

Textiles



Ecole des Hautes Etudes d'Ingénieur (HEI) – Yncréa HdF

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What is textile?

The word textile is derived from the Latin term “**texture**” for woven fabrics. Now, generally applied to **fibers, filaments, yarns, fabrics, garments** and other articles fabricated wholly from one or more of the above elements.

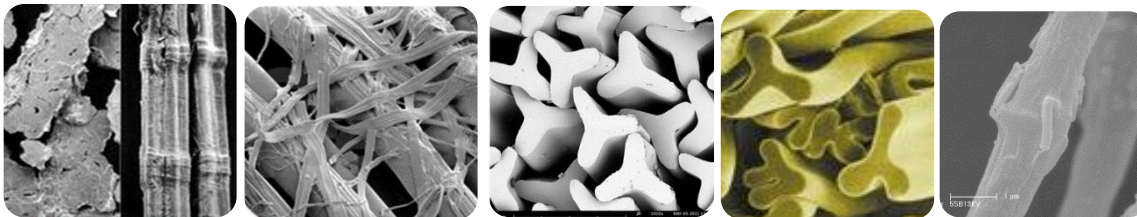
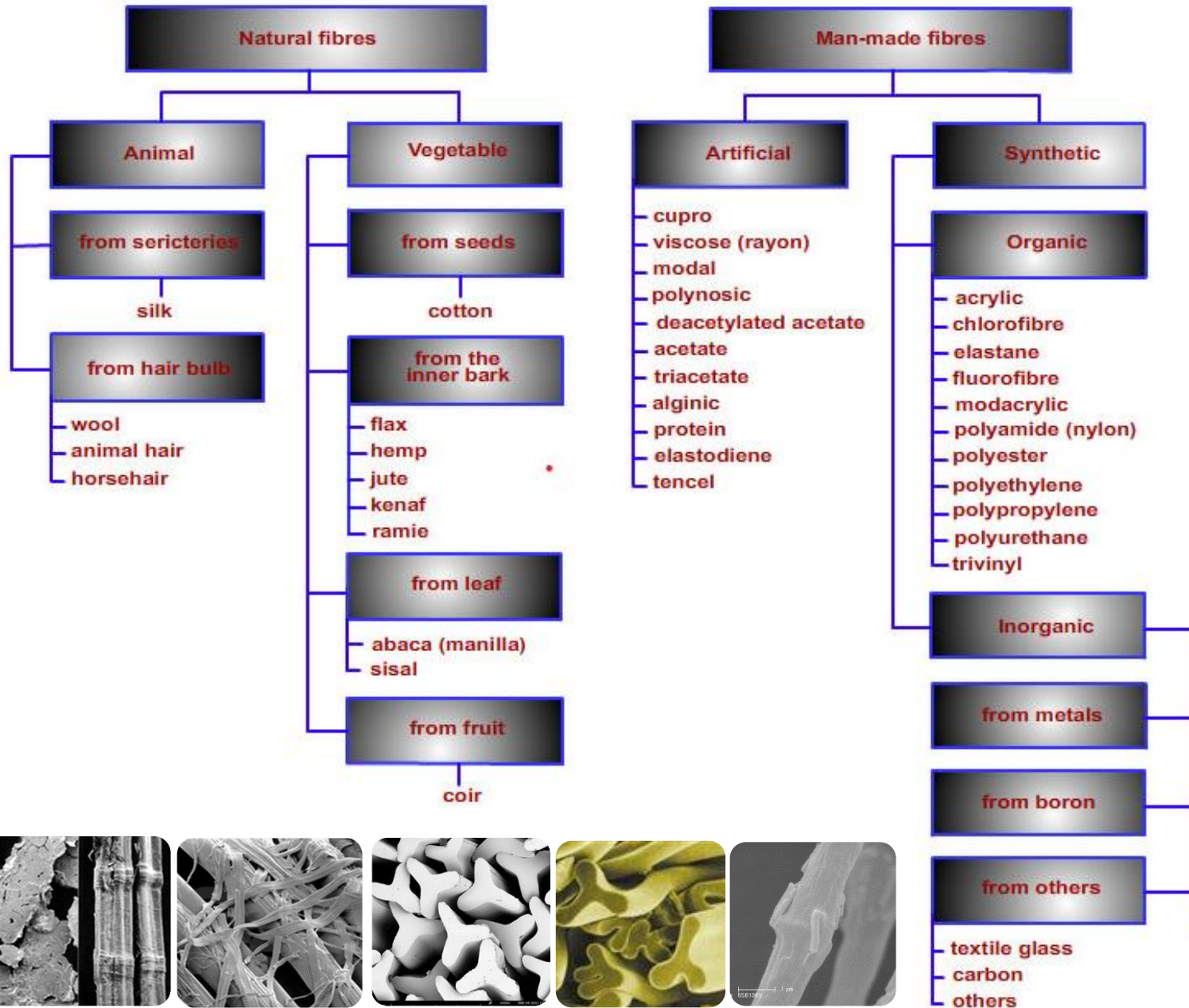
Fibers

