Man Made Wet-Spun & Dry-Spun Methods of Fibres Manufacturing

Man Made Fibre/Filament Manufacturing

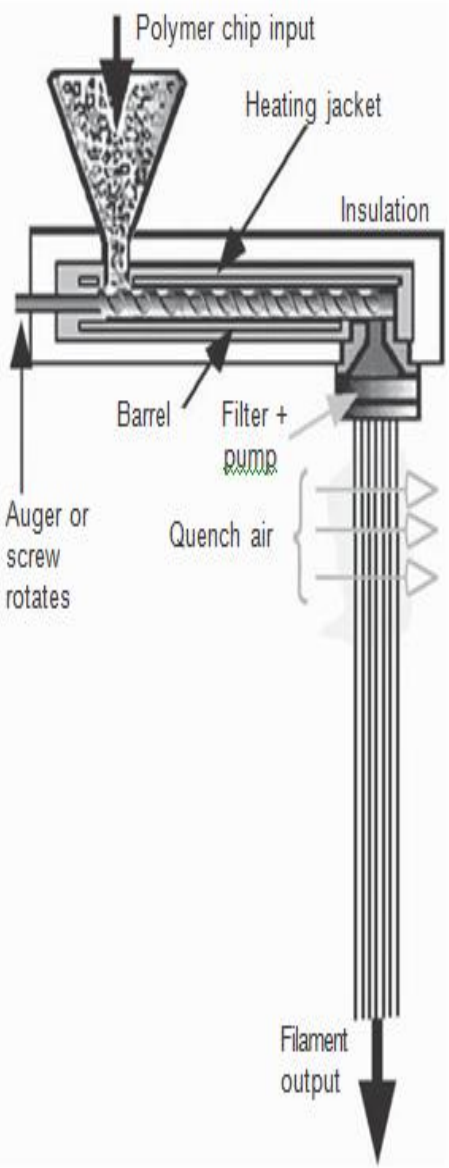


Fig. Simple fiber extrusion

Flow chart of synthetic process of man-made fiber

Synthetic fiber has its beginning with chemistry

↓

A media is developed & is filtered under pressure

↓

It is then extruded into continuous filaments

↓

The filaments are allowed to solidify

↓

Then they are stretched

↓

A finishing solution is then applied

↓

Then the bundle of filaments is crimped

↓

Cutting the bundle into staple length.

