

NEW TEXTILES

FIBER

Leah Buechley

MIT Media Lab

<http://newtextiles.media.mit.edu/>



steel



wool



sisal



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



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MANUFACTURED FIBERS

- Regenerated
 - Rayon (Viscose)
 - Acetate
 - Lyocell
 - Bamboo
- Synthetic
 - Nylon
 - Polyester
 - Acrylic



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MANUFACTURED FIBERS cont.

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



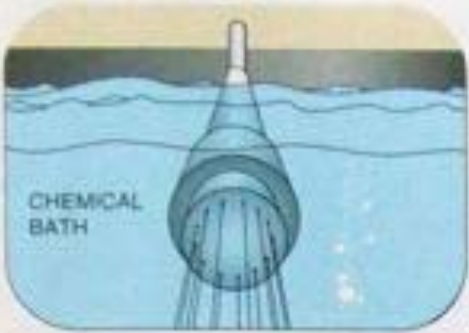
Asbestos fibers (Public domain photo)

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.

Wet Spinning: Acrylic, Lyocell, Rayon, Spandex




The diagram shows a spinneret at the top with a central tube and an outer sheath. A fiber is spun from the spinneret into a blue liquid labeled 'CHEMICAL BATH'. The fiber is shown as a bundle of strands.

1. Raw material is dissolved by chemicals.
2. Fiber is spun into chemical bath.
3. Fiber solidifies when coagulated by bath.

Oldest process
Most complex
Weak fibers until dry
Washing, bleaching, etc., required before use
Solvent may be recovered and reused

Dry Spinning
Acetate, Acrylic, Modacrylic, Spandex (Major Method)

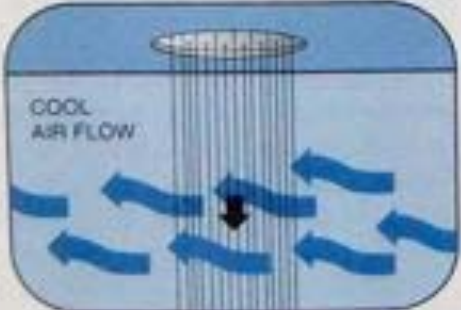


The diagram shows a spinneret at the top with a central tube and an outer sheath. A fiber is spun from the spinneret into a yellowish air stream. Red arrows indicate 'WARM AIR FLOW' around the fiber.

1. Resin solids are dissolved by solvent.
2. Fiber is spun into warm air.
3. Fiber solidifies by evaporation of the solvent.

Direct process
Solvent required
Solvent recovery required
No washing, etc., required