- Fibers are the **fundamental units** or the **building blocks** used in the making of textile yarns and fabrics.
- They are smallest visible unit of textile product.
- These fibers are of many types.



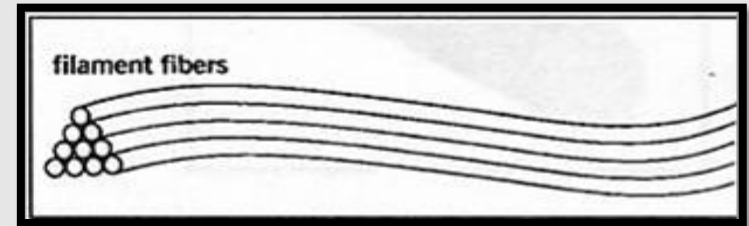
Polyester staple fibers

Fiber Classification



Filament

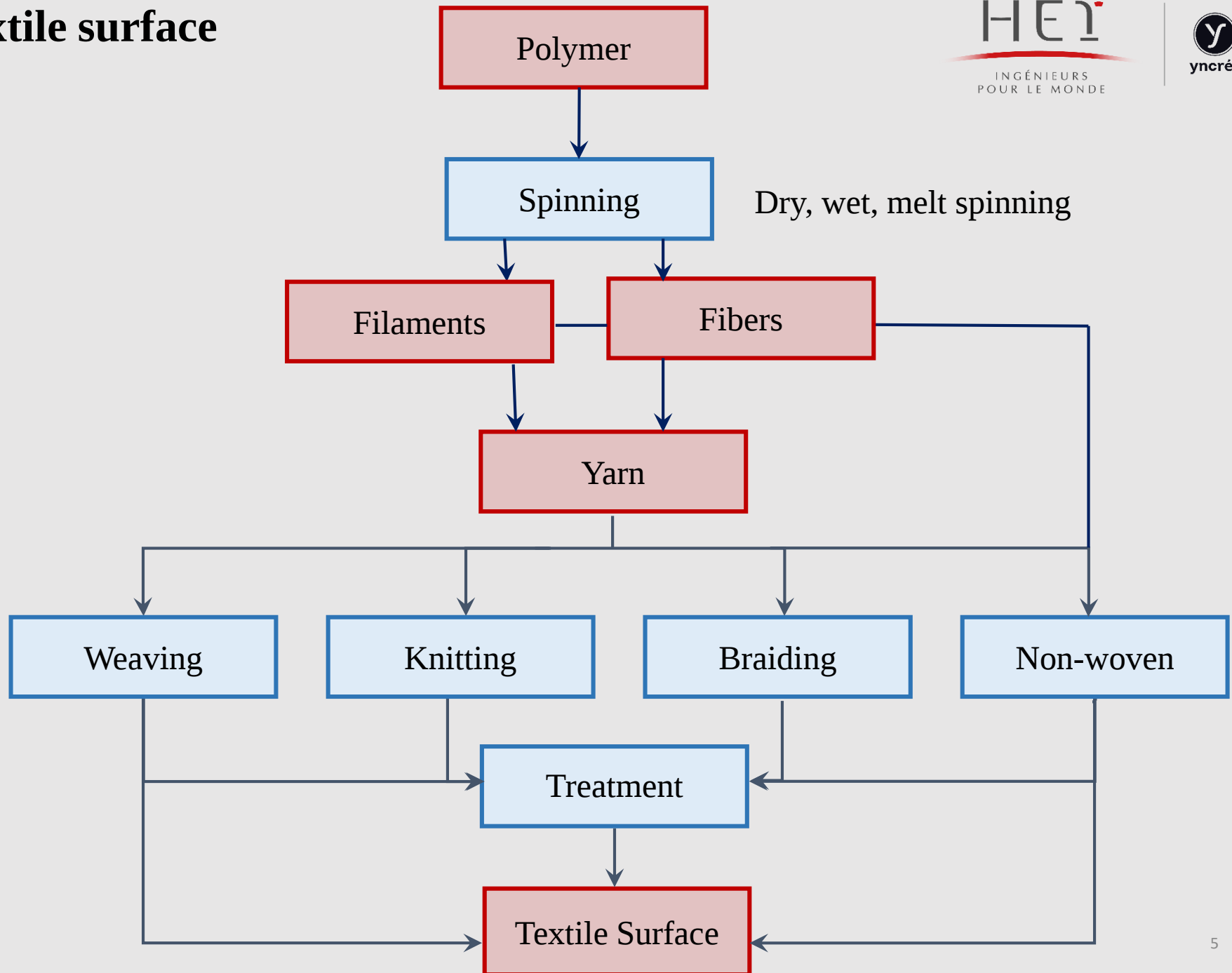
- Filament is a term given to long and strong fibers that are so long that they can work as yarns themselves.



