

Choosing the correct base coat resin

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Before developing a new finished leather, the tanner needs a great deal of information about the characteristics of the finished product if the leather is to match requirements completely and profitably.

Getting it right first time is always a worthwhile challenge as this leads to speedy and timely delivery and the opportunity to put a new product onto the market ahead of the competition. To achieve this, the tanner needs to know how best the finished product will match customer needs, primarily through selecting the most competitively priced raw material.

Having decided this, there still remain many process choices from beamhouse through to finishing. Usually there are many reference points from which existing processes may be adopted and this is the safest and easiest way to begin.

Meeting the specification

When the crust leather has been developed, the finisher needs to be aware of the more detailed specification for the finished leather. This may be very simple, or it may be quite complex. For example:

A WHITE FULL GRAIN SHOE UPPER LEATHER

Initially, this appears to be a simple requirement. A base coat can be formulated using white pigment mixed with a proportion of high UV resistant resins and auxiliaries, and applied in sufficient quantity to cover and fill the surface. This may be followed by the application of a suitable top coat and the resulting leather sent to the customer.

However, the customer may require a white leather that can be made into an article exhibiting properties that are superior to those of competitors. This could influence many things. For example:

1. When the final article is a white sports shoe, then the nature of its soling material and its colour could have an influence on the choice of finishing products used.
2. The design of the shoe may require the white leather to be stitched together with other components and these could include textile, synthetic materials and other finished leathers, possibly of different colours.
3. The shoe may need to be machine washable.
4. It may be for use at sub-zero temperatures.

Unless the finisher has all of this information, the resulting piece of leather may be aesthetically attractive but it may fail to meet one or more of the criteria that are required.

SUPER-SOFT SHEEPSKIN GARMENT LEATHER

The requirement infers that it is for a leather with a natural finished appearance. An appropriate sample of leather may be produced by the finisher, but when the design of the garment includes a combination of fabric and/or suede, this simple request becomes potentially more complex.

This requires a more sophisticated approach to formulating a finish that will include properties such as dry clean resistance, colour migration resistance and non-bleeding of dyestuffs when the leather becomes wet.

These two examples illustrate that comprehensive information must be made available for the finisher to understand the complete scope of the project prior to the first leather samples being produced.

Only when all of the relevant information is available can the finisher sensibly begin to make a practical and effective ►

Panel I

Compacted products

Compacted products are usually pre-formulated by the supplier to achieve pre-determined performance characteristics. This usually means that no additional blending is necessary because the product is supplied ready for application to the leather.

Hybrid resins

A "Hybrid" resin may be described as being a resin in which the acrylic phase is dispersed within the polyurethane particles during manufacture (not blended). In this case the physical properties are determined by the continuous polyurethane phase. Harder internal acrylic phases have little effect on film formation and not only can low temperature properties be independent of the internal phase, the VOC is reduced to almost zero and the dry film behaves like a polyurethane.

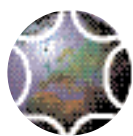


Figure 1: Typical properties required for modern finished leathers

Properties required	Garment	Shoe Upper	Leather goods	Upholstery	Automotive
Wet and dry flex resistance	●	●	●	●	●
Wet and dry adhesion resistance	●	●	●	●	●
UV resistance	▲	▲	▲	●	●
Wet and dry rub fastness	●	●	●	●	●
Inter-coat adhesion	●	●	●	●	●
Abrasion resistance	▲	▲	●	●	●
Low temperature resistance	▲	▲	▲	●	●
Coverage of defects	●	●	●	●	●
Natural appearance	●	▲	▲	▲	▲
Good emboss retention	▲	▲	●	●	●
Good solvent/dry clean resistance	▲	▲	▲	▲	●
Good filling properties	▲	●	●	●	●
Water spot resistance	▲	▲	●	▲	▲
● = normal requirements ▲ = often required					

formulation to meet the demands of the product manufacturer and that expected by the customer. Only then is there a chance of being right first time!

Establish the building blocks

One of the basic building blocks of any leather finish is the range of resins that may be formulated into the base, intermediate and top coat systems. The choice is wide and includes polyurethanes, acrylics, butadienes, hybrids and compacted products.

The simplest starting point is to try to use a single resin—for which there are advantages and disadvantages—in the finish formulation. In this event, the formulation will be simple. However, in practice the final recipe will very likely contain a blend of resins of different types. Each will have individual performance characteristics to build a wider variety of performance characteristics.