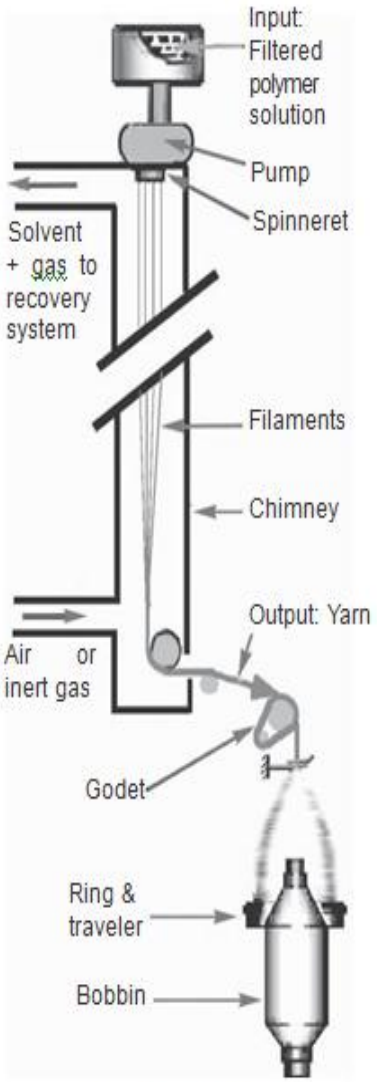


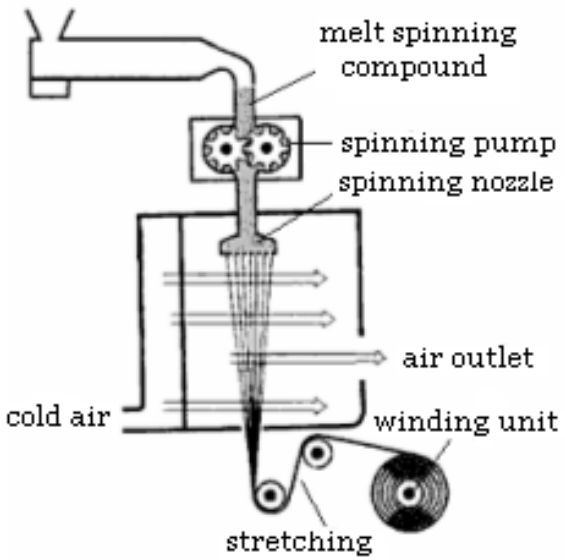
Fig. Dry spinning

Man Made Fiber Spinning Technology

There are typically ***three types*** of spinning for polymers:
Melt, **Dry** and **Wet**.

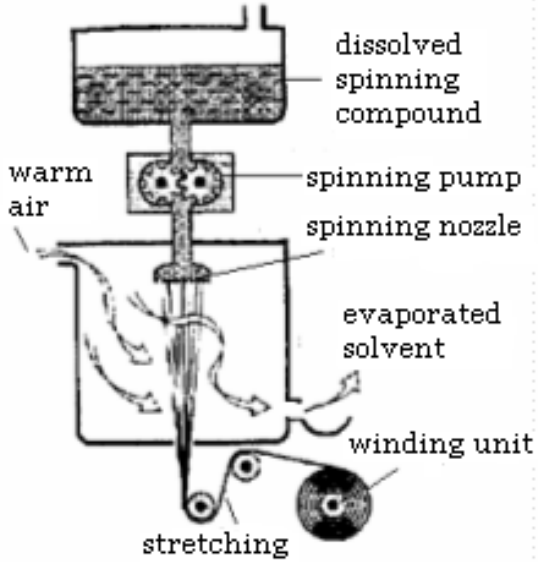
- Melt spinning **(Fig. 1)** is used for polymers that can be melted easily. [**nylon polyester, and polyolefin, poly propylene fibres]**
- Dry spinning **(Fig. 2)** involves dissolving the polymer into a solution that can be evaporated. [Acetate, poly-acrylonitrile and spandex fibre.]
- Wet spinning **(Fig. 3)** is used when the solvent cannot be evaporated and must be removed by chemical means. [Viscose]