Yarn

- It is an assembly of essential length and relatively small cross-section of fibers and/or filaments with or without twist.



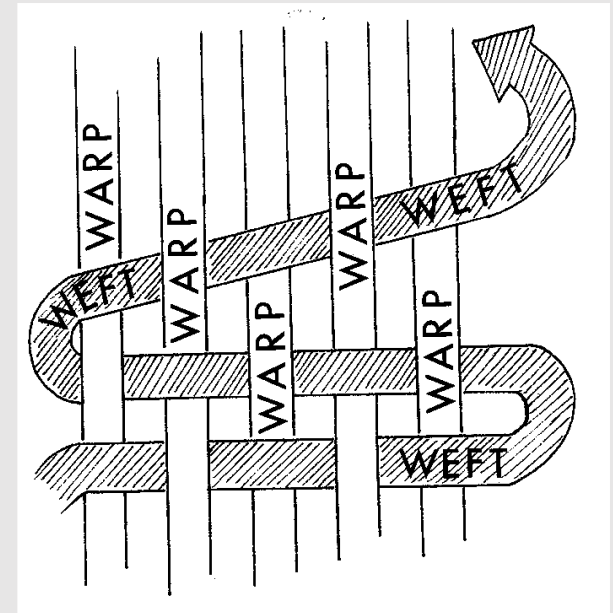


Cotton Spinning



Weaving

- Woven fabrics are made of two sets of yarns: **warp** and **weft**. These yarns are interlaced at 90° to each other.
- The warp yarns are parallel to each other and run lengthwise through the fabric or along the weaving machine direction.



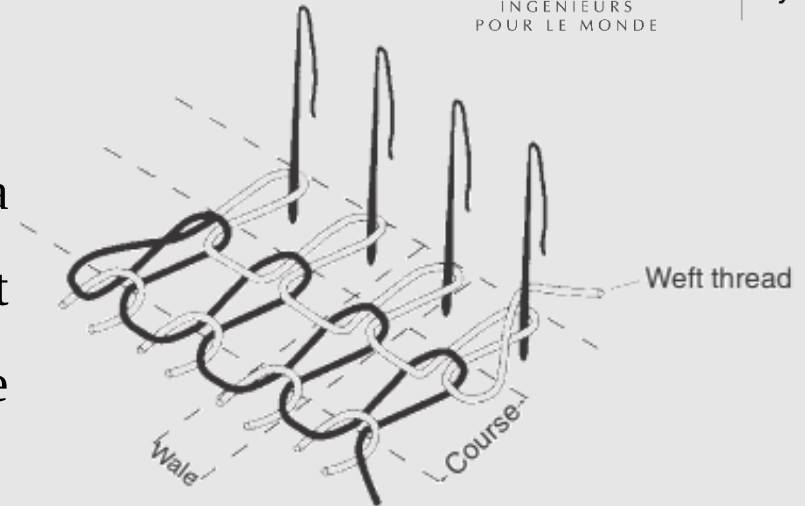
Interlacing of warp and filling yarns in a plain weave

