

Evolving possibilities for leather

The properties of leather are well known to footwear manufacturers. Leather has stood the demands of functionality and fashion since pre-recorded history and still remains a major element in the footwear sector. The two industries share a joint evolution, as leather was well-suited for footwear and footwear was the major outlet for the leather. Developments within the shoe industry largely accommodated the strengths and limits of leather and its needs remained a central concern as the leather industry developed technically.

However, many products are now available for the vast range of footwear being manufactured, while at the same time, the array of outlets for leather has also increased. The two industries have adjusted respectively to the needs of new materials and the demands of new and exacting consumer uses. Both have advanced technically in a changing world and, unless subject to major global change, will continue to evolve.

So what opportunities or problems are there for the footwear sector due to advances in the leather industry?

Chrome-free technology

Chrome tanned solid waste and residual chromium compounds in tannery effluents can be addressed, but treatment and disposal is expensive, and costs continue to rise.

The tanning agent used (*trivalent chromium*) does not constitute a problem in itself, but another chromium containing chemical (*hexavalent chromium*) is a known carcinogen. Although these are different chemicals, there is confusion and this has proved difficult in terms of limits to effluent discharge and legislation regarding disposal.

There are various techniques that can be used instead of chrome tannage, but these provide leathers with different properties. The major route is to lightly tan the hide or skin with an aldehyde, split and shave to substance and then incorporate a different tanning agent in an extended retanning/dyeing stage. This process is generally based on a synthetic tannage but includes vegetable tanning agents, softening agents and dyestuffs.

These leathers suit other end-uses but development for the footwear sector has not evolved. This is because the major barrier to progress is that these leathers cannot withstand a temperature of 100°C when saturated with water. Nevertheless, they are perfectly capable of withstanding very high temperatures at 'normal' moisture contents and wet leathers can be set at temperatures considerably less than 100°C.

From the perspective of the footwear-orientated tanner, the almost sacrosanct requirement for leather is the ability to withstand 'the boiling test'. Failure to meet this standard therefore blocks any advance. Fundamental research, however, shows that non-leathers can deform and maintain set at much



High specification chrome-free leathers meeting the needs of the automotive sector. Courtesy of VW.

lower temperatures than 100°C. As a result, two questions are raised.

1. Are these performance standards, originating from the footwear sector and adopted by footwear tanners as the unquestioned prime requirement, unnecessarily high?
2. Is it beyond the footwear sector to make shoes from damp leather at say 70°C, or alternatively use temperatures of more than 100°C coupled with low moisture content?

If the answer to both questions is 'yes', then the losses to both sectors over decades have been enormous. It is likely that controls within shoemaking processes are central to any advance and, if so, this is a small demand compared with the new opportunities that await development.

Physical properties based on engineering requirements

Originally there were only small differences between furniture and automotive leathers. Traditionally, these were both vegetable tanned, lightly finished and durable. As the demand for middle- to lower-end automobile leather increased, the leather industry responded by using chrome-tanned leathers. This was because large hides were available as US wet blue stock, chrome tannage was the preferred tannage and the specific needs of the automotive sector technology could be developed and supported by the chemical sector.

Cost factors meant that area yields were all important. However, these gains were at the expense of characteristics such as fine grain, uniform break, and traditional handle characteristics. Add heavy finishes, coupled with embossing to provide durability and uniformity, and the result was a product that met the needs of another sector. ➤

WORLD FOOTWEAR

Engineering specifications prevail throughout the automotive sector, so these were applied to leather. The product had to match the performance of competing materials used in seats, panels, and components.

Leathers became accepted on the basis of a life expectancy equal to that of the vehicle. They had to blend cleanly with synthetic materials in the multi-fabric requirements for car seat construction and interior fittings, and needed colour matching to the highest standards. While these leathers could never suit the footwear sector in aesthetic terms, they had attained the highest levels of physical performance. Pressure had been applied and standards that had once been considered unobtainable were achieved.

Disposal at the end of a useful life

Leather is over-engineered. Bury an old shoe at the end of its life and chrome leather will still be there in 100 years time. This is very different from the concept of product components failing at more or less the same time and where the longevity of a single component can be viewed as a form of waste. So is this property really needed?

