

'Greener' PUCFs

Leather is becoming ever more expensive, driven for the most part by increasing demand from the world's automotive industry where leather upholstery has become a 'must have' feature for an increasing number of new car owners. Although it also continues to be the preferred material for shoe uppers, it has become too expensive for many consumers who cannot afford to pay the price of a pair of leather shoes. As a result, more and more shoes are being made using synthetic upper materials, particularly PU-coated fabrics (PUCFs) where China is by far the largest producer.

Figures suggest that some seven billion pairs per year are now being made using this type of material, at least one billion of which are sports shoes of one sort or another. While PUCF uppers might not be as comfortable to wear as those made from leather, they are not harmful to the wearer. They are, however, considered to be so to people employed in the manufacture of the material itself and to the environment in general. Why is this?

PUCF

PUCFs are made by applying a very thin PU surface layer to either a woven or non-woven substrate with the latter providing a superior feel in the finished material. By carefully controlling the properties of the fibres used, a substrate can be made to bond precisely with its coating. They are made either by dry transfer coating using an embossed casting paper to impart the grain finish or, for better quality products, by wet coagulation which results in a smoother feel and better breathability.

In the coagulation process, the substrate is immersed in a solution of 25% PU and 75% DMF (dimethylformamide) that permeates and coats it. The substrate passes through further successively weaker immersions to a final one consisting purely of water. Coagulation occurs as the DMF leaches out

of the PU into the successive baths. It is this DMF that is potentially harmful to workers and, although this has long been recognised, developing an effective solvent-free system that was also cost effective has not proved easy.

A new production process called Insqin from Bayer MaterialScience may finally offer makers of PUCFs and their customers a chance to make their processes and supply chains solvent-free. The new range is said to offer an integrated package of pure waterborne PU technology, material co-development and certified manufacturer/partner programmes for PUCFs. The company is clearly confident in the impact its new process will have as it claims that it will help companies produce a new generation of PUCFs that will revolutionise the market. Bayer has a proven track record as a serious player in developing new PU polymers and one would not expect them to make such statements lightly.

SUSTAINABILITY AND COST

Nicholas Smith, global head of textile coating at the company, says that Insqin offers a practical solution that addresses the ongoing battle between sustainability and scalability. All kinds of coated fabric can be produced in an innovative and sustainable way that is entirely free of solvents. What Bayer seems to have managed to do is to replace all solvents with water in both the polymer resin used as the raw material for coating and, more importantly the company says, in the actual production process in which additional process solvent is often required. In other words, Insqin enables the production of PUCFs without the use of solvents, thereby eliminating the risk to workers' health and of environmental contamination.

He says that at present it is difficult to say how much Insqin might add to production costs for fabric manufacturers who choose to make the change. "There is an



enormous range in production costs for PUCFs made with solvent-based processes, depending on the application concerned and requirements for effect, feel and performance. However, what can be said is that there are a number of factors that will play together to bring production costs down over time."

Economies of scale are important in determining production costs and, as the demand for these materials increases, he insists that production costs will inevitably come down. He is also confident that the demand is there as PUCFs have become indispensable to the footwear industry. A second factor to be considered is what he refers to as 'the economy of experience' whereby as producers become increasingly experienced in making the new materials, so their costs will reduce. "Finally, we expect the resource costs to play an ever increasing role in overall material production costs," he says. "As the cost of energy and water rises sharply in China, the lower energy and water consumption of the new processes will start to bring their own economic contribution."

COLLECTIVE COMMITMENTS

While Bayer would appear to have a good system here, selling it to producers may prove tough going as PU coating is very much a price driven process. The company says it has foreseen this and has in place arguments designed to convince

companies to invest in Insqin. "Leading companies in the footwear industry have made collective commitments to improve the sustainability of their supply chains," says Mr Smith. "Insqin, by addressing not one but multiple sustainability impacts, is a response to a clear need from the market."

He does however acknowledge that, since the industry is so big and fragmented, it is important for large numbers of industry players to make a commitment to sustainability and to back that commitment with investment. Only if they invest in the necessary innovation can economies of scale and experience be reached; prices will then come down. "One or two companies alone will not bring about real improvement but, if the industry acts together, a major step-change will have been realised."

User organisations can either sign up for the complete integrated package or buy the technology and use it themselves; they will be free to avail themselves of as much or as little support as they need from Bayer. "PU-coated fabric manufacturers and their customers, the brand owners, tell us they benefit a lot from working with us," Mr Smith insists.

Bayer MaterialScience does indeed have considerable experience in developing waterborne polyurethanes and their formulation and application in making PU-coated materials. It says this has proved to be of great value to its business partners over the years as it encourages the development of better

materials, more suited to product needs, more quickly. A particular plus lies in the fact that it runs pilot coating lines at its own facilities, which allow it to show manufacturers how to scale the production of the materials to meet commercial demands.

BETTER OFF WITHOUT SOLVENTS

Returning to the sustainability question, he says the standard process for making PUCFs for shoes, clothes and accessories has, throughout its history, carried a risk of solvent emission (as described earlier) that sometimes involved worker exposure. In theory, at least, he believes manufacturers ought to have been able to contain the risk, but concedes that in practice it seems to have been difficult to achieve. One suspects that added cost would have had something to do with it.

Having said that, he believes things are now changing and that current thinking in the industry favours ceasing the use of substances of potential concern. Unfortunately, the use of any solvents, even if the process is carefully controlled, requires high volumes of water and energy for rinsing. Insqin therefore represents a game-changer for the manufacture of this type of material. He is doubtless right but, at the same time, such a fundamental change is a big undertaking for PUCF producers and one that will also need a major commitment from retail brands. 🌱



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