Weaving

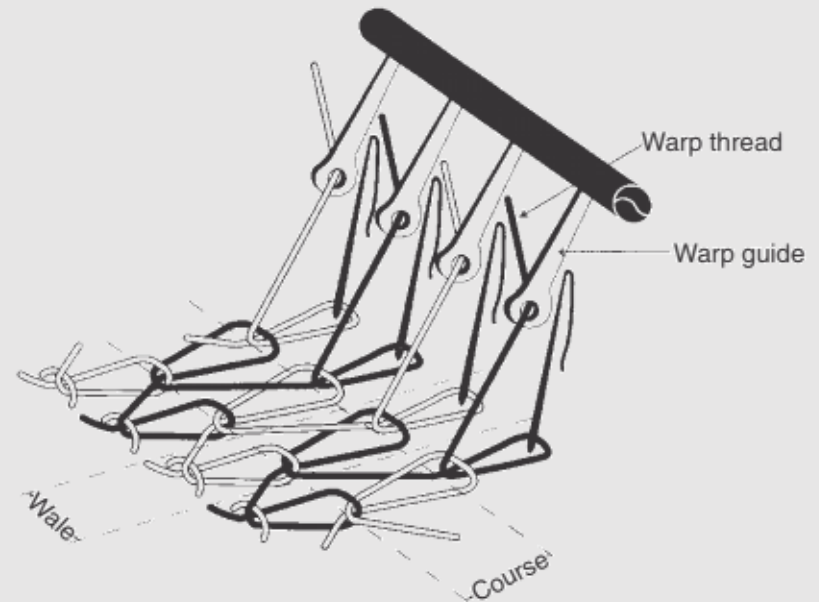


Knitting

- **Weft knitting** is a method of making a fabric in which the loops made by each weft thread, are formed across the width of the fabric.



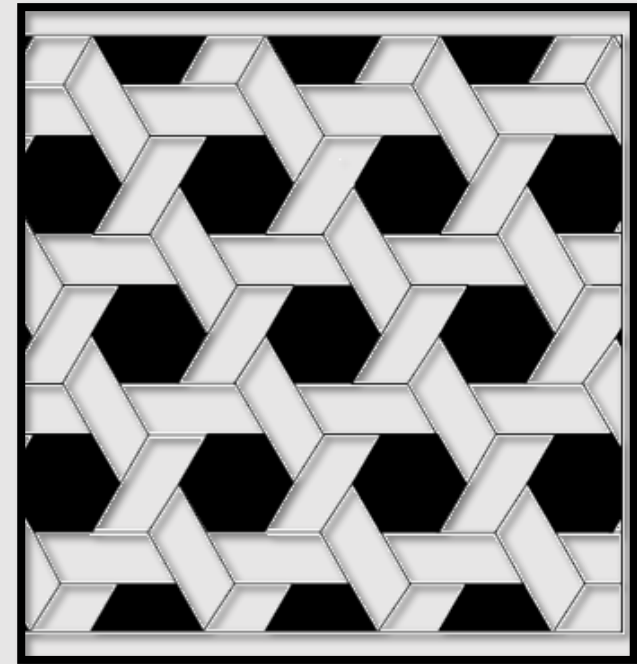
- **Warp knitting** is a method of making a fabric in which the loops made from each warp are formed along the length of the fabric.