Melt Spinning: Nylon, Olefin, Polyester, Saran

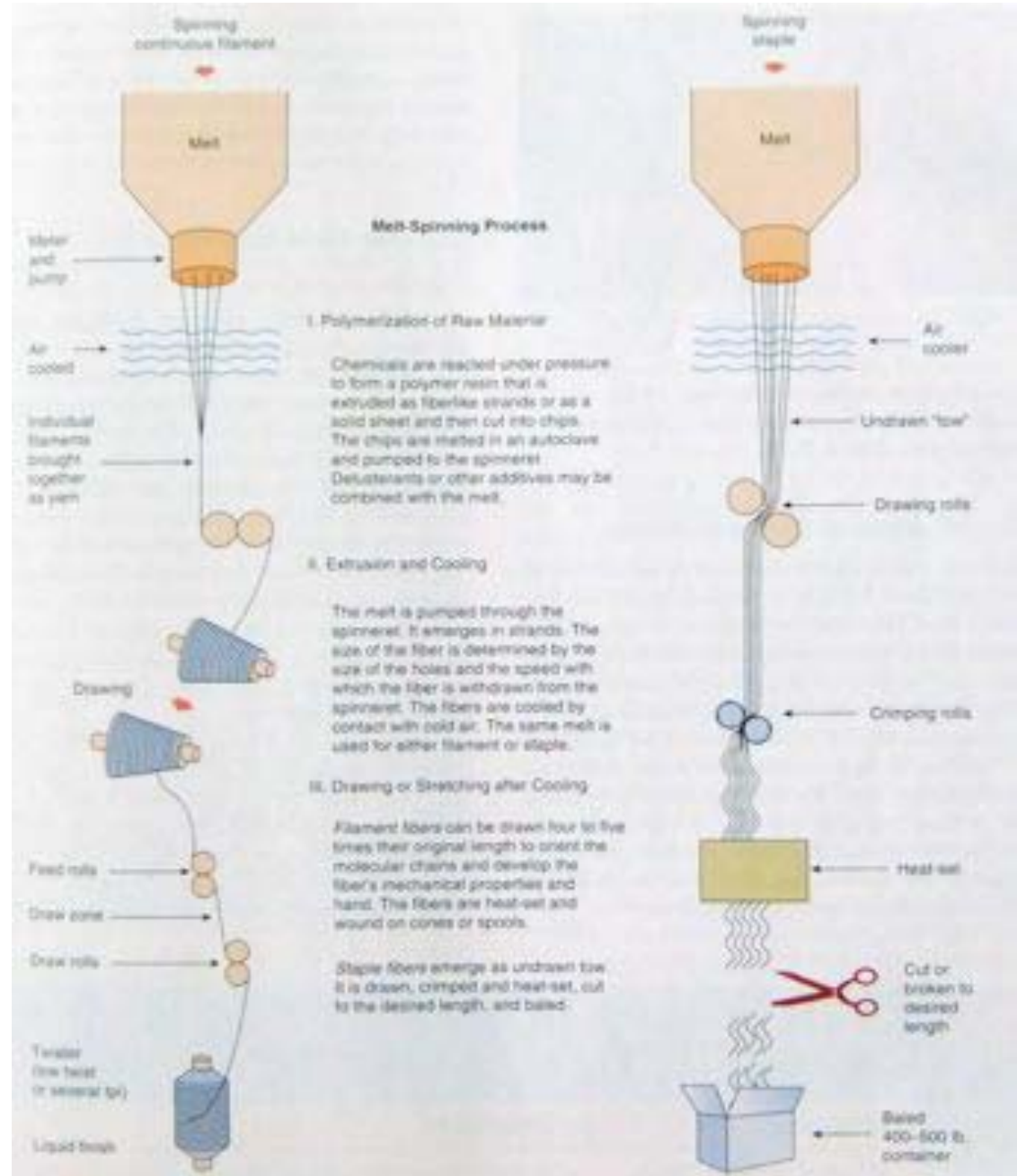


The diagram shows a spinneret at the top with a central tube and an outer sheath. A fiber is spun from the spinneret into a blue air stream. Blue arrows indicate 'COOL AIR FLOW' around the fiber.

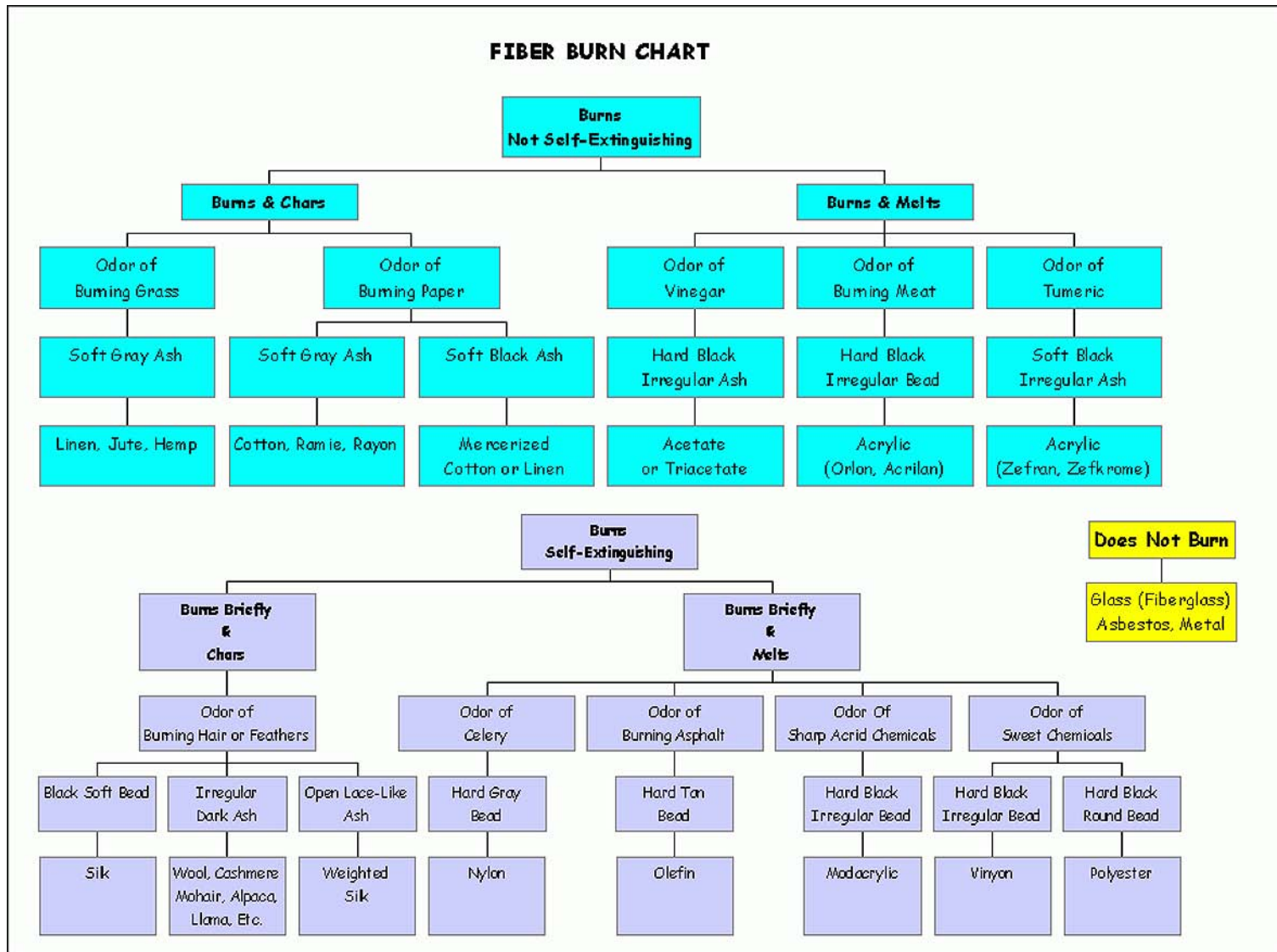
1. Resin solids are melted in autoclave.
2. Fiber is spun out into the air.
3. Fiber solidifies on cooling.

Least expensive
Direct process
High spinning speeds
No solvent, washing, etc., required
Fibers shaped like spinneret hole

HOW FIBERS ARE MADE cont.



IDENTIFYING FIBERS: BURN TEST



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MAS.962 Special Topics: New Textiles
Spring 2010

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