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SPANDEX

The development of Spandex was started during World War-II. At this time, chemists took on the challenge of developing synthetic replacement for rubber. Two primary motivating factors prompted their research. First, the war effort repaired most of the available rubber for building equipment.

Second, the price of rubber was unstable and it fluctuated frequently. Developing an alternative to rubber could solve both of these problems.

In 1940, the first polyurethane elastomers were produced. These polymers produced millable gums, which were an adequate alternative to rubber. But at the same five scientists at Du Pont produced first nylon polymers. But these nylon polymers were stiff and rigid, so efforts were begun to make more elastic.

The first Spandex fibres were produced on an experimental level by one of the early pioneers in polymer chemistry.

The variety of raw materials are used to produce stretchable Spandex fibres. This includes prepolymers which produce backbone of the fibres.

Spandex is a light weight, synthetic fibre that is used to make stretchable clothing such as sportswear. It is made up of long chain polymer called polyurethane, which is produced by reacting a polyester which a dissocyanate. The polymer is converted into a fibre by DRY SPINNING technique.

MANUFACTURING PROCESS :

Spandex Fibres are produced in four different ways including melt extrusion, reaction, spinning, solution dry spinning, and solution wet spinning. Each of these methods involve the initial step of reacting monomers to produce a prepolymer. Then the prepolymeric is reacted. Further, in various ways, and drawn out to produce a long fibre. Since solution dry spinning is used to produce over 90% of the World's Spandex Fibres.

Polymer Reactions :

(i) the first step in the production of Spandex is the production of the prepolymer. This is a done by mixing a "macroglyco" and "disocyanate monomer". The compounds are mixed in a reaction vessel and under the right conditions they react to form a prepolymer. Since the ratio of the component materials produces fibres with varying characteristics, it is strictly controlled. A typical ratio of glycol to diisocyanate may be 1:2.

(ii) In dry spinning fibre production, the prepolymer is further reacted with an equal amount of diametre. This is known as "chain extension reaction". The resulting solution is diluted with a solvent to produce, the spinning solution. The solvent helps make the solution thinner and move easily handled.

(iii) The spinning solution is pumped into cylindrical spinning cell where it is curved and converted into fibres. In this cell, the polymer solution is forced through a metal plate called spinnerle. This causes the solution to be aligned in strands of liquid polymer. As they pass through the cell, they are heated in the presence of a nitrogen and solvent gas. These conditions make the strands in solid stage.

(iv) As the fibres exit the cell, a specific amount of the solid strands are bundled together to produce desired thickness. Each fibre of Spandex is made up of many smaller individual fibresthat adhere to one another due to natural stickiness of their surface.

(v) The fibres are then treated with a finishing agent to make their strong, attractive and smooth. After this treatment, the fibres are transferred through a series of roller onto a spool.

(vi) When the spuds are filled with fibred they are put into final packaging and shipped to textile manufactures.

These fibres may be woven with other fibres such as cotton, or nylon to produce the fabric that is used in clothing manufacture. This fabric can also be dyed to produced a desired color.

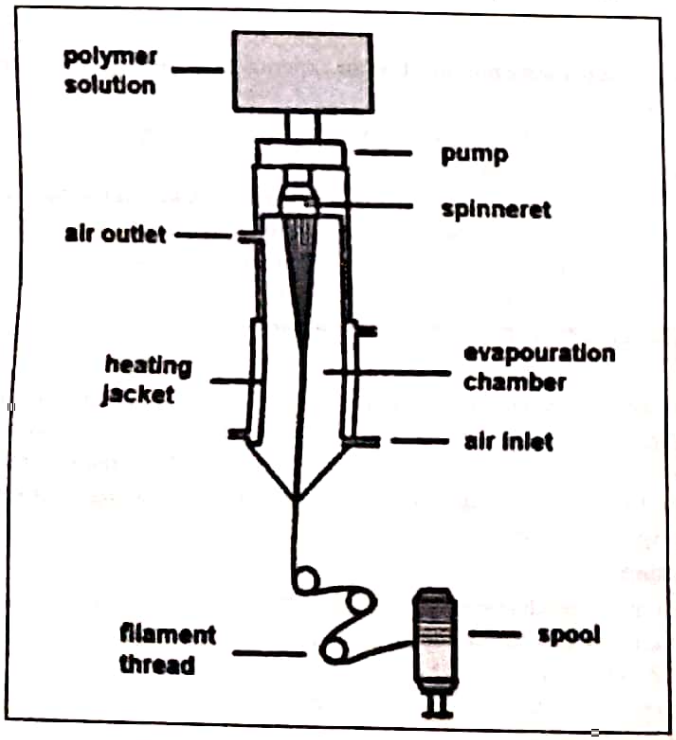

Fig. *Dry Spinning process of Spandex*

Physical Properties :

(i) Cross-section / diameter : Spandex filaments are extruded usually from circular spinnerites, but evaporation of solvent or the effects of drying may produce non-circular cross-section of shapes.

(ii) Density : The density of Spandex filament, ranges from 1.15 to 1.32 g/cc, the fibres lower density being based on polyesters.

(iii) Moisture Regain : The moisture of fibres from which the surface finish has been removed lies between 0.8 to 1.2%

(iv) Length : It can be of any length. May be used as filament or staple fibres.

(v) Colour : It has white or nearly white colour.

(vi) Luster : It has usually dull lusture.

(vii) Strength : Low strength compared to most other synthetic fibre.

(viii) Elasticity : Elastic properties are excellent. This is the outstanding characteristic of the fibre.

(ix) Heat : The heat resistance varies considerably amongst the different degrades over 300F.

(x) Flammability : It burns slowly.

(xi) Electrical conductivity : It has low electrical conductivity.

(xii) Breaking tendency : 0.6 to 0.9 gms/devices.

Chemical Properties :

(i) Acids : Good resistance to most of acids unless expouse is over 24 hours.

(ii) Alkalies : Good resistance to most of the alkalies but some types of alkalies may damage it.

(iii) Organic Solvent : Offer resistance to dry cleaning solvents.

(iv) Bleaches : Can be degraded by sodium hypochloride. Chlorine bleach should not be used.

(v) Dyeing : A full range of coloures is available. Some types are more difficult to dye than others.

IMPORTANT QUESTIONS

Q.1. What kind of Spandex fibre is and how it is obtained ?
Q.2. Which kind of spinning process is used in Spandex and explain ?
Q.3. Explain physical population of Spandex.
Q.4. Explain Manufacturing Process of Spandex.
Q.5. Explain chemical properties of Spandex.
Q.6. Explain spinning.
Q.7. Write the chemical used for making spandex.
Q.8. Explain uses of spandex.
Q.9. Explain strength of Spaandex fibre.
Q.10. Explain density of Spaandex fibre.