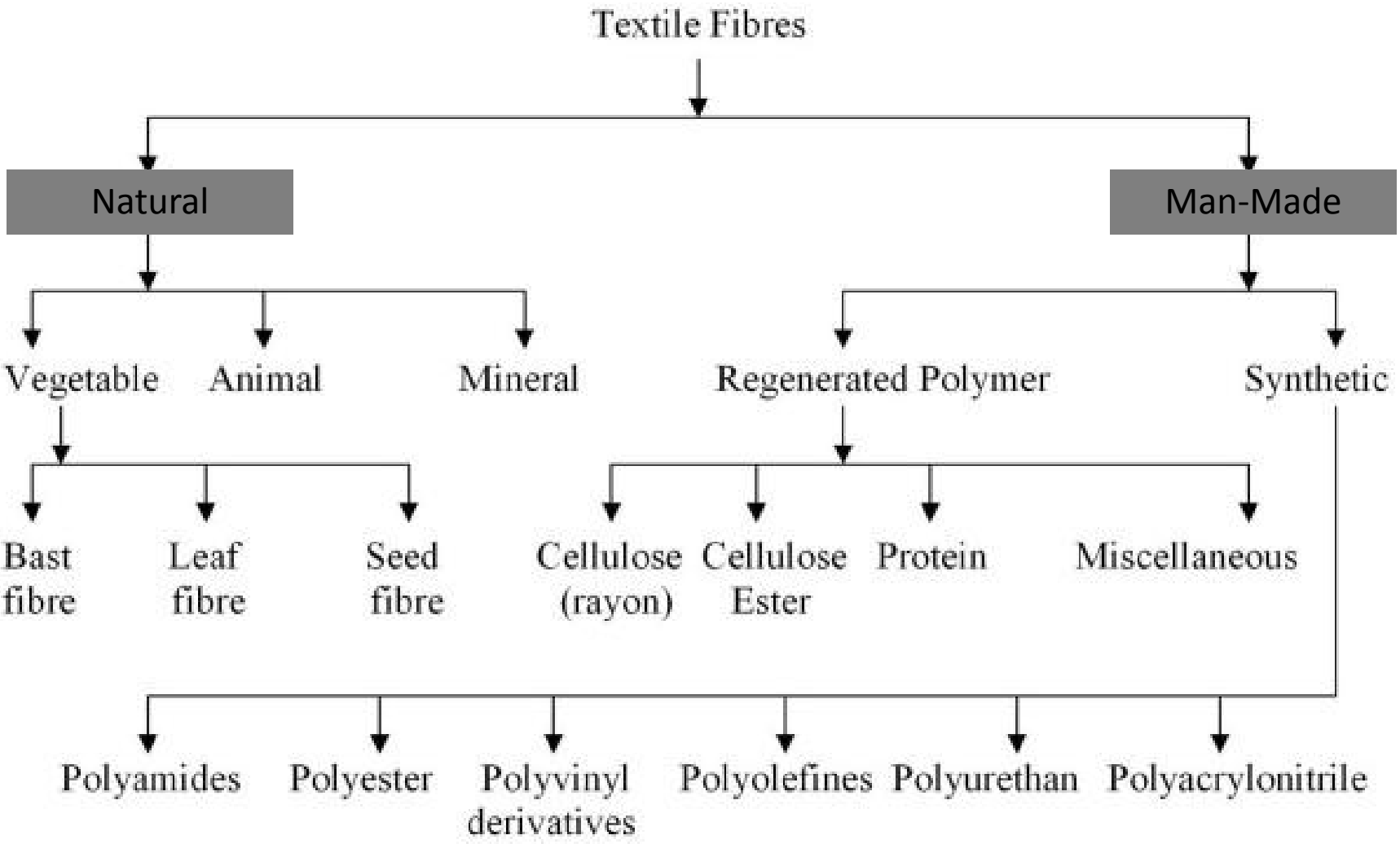
Introduction to Man-Made Fibres manufacturing