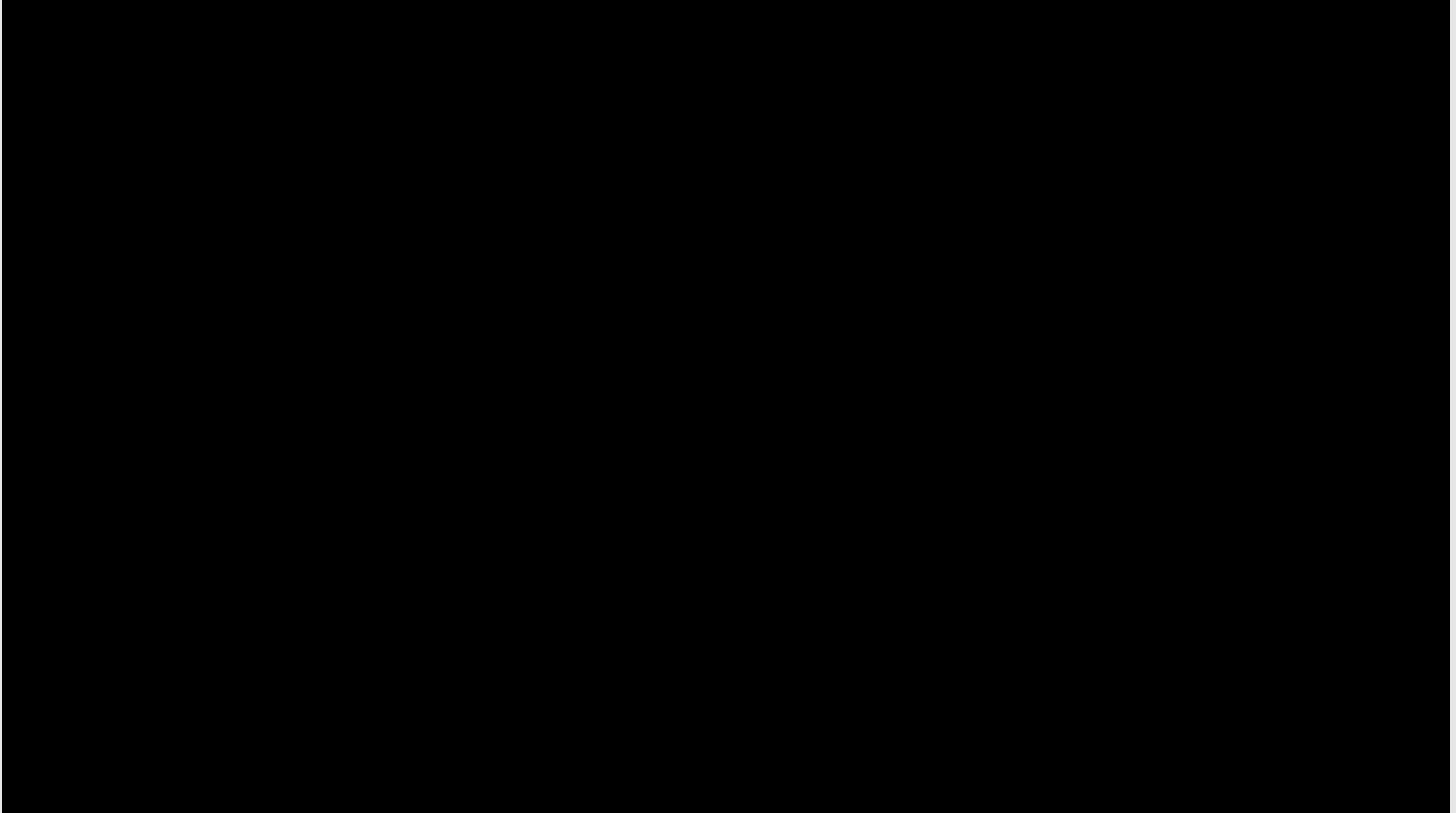
Braiding

- A method of interlacing three or more yarns or strips in such a way that they cross one another and are laid together in diagonal formation, forming a narrow strip of flat or tubular fabric.
- Tri-axial braided fabrics:
 - High tear and burst resistances due to the dissipation of strain in two directions.
 - High shear resistance due to intersections locking.



