Modern leather manufacturing - part 4

In this, the final instalment of our four-part series on modern leather manufacturing, we focus on finishing techniques.

The process of leather finishing, is, generally speaking, applying a coating to the leather. This is done for many reasons including: to give a more uniform appearance and hide any surface imperfections, to colour or decorate the surface for fashion purposes, or to provide a durable ‘coat’ that increases resistance to water and enables easier cleaning and maintenance. A huge range of leather finishes and techniques are available to the tanner today.

Aniline leather is a natural or dyed leather, finished by the application of a transparent surface coating. This can be clear or coloured with dye, but not pigment, is usually full grain and is less widely available and more expensive than other leathers - the intention is to show the original grain of the leather and, usually, only the better quality selections that are free from flaws are acceptable.

Suede has a nap finish produced on leather (sheep, calf, pigskin or cow hide) by abrasive action on the flesh side (see also flesh splits, later).

Nubuck is cow hide leather which is buffed on the grain side to give a high quality, velvety surface. Like suede, the effect is obtained by abrading (buffing) the surface of the leather using specially designed buffing machines in the tannery.

Semi-aniline leather has been coated with a finish containing a small amount of pigment, so that the natural grain is clearly visible.

Pigmented finished leather has a grain surface finish containing fine pigment particles in a binder that has been applied.

Rub-off leathers are produced by finishing with a pigmented base, followed by a darker top-finish, which is then polished off in the factory to give interesting two-tone results, for example what you would see on a Chesterfield sofa.

Corrected grain leather is produced by buffing away the top of the grain surface and then building up a new surface using...
safety concerns using cross-linking agents, but with proper working practices employees may be safely protected.

Water-based finishes are now used worldwide and the use of solvents is reducing. Roller coating and computer-controlled spraying machines are also becoming increasingly popular. Airless sprays are used to produce films on leather and create less emission than the original spraying guns, which were atomised using compressed air. Many finishing chemical suppliers now supply base coating systems for leather that are designed to minimise grain faults and maximise cutting yield.

Tannery equipment

Hides and skins are a natural product with variable shapes and sizes and, while it is difficult to design through-feed systems, they are available - for example for fleshing machines. Computer systems are now linked to most leather making equipment, especially where fine machine adjustments are required, such as in splitting. Drum operations can also be controlled by computer. Conveyor systems are increasingly used to reduce handling and process recipes are generated by programmes which record all details during processing for inspection and adjustment of

various finishes. This is the most common type of leather and is widely used for leathergoods, luggage and furniture. Frequently, the resin finish is embossed with a ‘grain’ pattern.

Nappa is a soft, full grain leather made from hide grain split leather. Dry drumming or ‘milling’ machines are used to soften it.

The flesh split layer is predominately used to produce ‘easy care’, water-resistant suede and less expensive white or black leather. The flesh split may be as large as 20 to 25 square feet in area and there are five basic ways to finish it:

1 Conventional finishing – using standard chemicals and finishing processes.
2 Laminating – adhering polyurethane sheets to the splits.

The release paper process – this is when embossed paper is fed, from a roll, through grip rollers on a long machine and successive layers of topcoat finishing material are applied. This is followed by the application of a pigmented resin finish and an adhesive layer, as the paper travels through the machine. After each layer of finish or adhesive is applied, the paper passes through a drier. The leather split is placed on the adhesive layer and the paper, layers of finish and the leather are finally bound together using a heated steel roller. When the paper is removed from the paper, the embossed effect is visible on the top finish of the split. The roll of paper can be re-used many times and different embossed patterns on different paper can be used to give a variety of appearances. The finish produced by this process is usually very tough and the resulting split is often used for sports or ‘easy care’ footwear uppers and furniture.

3 A mould/finish process – this was the original ‘Baycast’ method, using silicone moulds and polyurethane to reproduce a grain pattern on splits.
4 Suede – abrading on the split surface.

Polyurethane and acrylic polymers are used to carry the pigments in modern finishing films and cross-linking can produce high resistance to scuffing and abrasion. Cross-linking is when highly reactive cross-linking chemical agents such as polyisocyanates, polyfunctional aziridine, carbodiimides or ureic dispersions are added to polymer resins. These agents cross-link the polymer molecular chains together in the film by side linkages, either two or three dimensionally, resulting in tougher, colourfast films. There are some health and safety concerns using cross-linking agents, but with proper working practices employees may be safely protected.

Preparing leather for testing in SATRA laboratories.
the process conditions such as temperature, pH level and chemical concentration. Automatic feeding of chemicals to drums is also possible.

Computers for checking and adjusting colour are increasingly used during tanning, dyeing and finishing, for example based on the CIELAB system. Electronic leather measurement and online thickness recording have been around for several years.

Environmental considerations
All over the world, tanneries are focusing on using the best available technologies (BATs) for eliminating, reducing, replacing and recycling waste streams. Examples of measures taken, or under consideration include:

- reduction of salt (NaCl) in waste water by physical removal of loose, dry salt from the hides before processing
- replacement of ammonium chloride with carbon dioxide for deliming
- recycling chromium waste streams
- replacement of solvent-based finishes with water-based finishing materials
- reduction in the use of salt as a preservative, by using chilled, fresh hides
- separation of solids from waste water using sludge filters
- reverse osmosis for extraction of chemicals from waste water
- re-use of pickle liquors
- better housekeeping to control dust and particulates
- reduction of heavy metals in the chemicals used
- control of biocides
- development of reed beds for effluent treatment
- replacement of organic solvents with water-based degreasing agents.

Water waste pollution from tanneries is measured by testing waste for pH, organic strength (chemical oxygen demand or COD), suspended and dissolved solids, biocides, oils and various chemicals. After collection from tanneries and treatment by local authority treatment plants, final disposal of solid waste is achieved by a combination of landfill, incineration, composting, or use as agricultural fertiliser. Purified water is recycled for domestic and industrial use. In tanning clusters in various parts of the world, Common Effluent Treatment Plants (CETPs) are being developed to collect and treat the effluent from many tanneries on new industrial or leather technology sites, away from populated areas. Air pollution from the tannery should also be regulated by carefully controlling process conditions. Spot checks for the presence of pollutants, such as ammonia and sulphur dioxide, can be carried out using devices such as Dräger-Tubes, an established method for measuring and detecting contaminants in the soil, water and air. More than 500 substances can be detected and measured using the Dräger-Tube system.

Laboratories
Increasingly tanneries are installing laboratories to control physical, chemical and colour fastness properties of leather to specifications frequently demanded by customers. It is also usual for laboratory staff to monitor and control the waste water and air streams as described above.

Leather grading
One feature of recent years has been the development of the SATRA five point grading system for leather based on the usability of the leather when measured against a standard pattern. Increasing numbers of tanners and their customers are receiving training in the system backed by well-known brands.

How can SATRA help?
Please email leather@satra.co.uk for further information on the testing of leather.