Textile Fibres
Natural
Man-Made
Vegetable
Animal
Mineral
Regenerated Polymer
Synthetic
Bast fibre
Leaf fibre
Seed fibre
Cellulose (rayon)
Cellulose Ester
Protein
Miscellaneous
Polyamides
Polyester
Polyvinyl derivatives
Polyolefines
Polyurethan
Polyacrylonitrile

Man-Made (Regenerated Fibers

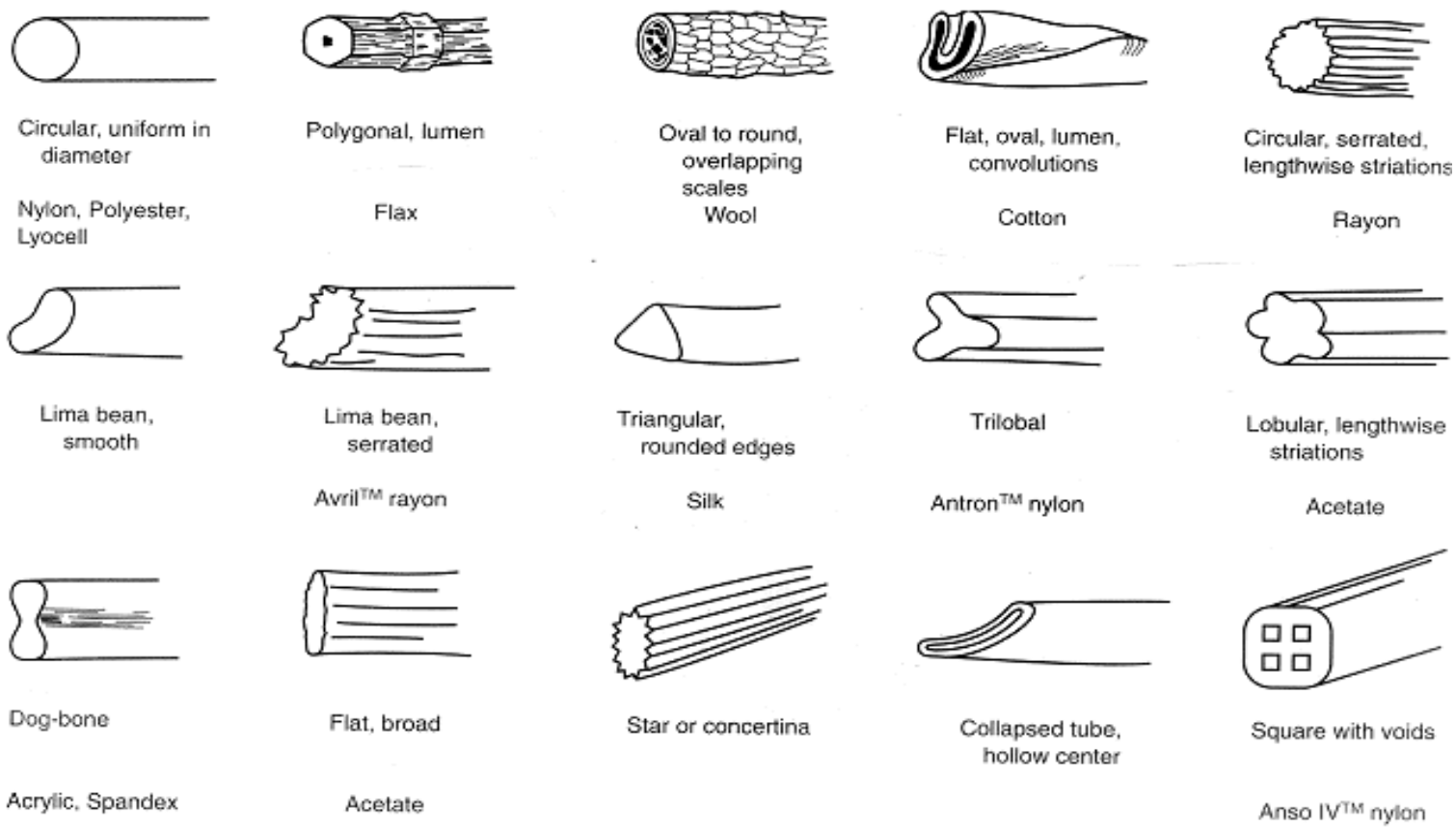
- Produced by using a natural component (for example cellulose (Linters, Wood pulp) is regenerated to form solid filaments.
- The fibre-forming substance is dissolved in a solvent before the solution is extruded.
- These fibre are tend to be smooth and uniform same as synthetic fibres.
- Rayon and Cellulose Acetates —chemically-altered cellulose; soft, lustrous, versatile