Tri-axial braided construction

Braiding of hockey sticks



Fibers / polymer

**Web
formation**

Dry-laid

Melt-laid

Wet-laid

Electrospinning

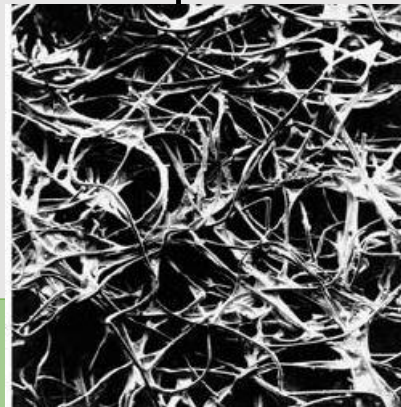
Bonding

Mechanical
bonding

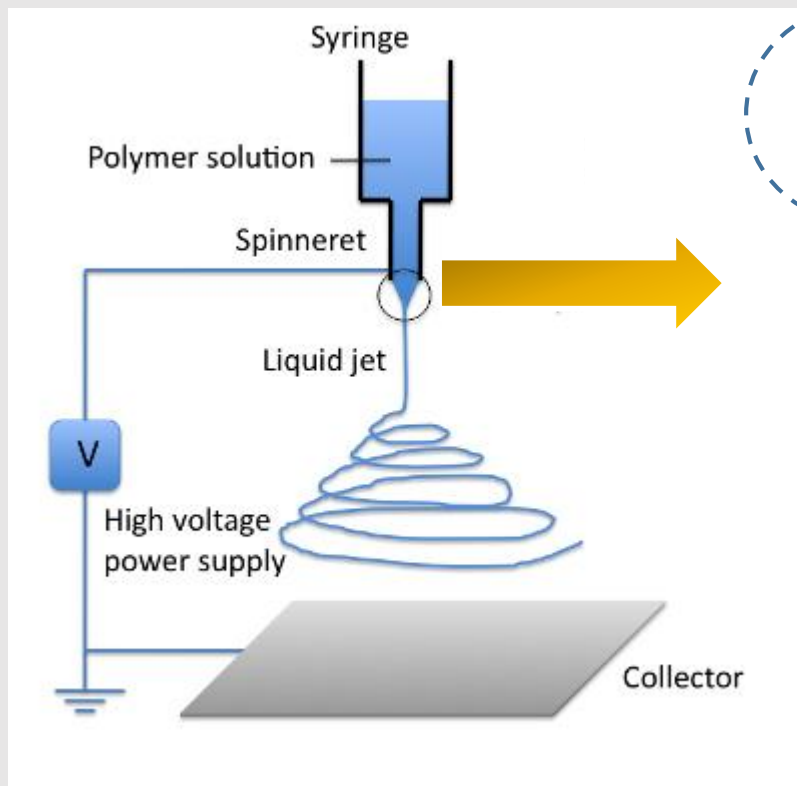
Thermal
bonding

Chemical
bonding

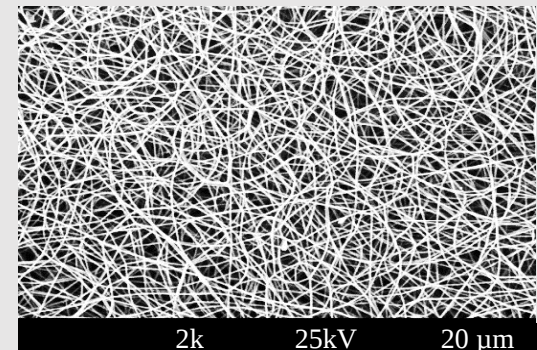
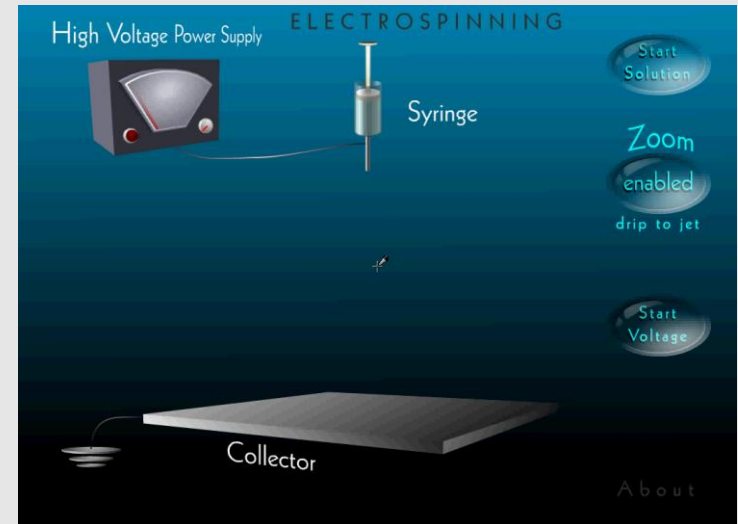
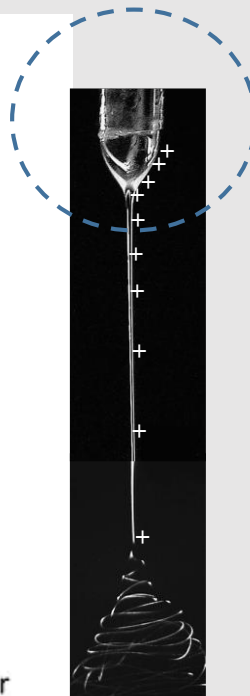
**Finishing
treatment**