FIG. 1



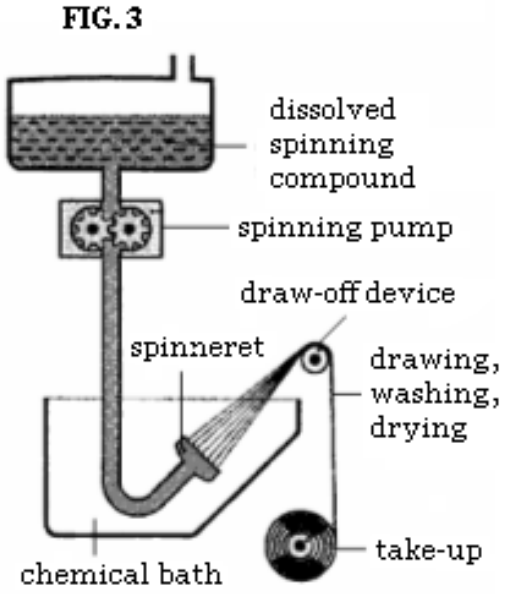
PRINCIPLE OF MELT SPINNING

FIG. 2



PRINCIPLE OF DRY SPINNING

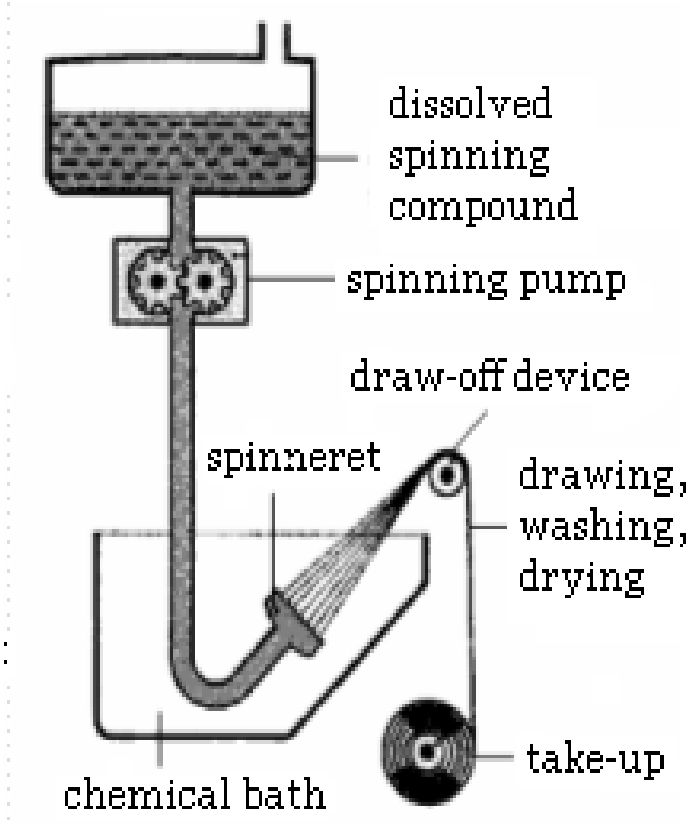
FIG. 3



PRINCIPLE OF WET SPINNING

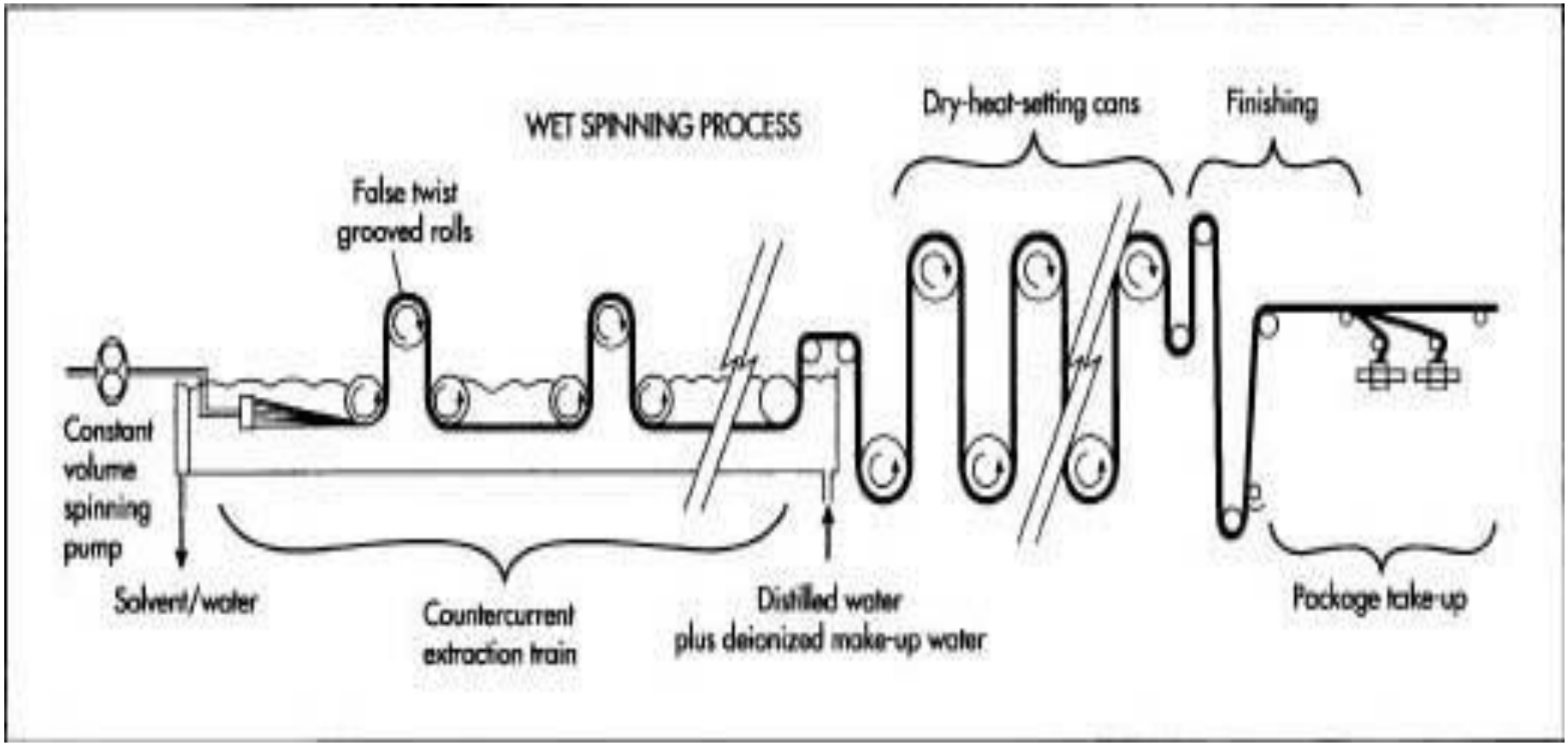
Wet spinning:

- In wet spinning the solution of fibre-forming material is extruded into a coagulating bath that causes the extruded filament to harden as a result of chemical or physical changes. Viscose Rayon, for example, is produced with wet spun method.



PRINCIPLE OF WET SPINNING

Wet spinning:

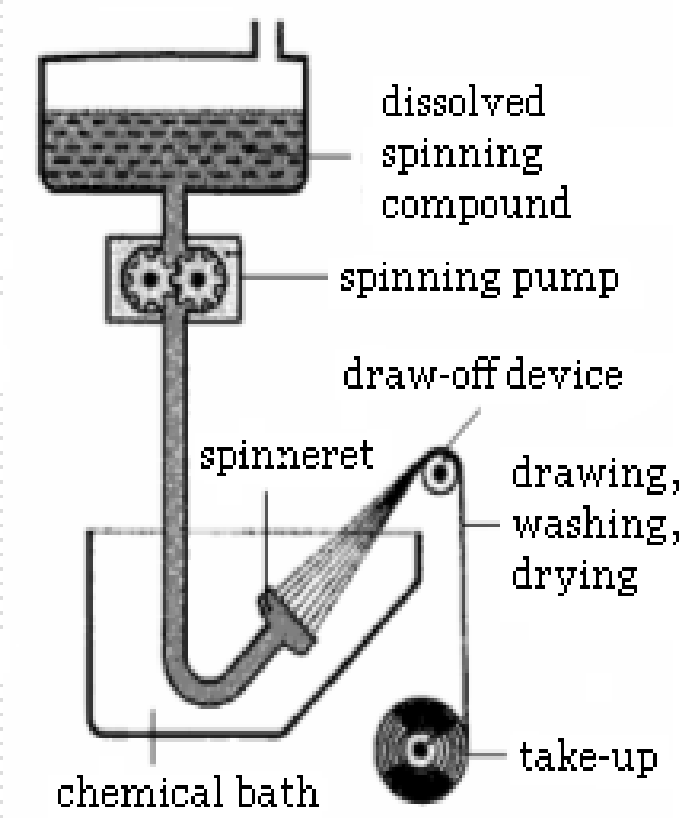


Wet spinning of Viscose Rayon:

- So the starting material is timber wood otherwise Linter.
- Viscose regenerated cellulose comes from wood pulp or cotton fibre linter.
- Wood is chop up into pieces and its constituent is purified and treated with dilute solution of Caustic soda which converts it in SODIUM CELLULOSE XANTHATE
- The solutions than “Ripened” The solution become first less viscose and then increasing nearly to its original viscosity;

Viscose Rayon Wet Spinning:

- In wet spinning the solution of fibre-forming material is extruded into a coagulating bath that causes the extruded filament to harden as a result of chemical changes and form the viscose filament.



PRINCIPLE OF WET SPINNING

Wet spinning of Viscose Rayon:

- Its nature is entirely different from natural cellulose. The final filament differs chemically from the original cellulose as it has suffered some degradation during the manufacturing process.

