

Heat setting polyamides with shape retention

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Heat-setting is a heat treatment by which shape retention, crease resistance, resilience and elasticity are imparted to the fibres. It also brings change in strength, stretch ability, softness, dye-ability and sometimes on the colour of the material.

All these changes are connected with the structural and chemical modifications occurring in the fibre. Heat setting is the process applicable to fabrics made from synthetic fibres like nylon and polyester in which the fabric is subjected to the action of high temperature for a short time to make it dimensionally stable. It is a process conducted so that the garments made from such fabrics retain their shape when washed and ironed.

The main objective of the heat setting process is to ensure that fabrics do not alter

their dimensions during use. This process is for the stabilisation of synthetic fibres so they do not shrink when subject to heat.

Heat setting operation is crucial for fabrics made up of synthetic fibres since it grants excellent dimensional stabilisation and crease-proof properties, maintained till the fabric is exposed to temperatures exceeding the heat setting one. The setting temperature used is above T_g .

In heat setting, inter-chain bonds, such as hydrogen and dipole bonds, break. This allows the molecular chains to move and adopt new, stress-free positions. New intermolecular bonds then form with the fabric in a relaxed condition at the setting temperature. After cooling, the polymer molecules in the filaments become frozen in place. The new bonds are then stable

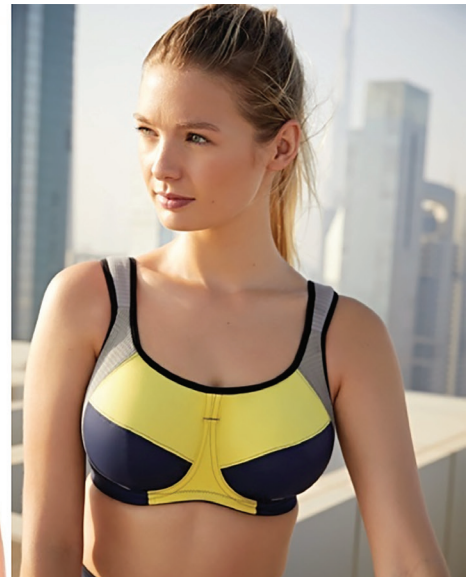
up to the heat setting temperature.

White or light-coloured textiles made from nylon or elastic fibers, as well as related combination fabric, becomes yellow easily.

Yellowing may happen at every stage, such as during the dyeing and finishing process, storing or hanging in the showcase, or even at home. There are many factors that can cause yellowing - the material itself may be susceptible to yellowing, or the chemicals used on the fabric (residual oil or softener) may become yellow easily, too.


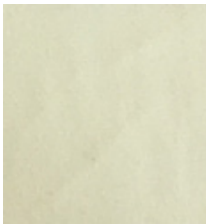
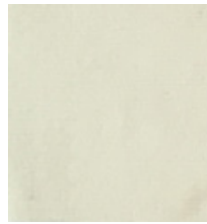
Reasons for Fabric Yellowing:

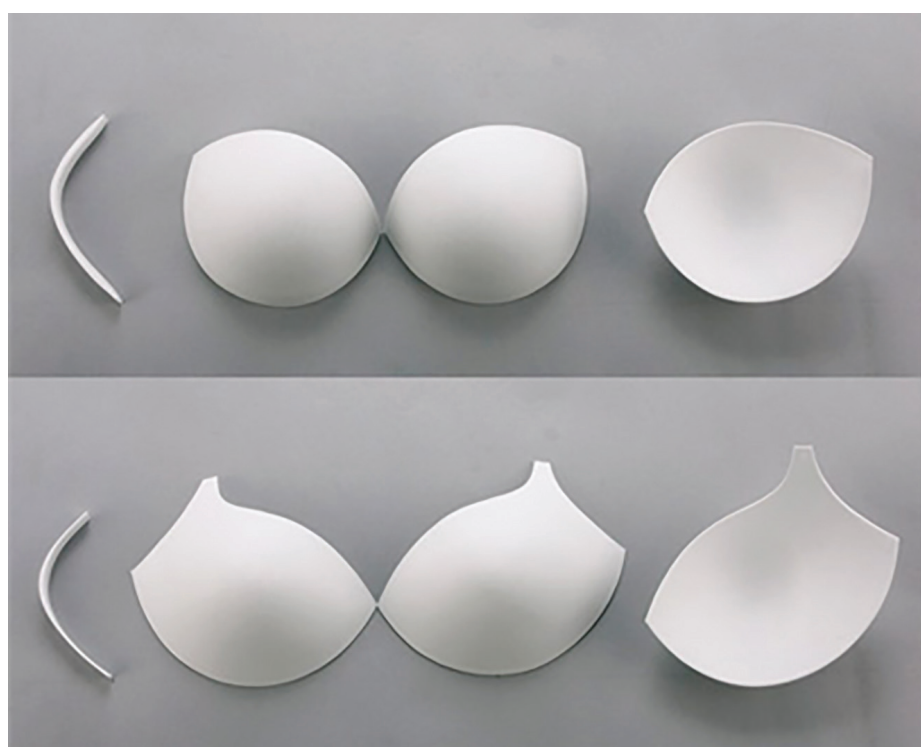
- Impurities such as spinning lubricants / oils and emulsifiers in Greige fabric.
- Heat-setting of wet fabric.
- Direct heated stenters produce NOx fumes through the oxidation of nitrogen. These



Heat setting polyamides enables shape retention for specific apparel applications, including sportswear

Technical brief: heat setting

	Unfinished		Finished with 5-10gpl Sarascour-RG(Conc)
	As is fabric	Passed through stenter at 180°C	Passed through stenter at 180°C
Samples			
Whiteness Index (W.I)	79	27	56
Yellowness Index (W.I)	2.18	17	9.87



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fumes are attacking the oils and the fibres during the setting operation, thereby causing yellowing.

- Moulding of fabrics, like in a women's sports bra.

Moulding

Polyamide and elastane blends are very susceptible to yellowing during moulding. Early attempts to produce moulded bra cups typically involved the moulding of nylon fabric. However, with nylon it is difficult to override the partial heat set which is applied when the fabric is produced.

As a result, when nylon fabrics are moulded and heat set, it is necessary to approach the

melting point of the nylon in order to override the partial heat set. This results in high levels of yellowing and it can also cause the fabric to become brittle.

This has made nylon commercially undesirable for moulding bra cups. Mouldable fabric must have enough fabric stretch in the wale and course (warp and weft) directions in order to prevent the non-elastic fibres from cutting and rupturing the spandex fibres, as the fabric is stretched during moulding.

Solutions

In response to nylon's weak defence against heat setting temperatures, Sarex has produced a product called Sarascour-RG(Conc).

The solution has been developed to enhance nylon's thermal stability and will reduce the tendency for polyamide or polyamide/elastane goods to yellow during the heat setting and moulding processes.

Sarascour-RG (Conc) features:

- An anti-thermal yellowing agent to prevent yellowing of fabrics and knits made from polyamide, polyamide/elastane, polyester and polyester/elastane during heat setting, finishing and moulding.
- Suitable for finishing both pale shades and fabrics treated with optical brightening agents.
- Prevents oxidation of end amino groups of polyamide during heat treatment, as well as yellowing due to NOx fumes in direct heated stenter.
- It will minimise the curling edges of the fabric

Materials and Methods

Materials: 100% polyamide fabric

Chemicals: Sarascour-RG(Conc)

Experimental

Fabric substrates were padded with 5-10gpl Sarascour-RG(Conc) with a pick-up of 65-70%. The bath pH was adjusted to 4.5-5.0.

After padding, the fabrics were heat set at 180-190°C for two minutes and then evaluated by the whiteness and yellowing index using CCM machine.

Results

The results showed that the anti-thermal-yellowing agent could enhance the decomposition temperature and hinder the thermal-oxidative degradation of polyamide. Besides, the whiteness values of the fabric treated with Sarascour-RG(Conc) is distinctly higher than that of untreated fabric.