NEW TEXTILES
FIBER

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http://newtextiles.media.mit.edu/
sisal, cotton, wool, steel, carbon, cotton, aluminum, copper, hemp, polyester-acrylic
STAPLES AND FILAMENTS

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MEASURING FIBERS

• Diameter
  – micrometers

• Length
  – Staples and tow: centimeters or inches
  – Filaments: kilometers or miles

• Denier
  – The weight in grams of 9000 meters of fiber or yarn

• Tex
  – The weight in grams of 1000 meters of fiber or yarn

• Denier per filament (dpf)
MEASURING FIBERS cont.

• Abrasion resistance
• Flexibility
• Tenacity
  – Force required to break yarn
• Elongation
  – Percent elongation at break
• Elastic recovery
  – Percentage of return to original length
• Absorbency
  – Moisture percentage of weight
• Conductivity
NATURAL FIBERS

- **Plant**
  - Seed fibers: Cotton
  - Bast (plant stem) fibers: flax, ramie, hemp
  - Leaf fibers: pina, sisal

- **Protein**
  - Wool
  - Silk
  - Spider silk
MANUFACTURED FIBERS

• Regenerated
  – Rayon (Viscose)
  – Acetate
  – Lyocell
  – Bamboo

• Synthetic
  – Nylon
  – Polyester
  – Acrylic
MANUFACTURED FIBERS cont.

- Elastomers
  - Rubber: Neoprene
  - Spandex (Lycra, Elastane)
- Aramid
  - Kevlar
- Glass
- Metal
- Carbon
- Asbestos
HOW FIBERS ARE MADE

1. A “dope” is prepared
   chemical or heating process creates a viscous solution

2. Dope is extruded through “spinneret”
   filament is produced

3. Fiber is solidified
   chemical or cooling process hardens filament
HOW FIBERS ARE MADE cont.
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1. Polymerization of Raw Material
   Chemicals are reacted under pressure to form a polymer resin that is extruded as fiberlike strands or as a solid sheet and then cut into chips. The chips are melted in an autoclave and pumped to the spinneret. Delustrants or other additives may be combined with the melt.

2. Extrusion and Cooling
   The melt is pumped through the spinneret. It emerges in strands. The size of the fiber is determined by the size of the holes and the speed with which the fiber is withdrawn from the spinneret. The fibers are cooled by contact with cold air. The same melt is used for either filament or staple.

3. Drawing or Stretching after Cooling
   Filament fibers can be drawn four to five times their original length to orient the molecular chains and develop the fiber's mechanical properties and hand. The fibers are heat-set and wound on cones or spools.
   Staple fibers emerge as undrawn tow. It is drawn, combed and heat-set, cut to the desired length, and baled.

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