Electrospinning technique - principle



Taylor cone



Electrospun membrane



Essential properties

- **Objective performances**
- **Functional Properties**
- Aesthetics (Comfort, Fashion, ...)



Common points

Provide textile solutions to special needs expressed by their users

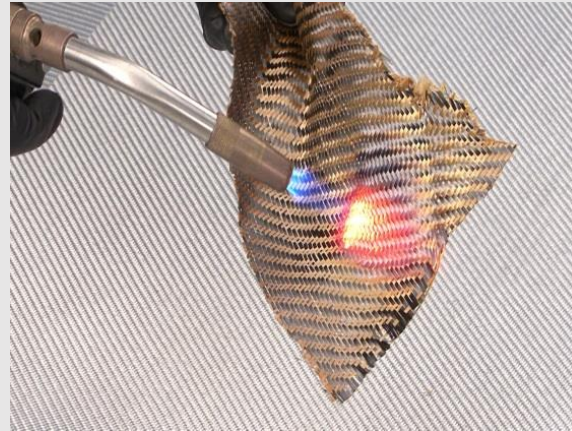
- They make it possible to produce finished products that could not be designed with other materials.
- They provide a better solution than other materials, technically or economically.

Technical techniques advantageous

- Lighten the structures
- Better durability
- High mechanical performance
- Rigidity/Softness
- Anti-corrosion properties
- Resistance to fatigue, crack propagation
- Very short manufacturing time
- Decoration and contribute to comfort

Textile treatment

Finishing Flame retardant, hydrophobic, antistatic, ... functionalization



Carbon fiber tissue

Coating Depositing a formulated polymeric resin on the textile surface.

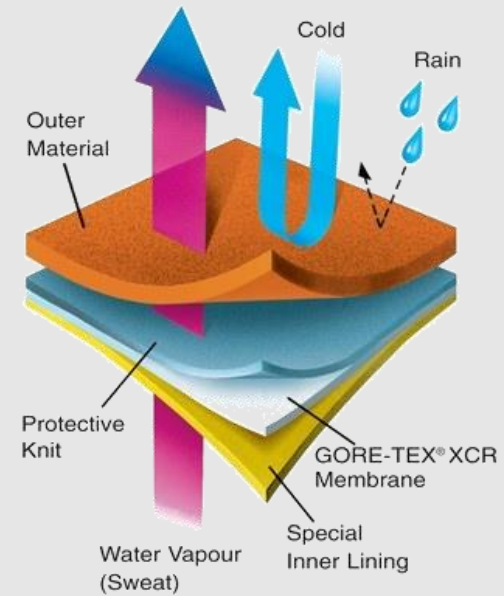


Bladder tank on polyester tissu coated with PVC

Textile treatment

Lamination

Assembling several layers that at least one is a textile layer
waterproof-breathable membrane



Composites

Using textile surface as composite materials reinforcement

Textile Reinforced Concrete: concrete matrix and
glass or carbon textile reinforcement





Agriculture



Construction
&
Engineering



Medical
&
Hygiene



Geotextiles



Interiors



Sport



Industry



Environment



Transport



Protection



Packaging



Clothing

Applications

Applications: Transport

- Ensuring aesthetic, comfort and safety functions
- 11 kg of textiles are used in the passenger compartment of a vehicle



