Perfect way to process Elastane (Lycra) blended fabrics

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ELASTANE (Spandex / Lycra) was invented by Du Pont scientist Joseph Shivers in 1959 after a decade of intensive research reacting a long chain polyglycol with a short chain diisocynate with atleast 85% of mass being segmented polyurethane. The polymer was converted into a fiber using a dry spinning technique. Elastane was produced on an industrial scale by the US Company Du Pont under the brand name 'Lycra' in 1962. In the US, Elastane is commonly referred to as Spandex.Elastane is chemically a polyurethane with elastomeric behavior which can be easily blended with man-made fibers like polyester, nylon and also with natural fibers like cotton, wool, silk and linen. The elastomeric behavior is due to the soft (amorphous / rubber like) and crystalline (rigid / hard) polymer strands inside the Elastane fiber. In their natural state, the amorphous segments have random molecular structure that intermingle with each other and make the fibers soft. The rigid segments bond with each other to give structure to the fiber. When the fiber is stretched the bonds between the rigid segments break and the amorphous segments straighten out, making them longer while increasing the strength of the fiber. When the stretch becomes maximum up to five times its original length, the rigid segments bond with each other again while the amorphous segments remain in their elongated state maintaining the strength of the fiber. Once he stretch is released the amorphous segments recoil and the fiber returns to its original relaxed state. This amazing elastomeric property, abrasion resistance, compatibility with other materials has propelled its growth in consumption over the past decades. These days Elastane blends are frequently used for women and men's inner-wear, outerwear and active wear

Elastane was invented to replace and overcome the shortcomings of rubber. Elastane turned out to be lighter, softer, smoother, stronger, long-lasting and more versatile than rubber. As the years went by newer applications using Elastane were continuously developed. Though there are many types of Elastane fibers, the two most commonly used types are: Two way Elastane that can be stretched one way (Length or Width wise) and Four way Elastane that can be stretched both ways (Length and Width wise).

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Unsaturated oils, grease, fatty acids and their derivatives will discolor and degrade Polyurethane based Elastane fibers. Heat and chemicals liberating chlorine or sulphuric acid will damage Polyurethane based Elastane fibers. Furthermore burnt gas fumes (NOx) and atmospheric pollutants, prolonged exposure to ultraviolet light decreases the initial whiteness of Polyurethane based Elastane fibers. Another drawback of with this fiber is that it cannot be dyed with disperse dyes. To deal with this problem, Poly Trimethylene Terephthalate (PTT) based Elastane fiber was developed. Since PTT belongs to the polyester family, it can be dyed with disperse dyes at 125° to 130° C. PTT based Elastane fiber has much better chlorine resistance as compared to its counterparts. This is an advantage as it can be used in stretch denims which are usually bleached with chlorine for its typical effects. Another type of chlorine resistant Elastane fiber based on crosslinked polyolefin was later developed with high temperature tolerance up to 220° C.

Polyurethane based Elastane fiber is still dominant in the market and dyers should be aware of the dyeing characteristics

Challenges in processing Elastane blended fabrics	**Solutions**
Residual Stress	Pre-relaxation
Creeping of Yarn	Pre-relaxation
Center line (edge line) marks	Pre-relaxation
Distortion of fabric structure	Pre-relaxation
Dimensional stability	Heat setting
Crack marks	Heat setting
Curling of fabric	Heat setting
Yellowing of greige fabric	Heat setting
Silicone spin finish removal	Heat setting & Processing
Crease marks	Processing
Uneven dyeing	Processing
Wash fastness	Processing

of this fiber. Although Polyurethane based Elastane fiber does not have specific dye accepting sites, it exhibits some degree of affinity to many class of dyes like disperse, direct, reactive, metal complex dyes. In general these dyes end up dyeing with poor wash / wet fastness

Elastane fibers contain a heavy load of silicon based spin finish. During pre-setting of Elastane containing fabric, these spin finishes are very difficult to remove completely, leading to appearance of dye spots later in the fabric. As silicone spin finish is prone to breakdown under alkaline conditions, it is advisable to adopt acidic pre-scour process using Leomine Wash DFB which exhibits excellent emulsifying properties along with Leomine Disperse WAD. Under acidic conditions, silicone spin finish is kept in a stable emulsion and can be removed more easily and quickly. There are a number of challenges that a processor faces handling Elastane blended fabrics. The major ones are listed below:

Dyeing of Polyester-Elastane blends :

Polyurethane based Elastane fibers behaves like a 'sponge' taking up dyes. Disperse dyes stained on the Elastane fiber might not be completely removed by a single alkaline Reduction Clearing (RC) process. In most cases two RC's are required. An effective method of Reduction Clearing in acidic medium can be accomplished using Leomine Clear RCE

Polyurethane based Elastane fiber need to be dyed at 125° C to preserve the elasticity of the fiber. However, not all disperse dyes can achieve maximum buildup at this temperature and may leave unfixed dyes on the dyed material leading to poor wash fastness. Some dyers dye at 130° C to get a compromise amongst fiber quality, choice of dyes and fastness. The use of an effective dispersing agent like Leomine Disperse XPD / XPL helps reduce dye staining on Elastane fiber by preventing dye particle agglomeration. Leveling agent should be carefully selected. Any levelling agent containing a carrier or with strong fiber-active action (eg. APEO) will lower the wet fastness. They will also damage the Elastane fiber. Use of dyebath active levelling agents like Leomine Level PEX or Leomine Level PES is recommended.

Since fabrics made of polyester-elastane blends are more prone to crease formation, the use of a good anti-crease like Leomine Anticrease Jet N is necessary.

Dyeing of Cotton-Elastane blends:

Polyurethane based Elastane fiber is less stable under alkaline conditions, so measures should be taken to avoid alkaline hydrolysis of the fiber. When dyeing with reactive dyes, Soda ash should be used instead of Sodium Hydroxide

Agglomeration of reactive dye particles will stain Elastane fiber making removal of unfixed dye more difficult. The use of protective colloid like Leomine Disperse WAD will help in avoiding build up and agglomeration of dye molecules

During soaping Polyurethane based Elastane will be damaged if the pH of the soaping bath goes too high. Under hard water conditions, depending upon the hardness the bath pH will raise to 8.5 and beyond due to the decomposition of bicarbonates to carbonates. This can be stabilized by addition of Leomine Buffer DPT in the soaping bath

A good anti-creasing agent like Leomine Anticrease Jet N is a must addition in the dyebath

Formaldehyde free cationic fixing agent like Leomine Fast Fix FFF is used to enhance washing and wet contact fastness

Elastane fibers are very versatile and functional but need to be handled with care to bring out its best effects in Textiles. Leomine Organics Pvt Ltd. with its knowledge in chemistry helps the industry in handling Elastane and putting it to use in the most effective way thereby reaping its unique benefits ■