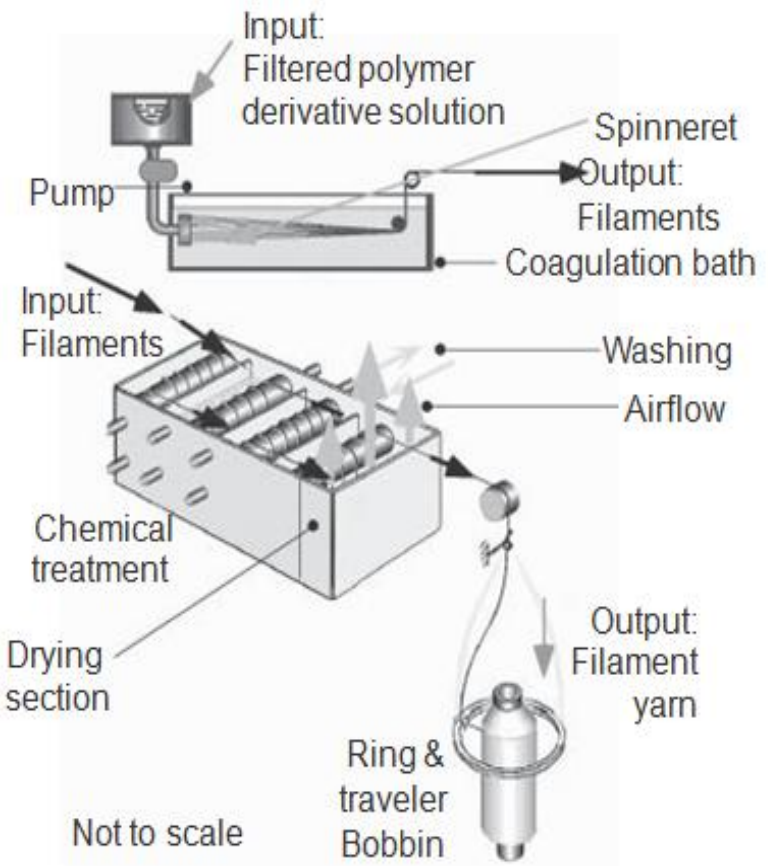


Fig. Wet spinning

Properties of Viscose Rayon:

- **Viscose rayon filament:** - Under the microscope viscose rayon filament rigid and show deeply serrated outline in cross-section.
- **Viscose Filament and Staple fiber:** - It used either in filament form, or cut into staple before making into yarn.
- **Luster:** - Regenerated cellulose filaments are highly luster, but can be diluter by suitable treatment.
- **Strength**: The fibers are not very strong, especially when they are wet. Tenacity ranges. 1.8-3.0 g tex when dry. They decrease in strength on wetting can be as much as 70%
- **Extension & Elasticity:**- Viscose rayon is not very elastic (Elongation at break 17-25% and will creased badly unless a special creased resistant.

Properties of Viscose Rayon:

- **Getting wet:** - The fibers are very absorbent and do not dry quickly. (SMR 11.5-16%)
- **Heat Conductivity:** - Its containing 100% cellulose and a good conductor of heat. So, viscose rayon like cotton is cool to wear.
- **Heat damaged:** - The fibers are damaged by heat and should be ironed as cooler settings.
- **Sun slight:** - White viscose rayon is discolored by exposure to sunlight, but long exposures will weakened the fabrics.
- **Getting dirty:** - The smooth surface of regenerated cellulose fibers helps it to resist soiling but shrinkage may accurse on washing.
- **Mildew and moths:** - It is also damaged by mildew and if left in damp conditions but they are not attached by moths.

Properties of Viscose Rayon:

- **Bleaching:** - Oxidized bleaches can be used if care is taken and any bleach is removed by through rinsing after wards.

- **Alkalis:** - Viscose rayon is not harmed by weak solutions of alkalis but strong alkalis cause swelling of fibers and loss of strength.

- **Acids:** - Viscose rayon fibers are damaged by weak acids. It can dye with reactive and direct dyes. It is fairly cheep.

- **Cost :** Viscose rayon is a least expensive fiber so that it is used widely through as is cotton, but due to regenerate reduced.