On nearly every occasion there is a good case for blending a combination of two or more types of resin. This is dependent upon the classification and nature of the crust material to be finished and the final requirement. For example, is the leather full or corrected grain, a split, chrome tanned, wet white, vegetable tanned or retanned? Is it to be used for furniture, automotive, shoes, leathergoods or garments? All of these factors will have an influence upon the final choice.

Preparation of the finish formula

Preparing a formulation that fulfils the set of customer requirements is not difficult provided that the finisher has experience of the products to be used and that comprehensive technical data is available from the product supplier. Even then, some guidelines are often useful.

PHYSICAL PROPERTIES OF FINISHED LEATHERS

The most common physical properties expected of finished leathers are given in *Figure 1*, although each individual type of leather may only require selected properties.

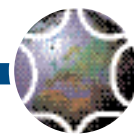
PROPERTIES OF POLYMERS

To match these performance requirements, the different properties in terms of the strengths and weaknesses of each individual type of resin should be considered. A useful general guide to these properties is provided in *Figure 2*.

Among the acrylic and polyurethane resins there are products that achieve very specific properties such as a high level of solvent resistance, excellent embossing, good wet flex and high UV resistant properties. Very specific products are available that have one or more of these characteristics and these may be useful when blended into a system. Nevertheless, care needs to be taken when developing formulations as most resins also have weaknesses. These require an understanding and need to be taken into account together with the compatibility with other

Figure 2: Typical properties of polymers used for leather finishing

Properties required	Acrylic	Polyurethane	Butadiene	Hybrid	Compact
Wet flex resistance	✗◆	✓	✗	✓	✓
Dry flex resistance	✓	✓	✓	✓	✓
Wet adhesion resistance	✗	✓	✗	✓	✓
Dry adhesion resistance	✓	✓	✗	✓	✓
UV resistance	✓	✓◆	✗	✓	✓◆
Wet rub fastness	✓	✗	✗	✗	✓
Dry rub fastness	✓	✓	✗	✓	✓
Inter-coat adhesion	✓	✓	✗	✓	✓
Abrasion resistance	✗	✓	✓	✓	◆
Cold temperature resistance	✗	✓	✓	✓	✓◆
Coverage of defects	✗	✓	✓	✓	✓
Pigment binding properties	✓	✓	✗	✓	✓
Natural appearance	✓	✗	✗	✗	◆
Emboss retention	✗◆	✓	✓	✓	✓
Plating properties	✗	✗	✓	✓	✓
Solvent resistance	✗◆	✗◆	✓	✓	✗
Filling properties	✗	✓	✓	✗	✓
Water spot resistance	✓	✗	✗	✗	✗
✓ = generally good ✗ = weak ◆ = Selected products available within the range					



products used in the formulation before the final choice is made.

It should be noted that compact resins are tailor-made to obtain particular properties and for this reason their overall performance is included in *Figure 2* to show the wider scope of possibilities.

A GUIDE TO CROSS-LINKERS

When a cross-linking product is added to an individual resin, its characteristics are likely to change and in most cases performance will improve. Care has to be taken over the choice of resin and the proportion of cross-linker that is added because serious disadvantages can occur when too high a proportion is used. For example, the resin film may become hard and brittle resulting in a loss of flexibility. However, when used as recommended—normally up to 5% solid matter based on the weight of the resin—optimal results can be obtained. The different types of cross-linking mechanisms that are available and a guide to suitability for different applications are given in *Figure 3*.

Again, there are strengths and weaknesses in the various products under consideration. Aziridine, for example, is highly versatile and very efficient, but it is also highly toxic and should

Figure 3: Guide to available cross-linkers

Type	Versatility	Efficiency	Toxicity	Curing temperature	Light fastness
Aziridine	High	Very good	High	Medium	No
Isocyanate	Medium/high	Good	Medium	High	Yes
Carbodiimide	Medium/high	Good	Low/medium	High	Yes
Metal oxide	Medium	Poor	Low/medium	Low	Yes
Epoxy	Limited	Good	Low	Too high	Yes
Melamine	Limited	Good	Low	Too high	Yes

be replaced with a suitable alternative of the isocyanate or carbodiimide type wherever possible.

Fundamentals for success

Most of the ever-increasing customer requirements for higher performance can be achieved through the suitable choice of resin for the finish base coat. Complete information of exactly what is required by the customer, coupled with a comprehensive knowledge of the behaviour and final performance of the products available, are both fundamental to success. When the tanner and the finisher have this information and knowledge to hand then the fulfilment of a “right first time” finishing system is possible! 📌