Man-Made (Synthetic Fibers

- Made from derivatives of petroleum, coal and natural gas.
  - Nylon —most durable of man-made fibers; extremely light weight
  - Polyester —most widely used man-made fiber
  - Acrylic —provides warmth from a lightweight, soft and resilient fiber
  - Spandex —extreme elastic properties

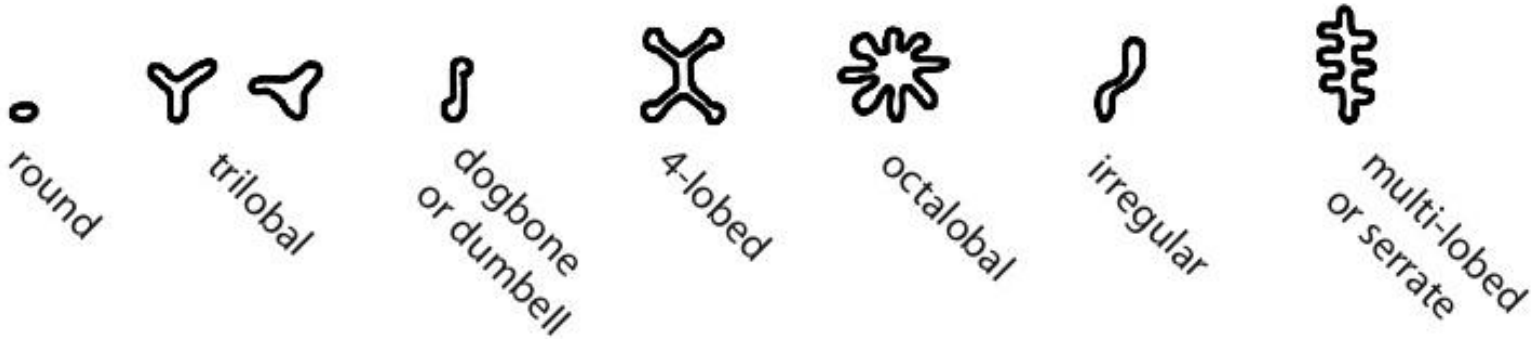
Synthetic (Man-Made) Fibers

- The shape of a man-made fiber can determine the value of fiber.
- Synthetic fibers tend to be smooth and uniform and some may have long striations lines on the other layer

