HAPTIC COATING – A NEW SELECTIVE ADDITIVE 3D COATING TECHNOLOGY

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Abstract

A new selective additive 3D coating technology was developed and implemented in mass production. Besides attractive visual design opportunities, a strong focus is put on the touch experience of final products. Haptic perceptions can be controlled by application of selective multi-layer 3D textures, by the shape and thickness of these 3D textures, and by the coating formulation itself. The coating formulation can be fine-tuned to achieve soft-touch nubuck-like effects, as well as smooth, slippery, sticky effects or rough sandpaper like effects. In combination with attractive colors such as metallics, color shifting or thermochromic colors and finishes with controlled matte or glossy surfaces, a huge freedom of design is allowed.

Today, haptic coatings are applied on textile substrates for the sporting goods industry. The haptic coatings are very robust and only use safe and environmentally friendly chemistry. They fulfill all mechanical requirements for application on sneakers and sports apparel. In addition, full compliance to the strictest restricted substances list (RSL) and manufacturing restricted substances list (MRSL) can be achieved.

With the selective additive coating approach, highest material efficiency can be achieved. This revolutionary approach to sneaker manufacturing improves the sustainability and the environmental footprint of the supply chain for sports footwear and garments. There is no more cutting waste and material is only applied where it is needed. Huafeng as a T2 supplier moved into a new business model of component manufacturing with haptic coatings. Component manufacturing allows a lean manufacturing chain, full accountability on quality and more flexibility in the supply chain.

Introduction

The traditional manufacturing of athletic footwear is a multi-step labor intensive process. The upper materials of a sneaker are usually composed out of many different materials. The purchase of all these separate materials from different suppliers has to be coordinated carefully to meet delivery deadlines and quality expectations. In many cases minimum quantity orders, logistics, and shipment issues complicate the situation. For a TIER-1 shoe factory, this can be a troublesome and hard to control process. In addition, the various materials have to be attached to each other. Traditionally, this is done by stitching operations, and in some cases by hot melt lamination processes. In any case, this creates a lot of manual labor and cost. Most materials

are delivered as rolls and need to be cut to size before attachment. This creates cutting loss and cutting waste that is difficult to recycle. Haptic, the new selective additive 3D coating technology addresses all these above mentioned disadvantages of traditional footwear manufacturing and offers solutions for better design, more sustainability and less labor cost.[1] Haptic was introduced to the market in early 2015 and since then has shown rapid growth and success.

Haptic Technology and Advantages

Chemistry and Application Technology

Haptic is usually applied on textile substrates based on synthetic fibers. For athletic footwear, polyester or polyester/nylon sandwich mesh is usually the best substrate material. Haptic chemistry is based on high-solid water based polyurethane dispersions (PUDs).[2] Curing at room temperature is achieved by mixing isocyanate hardeners into the formulation shortly before application with a pot life of 2 - 4 h. The basic idea of haptic coatings is to apply a very thick 3D coating in specific areas of the substrate while other areas stay uncoated and provide full textile functionality such as breathability and flexibility. High coating thickness can be achieved by high-solid formulations (up to 75 % solids), high viscosity thixotropic base coats, and a multi-layer application similar to digital 3D printing technologies that have created huge attention in the market recently. However, haptic today is not applied by digital means but by screen printing technology. Both manual and automatic screen printing can be used. Special automatic screen printing machines were developed to ensure high precision printing in a multi-layer approach. Figure 1 shows a typical multi-layer haptic coating consisting of two main coating formulations, i.e., a base coat that provides most of the coating thickness and a top coat that provides color, gloss, and touch perception.

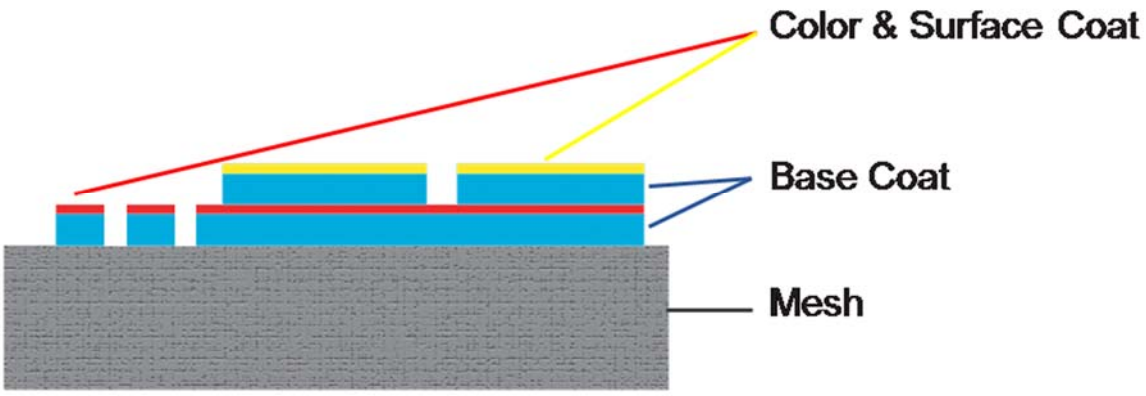

Figure 1. Schematic cross-section of a Haptic coating system on sandwich mesh.