Dry spinning:

- In dry spinning the fibre-forming substance is dissolved in a solvent before the solution is extruded. As the jets of solution emerge from the spinneret, a stream of hot air causes the solvent to evaporate from the spinning solution, leaving solid filaments. Acetate is dry spun by extruding acetone solutions of cellulose acetate into hot air.

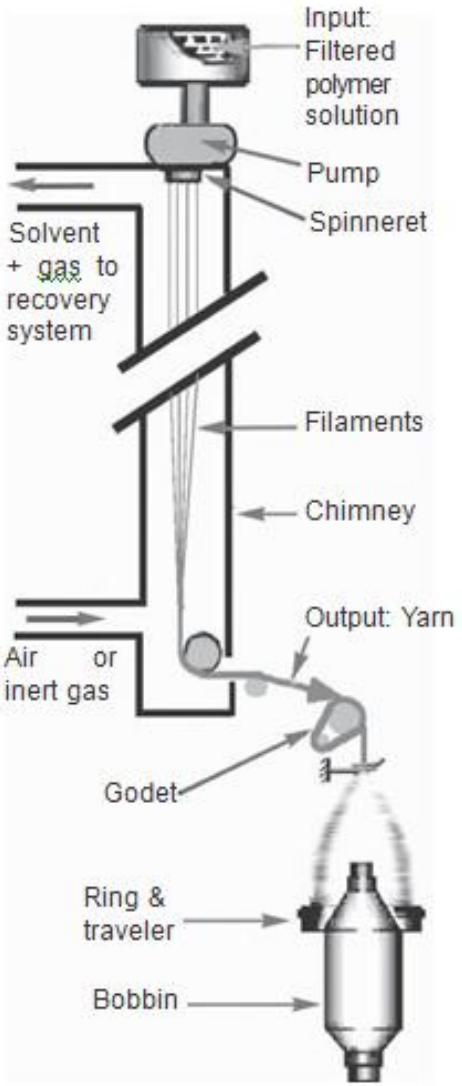


Fig. Dry spinning

Acrylic Fibre Composition

- Acrylic fiber is a synthetic fiber that closely resembles wool in its character. **Acrylic fibers** are made from a polymer (polyacrylonitrile) and a comonomer. Typical co-monomers are vinyl acetate or methyl acrylate. The co-monomer is added to improve dyeability and the textile process-ability of the acrylic.
- According to the definition of the ISO (International Standards Organization) and BISFA (International Synthetic Fiber Standardization Office), fibers which contain a minimum of 85% acrylonitrile in their chemical structure are called "Acrylic Fibers".

Acrylic Spinning:

- The comonomers vinyl chloride, vinylidene chloride or vinyl bromide used in modacrylic give the fiber flame retardant properties.
- Acrylic fiber is produced with two different systems: wet spinning (about 13.2%) and dry spinning. Acrylic fiber can be supplied as producer-dyed either by pigmentation of the dope or with jel dyeing systems. It can be used 100% alone, or in blends with other natural and synthetic fibers.

Acrylic (Orlon) and Modeacrylic

- DuPont created the first acrylic fibers in 1941 and trademarked them under the name **Orlon**. It was first developed in the mid-1940s but was not produced in large quantities until the 1950s.
- Modacrylic is a modified acrylic fiber that contains at least 35% and at most 85% acrylonitrile monomer. End-uses of modacrylic include protective clothing.

General Properties and End uses of Acrylic fibre

- Easy to wash and good dimensional stability.
- Resistance to damage by moths and chemical substances.
- Excellent color-fastness and dyeability in brilliant colors.
- Highly resistant to sunlight.
- Lightweight, soft, and warm, with a wool-like touch

End Uses of Acrylic Fiber:

- Apparel: Sweaters, socks, fleece wear, circular knit apparel, sportswear and childrens wear
- Household Textiles: Carpet, blankets, area rugs, upholstery, pile fabrics
- Outdoor end uses: Car tops, boat covers, awnings, outdoor furniture
- Industrial end uses: Filtration materials, reinforcement materials in construction, car batteries