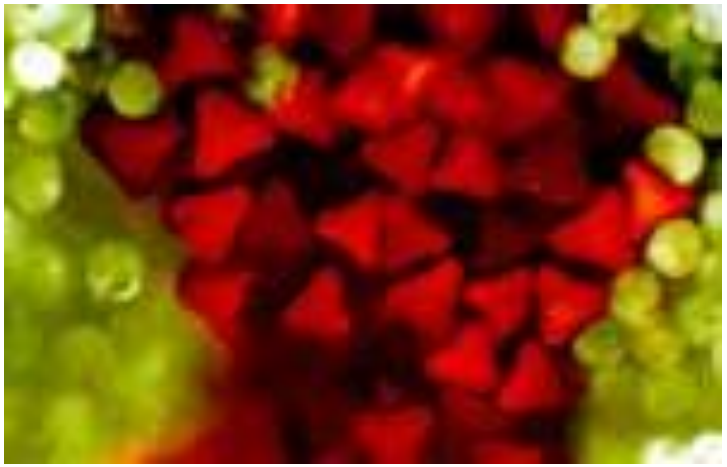


Filament Cross-Sections

- Cross section of a man-made fiber can be manufacturer-specific.
- Some cross sections are more common than others, and some shapes may only be produced for a short period of time.



Synthetic Fibers



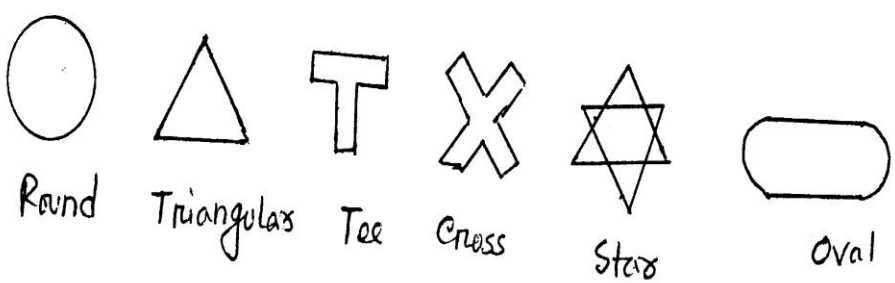
- Cross sections of nylon carpet fibers seen with a scanning electron microscope (SEM)

Spinneret

A nozzle or plate provided with fine holes or slits through a fibre forming solution or melt is extruded in form of filament, is called spinneret.

This is the most important part of a MMF producing m/c. The number of holes, sizes and shapes vary with the filament desired.

- Shape of holes:



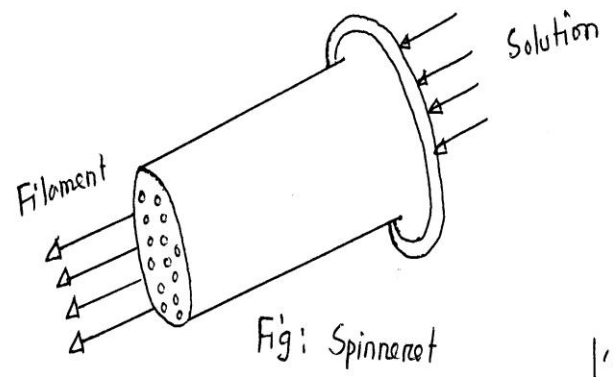


Fig: Spinneret

Forms of Man Made Fibre (MMF):

MMF are produced in three types –

1. **Filament:** Filament are spun from spinnerets with 350 holes or less is determined by the size of the yarn to be made

   Monofilament: This filament is made only of a single filament.

   Multifilament: These filaments are made of more than one filament.

2. **Staple:** Man-made staple fibre is of limited and relatively short length

3. **Filament tow.** An assemble of twist free fibre.

Spinning of Man-Made Filaments

- The conversion of polymer into fibre is called spinning. The fibre forming substance is made temporarily fluid, extruded through spinneret and then returned to solid state (solidification) in fibre form.
- Three types of spinning process:
  - **Melt spinning (Synthetic).**
  - **Wet spinning.**
  - **Dry spinning.**