The top coat/surface coat will not only provide color and gloss but can also be modified for various touch perceptions. Depending on the coating formulation, soft touch, micro texture, rough texture and sandpaper effects can be achieved. By adding more layers of base coat on

top of the first color coat, a second level of height can be achieved. Overall design can create uncoated areas and hole-like structures in the basecoat and topcoat, allowing the observers to see through down to the substrate or down to the first color coat. In that way, multi-level and multi color designs can be achieved , something never seen before on a sneaker.

Athletic footwear has many harsh requirements on quality. Shoes face an intensive wear process, and coating and mesh need to be prepared to perform. Haptic coatings are robust due to chemical crosslinking and high coating thickness. In addition, the coatings adhere very well to the synthetic fibers not only because of chemical compatibility but also because of physical penetration into the knitted structures of the fabrics. Haptic coatings can even fill up small holes in the sandwich mesh to fully cover the substrate without telegraphic effects and providing smooth surfaces. Figure 2 shows a microscopic picture of a cross-section.

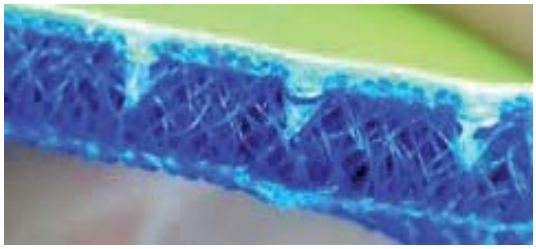

Figure 2. Microscopic cross-section of a haptic coating.

It can be seen that the base coat layer penetrates deep into the fabric materials and physically hooks up to the fiber structure resulting in an exceptional strong bonding and durable products.

Manufacturing Advantages of Haptic 3D Coatings

Along with the highly durable quality of haptic coatings, it offers many advantages during the design and manufacturing process, and allows lean and efficient supply chains. With Haptic technology, Huafeng as a typical TIER-2 textile supplier could first time move into a component supply business model. Instead of rolls of textile material now ready-to-assemble, upper components are supplied to TIER-1 shoe factories. This business model creates advantages as now Huafeng takes full accountability of quality and delivery, and relaxes the TIER-1 logistics challenge sourcing various materials from various suppliers. For the sports brand, it also becomes easy to manage the supply chains as less TIER-2 suppliers are involved. Most importantly, lead time can be significantly shortened and clear responsibilities on quality are defined (Figure 3).

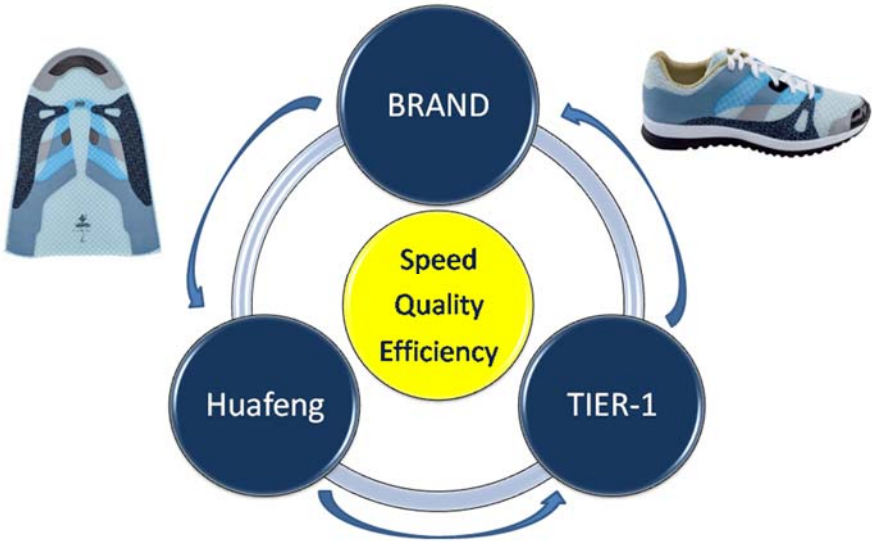

Figure 3. Manufacturing advantages of haptic footwear uppers.

Screen printing technology can be automated quite easily compared to stitching operations. By applying haptic coatings for upper design, there is no need for joining other materials on top of the base mesh by sewing operation. This results in very efficient and less labor intensive production of footwear uppers.

Sustainability Considerations

Sustainability today is a must have for all new developments in the sporting goods industry. Right from the beginning, haptic coatings were developed with a clear goal of offering the best sustainability beside of hard fact manufacturing and cost advantages. Two main features lead to high sustainability: haptic is an additive manufacturing technology, and haptic is fully water based.

The additive manufacturing approach allows building up coating thickness step-by-step. During that process, the coating material is selectively added at the location where it is needed. There is no cutting waste to be disposed and coating material loss is very low. Material loss basically only appears when colors are changed and screens are cleaned. Therefore, highest material efficiencies can be achieved.

The fully waterborne chemistry guarantees safe and healthy work places and is in full compliance with the goals of ZDHC, an industrywide campaign to face out toxic chemicals within the textile supply chains.[3] Workers enjoy clean and fresh air without inhaling solvents. This is especially important when operating in less developed countries where extraction systems are often not up to requirements. Importantly, there is no fire hazard in the factory and workers do their job in a safe environment.

Conclusions

Haptic coatings offer a great new opportunity to athletic footwear manufacturing. High efficiency at low cos, sustainable chemistry and application process leads to multiple benefits within the supply chain. In addition the selective additive 3D coating approach allows creative spectacular designs not seen before in the footwear industry.

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