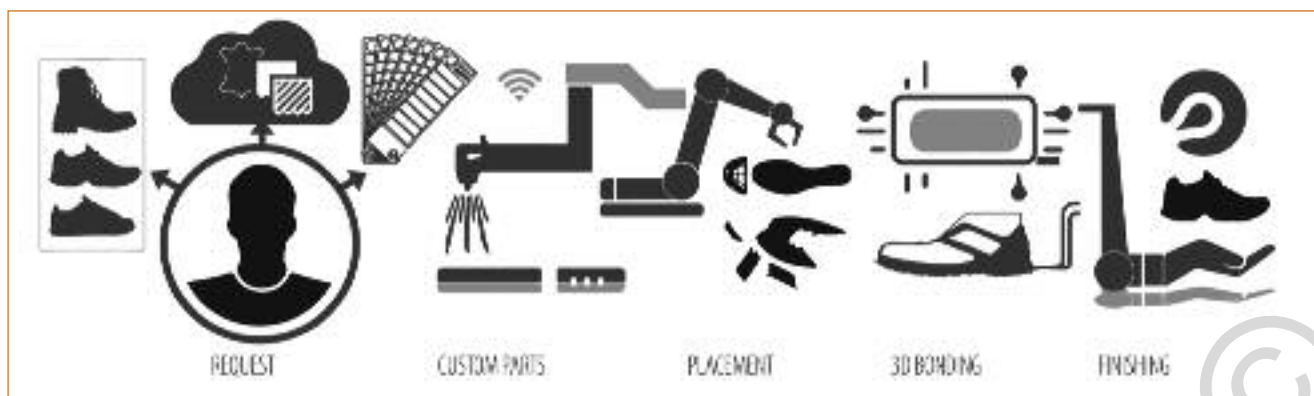
How polymers behave

At Huntsman Polyurethanes, global business development manager, Johan van Dyck, says that taking six years to bring this idea to market proves one thing immediately: if it were easy to do what the three partners have done, it would have happened already. But this is difficult. The process requires analysis of a complex set of canals between the components and a deep knowledge of how polymers behave. Simulation of polymer injection has been widely studied, but some issues remain unresolved, according to the companies, particularly in the case of long and narrow canals. "The concept was there, Mr van Dyck says, "but to get to where we are now we had to go back to square one several times, learning a lot each time. That's why this took so long"



Suitable for assembling all types of shoes, the new process will make it easier for brands to move to a 'local for local' set-up.

CREDIT: SIMPLICITY WORKS



He describes polyurethane as a unique material for footwear because, as well as being a good adhesive, you can make it hard or soft, flexible or rigid, high-density or low-density. In this project, though, there was the added challenge of the PU having to go into the tiny channels between components in the mould. "Plus it has to work in existing production set-ups," Mr van Dyck continues, "and work time after time. It has to work with leather and with textiles and not adhere to the mould. The wish-list for this project was long."

Input, output

There is no real limit on the number of components that companies could insert into the mould. The important thing, Johan van Dyck says, is for them to "think about what they want to get out"; it is this that should determine what goes in. He believes, for example, that this technology will bring a boost to the manufacture and sale of orthopaedic-type footwear, which is much needed because people are working for longer now and, as we grow older, our foot health demands more careful attention. Safety shoes offer another good example; these need to comply with standards such as EN343 and EN345 for water-resistance, breathability, protection at the toe-cap and so on. Manufacturers will need to bear all these requirements in mind when deciding how to construct their products.

Safety shoes are far from a random example. One of the early adopters of the technology is Portuguese safety footwear specialist AMF. This Guimarães-based company, which has a

Partners Simplicity Works, Huntsman Polyurethanes and DESMA worked together to come up with a new, highly automated, cost-effective way of bonding together two-dimensional components to form a seamless, three-dimensional upper.

CREDIT: SIMPLICITY WORKS

daily output of more than 4,000 pairs of high-tech safety shoes "with a fashionable design", aims to open a new factory in the course of 2019, a facility that will centre on automated production enabled by the new bonding process.

Local for local

In total, around 20 brands are using the bonding technology already, although most have preferred to embrace it under a non-disclosure agreement, Johan van Dyck explains. The Huntsman business development manager says the other companies on the list "are all names that you would know". He insists that these companies are completely serious about producing their footwear closer to where consumers will buy it and that "local for local" makes more sense than ever for them.

Less waste and less shipping means greater sustainability, all of which helps these brands and manufacturers achieve an important business target: they are all "extremely eager" to differentiate themselves from their competitors. With this system, brands can offer customisation but then deliver the shoes in a few days, as today's consumers demand, rather than expect them to wait for weeks while the product travels across the oceans of the world. Political tensions, not least the trade dispute between China and the US, are also playing a part.

Innovation for uppers

"Automation is the key thing though," Mr van Dyck continues, "and with this bonding technology you can fully automate. And it's interesting because what all these companies have told us is that they were no longer worried about soling and that the upper is where innovation is needed because the upper is where all the labour still goes in. The market is changing. We have already seen that with knitted uppers, which are great for automation. Well, this technology will be, too, including for shoes with leather uppers. This will bring new opportunities for the whole industry and PU is the big card we want to play."

He has no concerns about what this new way of using two-dimensional components might mean for the momentum behind 3D printing in footwear. "I think 3D printing will continue to make progress," he insists, "as it has done in projects such as the FitStation idea involving DESMA and HP. You can have 2D and 3D; you can combine them. That opens up another new window of opportunity."



Manufacturers can construct footwear products with whatever functionality they need using the new system. If they include properties such as waterproofing in the components, those properties will be in the finished shoe. CREDIT: AMF