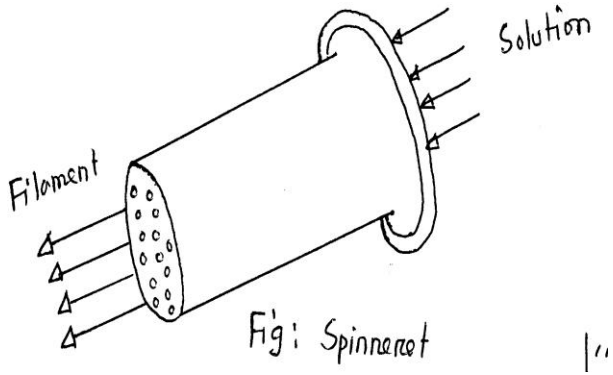


Fig: Spinneret

Man Made Fibre/Filament Manufacturing

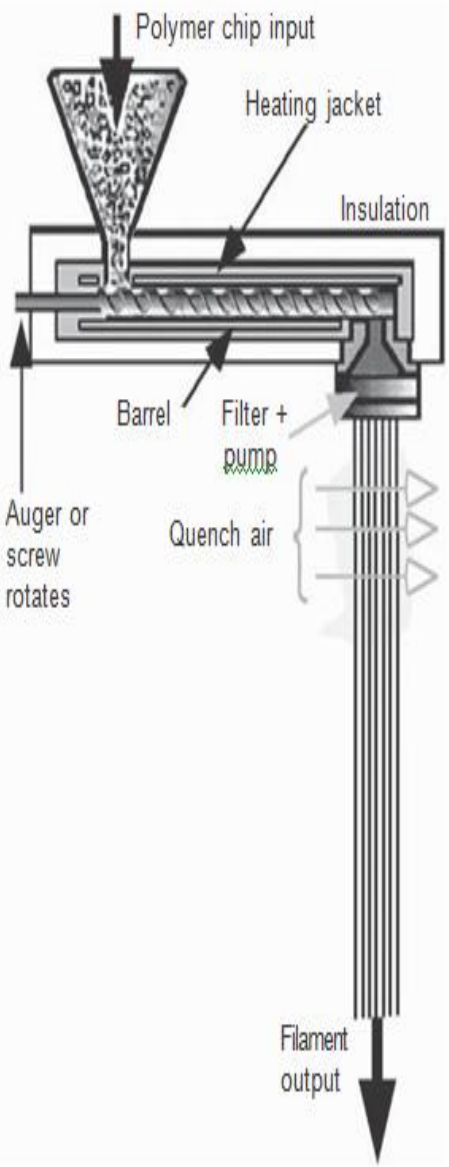


Fig. Simple fiber extrusion

Flow chart of synthetic process of man-made fiber

Synthetic fiber has its beginning with chemistry

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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.

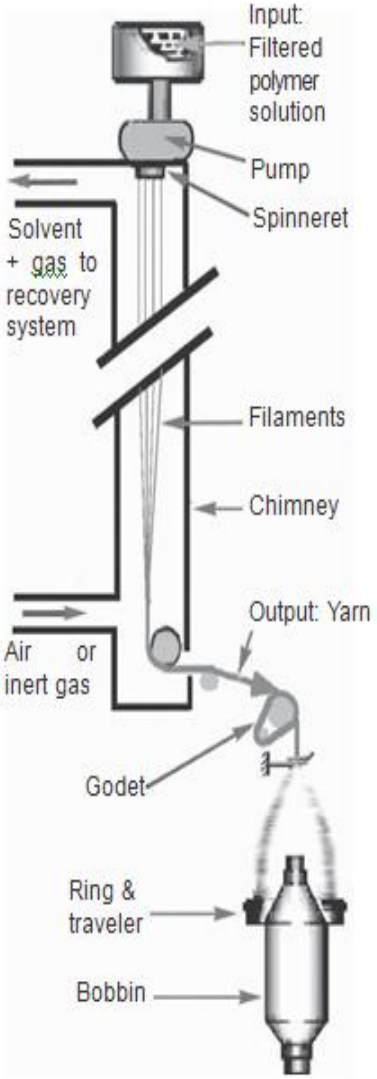
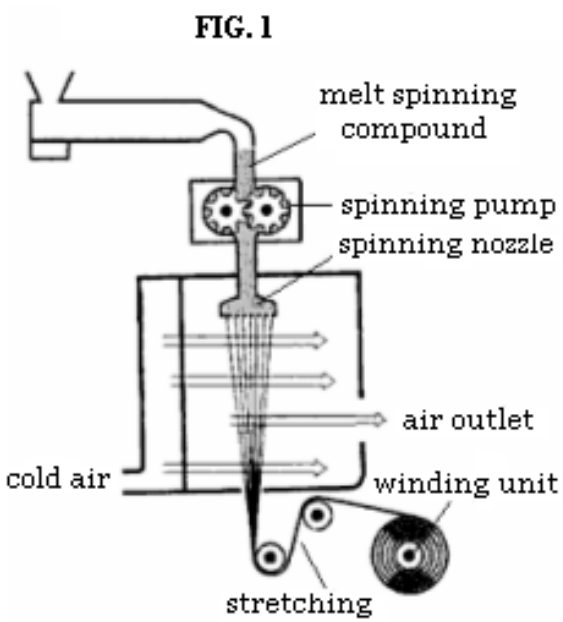