Seatbelt on high tenacity polyester



Viscose high tenacity for tire reinforcement



Airbags on Polyamide



Nonwoven filters



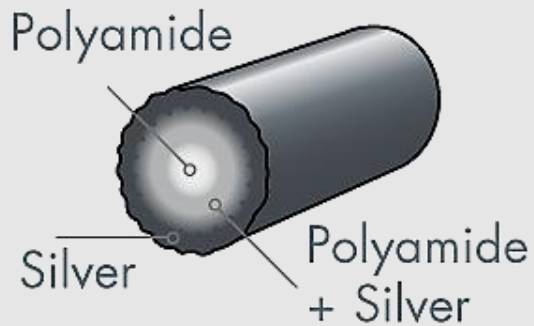
Airbus A380 cells from Hexcel composite



3D woven fabric for aerospace

Applications: Protection

- protection against heat and flames
- protection against static electricity



Fibres SilveR.STAT®
protection statique et bactérienne
dans les textiles



Antistatic sewing thread



Knitted gloves of Kevlar®

- protection against mechanical risks

Applications: Medical

Non-implantable
materials

Pad
Bandage
Plaster ...



Implantable materials

Suture
Vascular graft
Artificial ligaments
Vascular bypass ...



Hygiene products

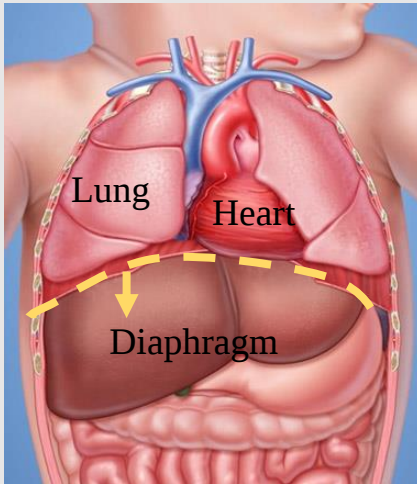
Surgical cloth
Wipes ...



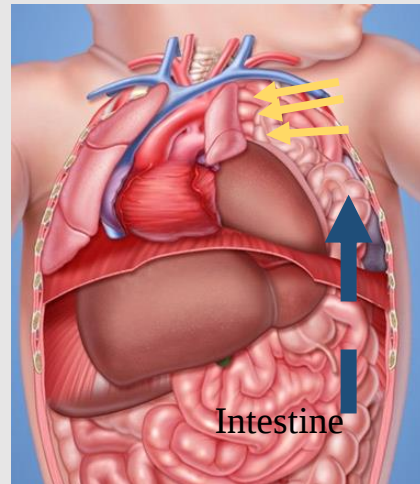
Applications: Medical

Congenital Diaphragmatic Hernia (CDH) disease

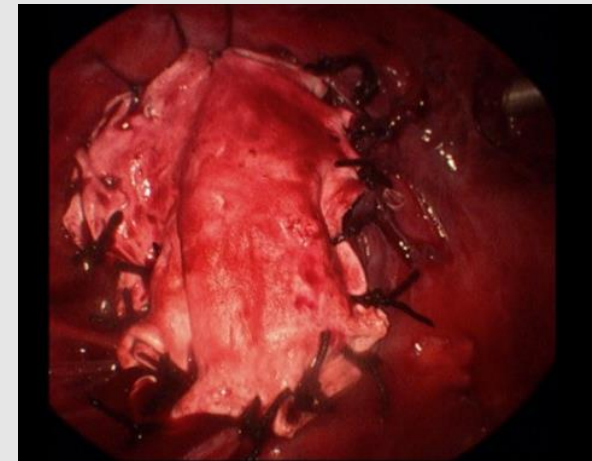
Normal baby



Baby with CDH



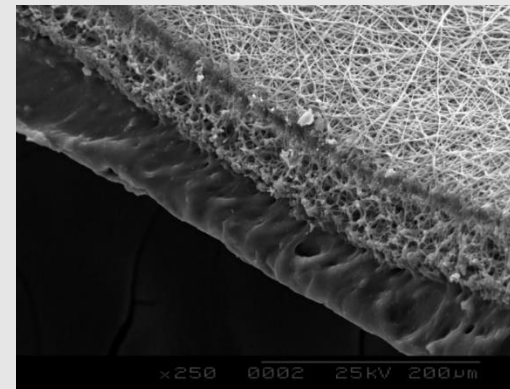
Treatment in the case of large orifice



e-PTFE prosthesis

- Abnormal opening in baby diaphragm
- 158 case in France, 2011

Electrospun membrane as a candidate!?



SEM images of double-faced membrane

All questions are welcome...