The concept of recycling automobiles at the end of their useful life throws light on this matter. Major car components are now specified with the intent of future disassembly, free from contamination and fit for recycling. However, there is still some waste and upholstery fabrics fall into this category, with incineration being the easiest means of disposal. And, chrome leather can only be combusted under controlled conditions which creates limitations for easy waste management. Another favoured option for waste is composting, but these chrome leathers do not decompose.

Many chrome-free leathers used by the automotive sector can withstand extreme wear and abuse but can be incinerated or composted. Alternative routes could be methane generation and energy recovery as this is a well-established technology. As legislation increasingly restricts the composition of waste for landfill or incineration, the pressure for disassembly will increase. In this event, there will be a higher value in leathers that are fully functional but able to decompose or serve as an energy source.

In addition, as major brands grow and become more powerful, environmental respect, in terms of full re-use/recycling, can become a major marketing tool. If there is an incentive or pressure to meet change, then technical developments in both sectors should lead to fresh opportunities.

Colour measurement and control

There have been advances in colorimetry and management. This means that colour can be accurately measured and colour formulations generated in a few moments. This information can be sent almost anywhere in the world where, using appropriate dispensing equipment, precise pigment blends can be generated.

Chemical providers can thus supply the leather sector with precision colour that remains uniform batch after batch. Moreover, the need to send colour samples can be avoided, the



If footwear leathers were chrome free and less stable, composting or bio-gas generation with suitable household/industrial waste can provide another option to incineration.

colours can be matched under any light source and also address specific finish requirements such as lightfastness or elements of cost.

This technology generally applies to pigmented finishes. However, there have been advances within leather dyeing technology that can lead to greater uniformity. Developments in dyestuff manufacture play an important role and integrated colour measurement and matching services by chemical suppliers offer considerable support to tanners.

There are colour restrictions that can be caused by the inherent colour arising from various tanning agents, but a wide range of colour is available, which can be highly reproducible.

Machine innovation and management of manufacture

Leather-making techniques and machinery have evolved. Although there are many high-skill bespoke-type leather-makers, the shift has been towards larger units and these have invested heavily in high quality plant and machinery. Most of these machines incorporate computer controls so operator input has diminished. This ensures that machine functions should be performed both professionally and with considerable uniformity. The same applies to chemical processing.

In addition to this, considerable development work for new textures and effects is taking place within the chemical sector. This means that processes are tailor-made to specific tannery needs. The tanner's role has shifted from leather development and correction of process towards that of a chemical engineer. This means greater consistency.

Resource and information management

As with all other industries, there is massive scope to better manage existing resources, control events and for better liaison within the full manufacturing chain. At the same time there have been considerable environmental problems for responsible tanners to overcome. Substantial advances have been made and this information has been rapidly disseminated throughout the industry at almost no cost. These events have enabled a better understanding of the leather-making sequence that can lead to a tightly targeted product and a more consistent outcome.

Advantage for the footwear sector

A number of issues pertinent to the footwear sector have been raised and if taken into account should serve a useful purpose.

The technology of leather manufacture is complex, but is now better understood at all levels. Superb plant, equipment and control systems are available, so that a high level of consistency in terms of technical performance should be expected.

The leather industry is capable of change. Supply to other sectors has provided results that are equal or superior to alternative materials. As a result of pressure, the performance and consistency of these products has continued to improve.

The need—or perceived need—to withstand extreme conditions has smothered the advance and development of leather technology. If footwear manufacturers can

accommodate changes within construction techniques, then this will call for more precise management and better control. There is a bonus in the form of genuinely different leathers, with many new properties.

What is also clear is that almost all the problems discussed centre around chrome tanned leathers. In the past, vegetable and, to a lesser extent, semi-chrome tanned leathers were extensively used. In the latter's case, up until only some thirty years ago. They were, on the whole, far easier to process in the shoe factory and would develop good setting properties at much lower temperatures. Indeed, they had to, as the concept of 'heat setting' was not around.

They were also far more amenable to recycling in the form of leatherboard and glue type products. The downside, however, was that they would not hold their shape in wear very well and would tend to mould to the foot, hence the expression to 'break-in' a new pair of shoes. The modern consumer no longer expects to have to do this and, rather than change tannages, the industry has opted for softer constructions based on sports shoes.

As in so many other industries, some radical rethinking may be needed to meet all the new challenges. Despite the emergence of new outlets for leather, the world's tanners are still highly dependent on the world's shoemakers. It is therefore in their common interest to seek the solutions together. 



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