Fig. Dry spinning

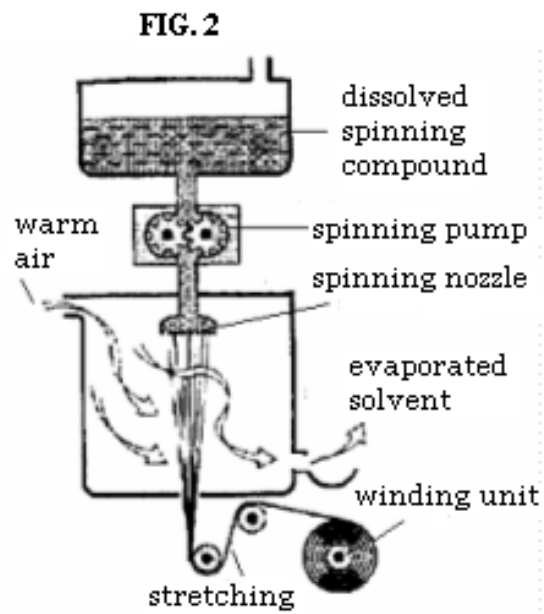
Man Made Fiber Spinning Technology

There are typically ***three types*** of spinning for polymers:

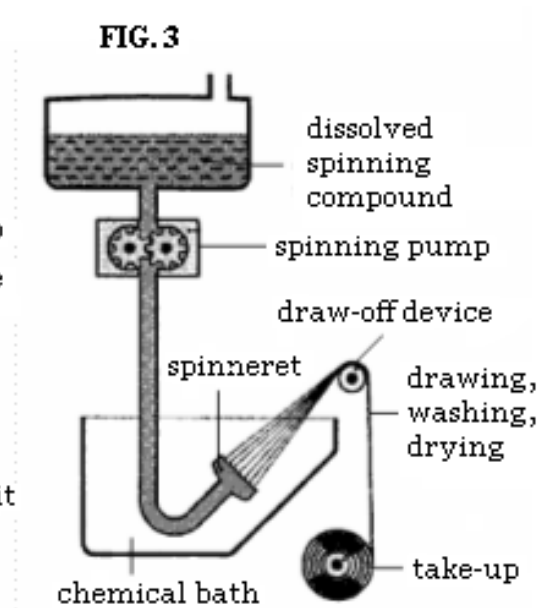
- Melt spinning **(Fig. 1)** is used for polymers that can be melted easily. [**nylon polyester, and polyolefin, poly propylene fibres]**
- Dry spinning **(Fig. 2)** involves dissolving the polymer into a solution that can be evaporated. [Acetate, poly-acrylonitrile and spandex fibre.]
- Wet spinning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



PRINCIPLE OF MELT SPINNING



PRINCIPLE OF DRY SPINNING



PRINCIPLE OF WET SPINNING