Intro to Nonwovens for PPE

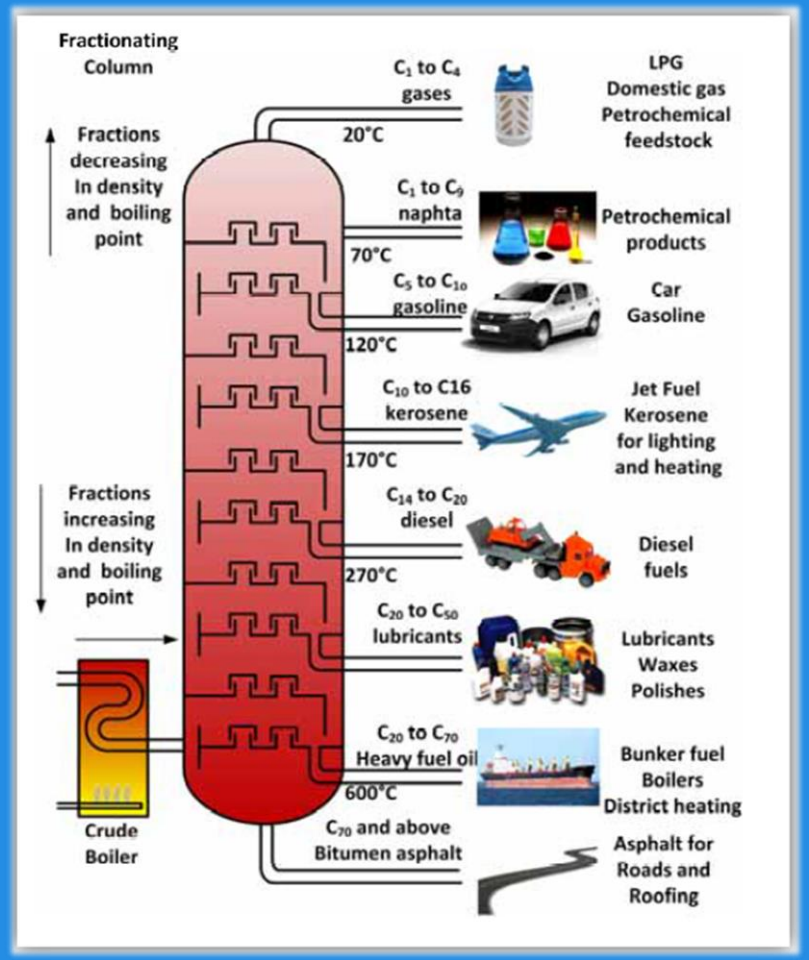
Nonwovens Processes and Products overview for PPE currently in demand

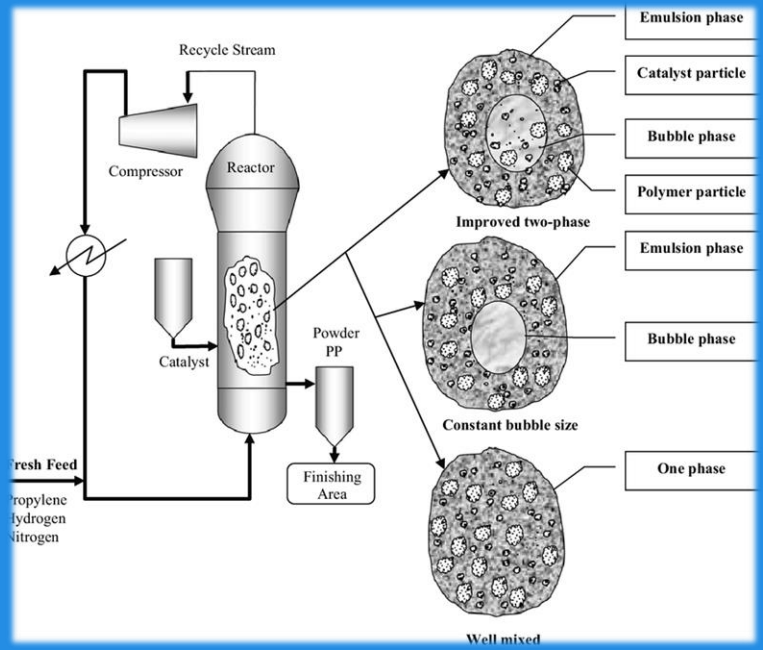
Nonwovens used in PPE

- Spunbond
- Flashspun
- Meltblown
- SMS
- Wet laid
- Many types of spunbond as well, we will focus on the most commonly used in medical PPE

- Many others, nonwovens is a large and varied industry
- Web Formation
  - Carding
  - Wet lay
  - Air lay
- Bonding
  - Hydroentagling
  - Needle punch
  - Resin bond
  - Through air bonding

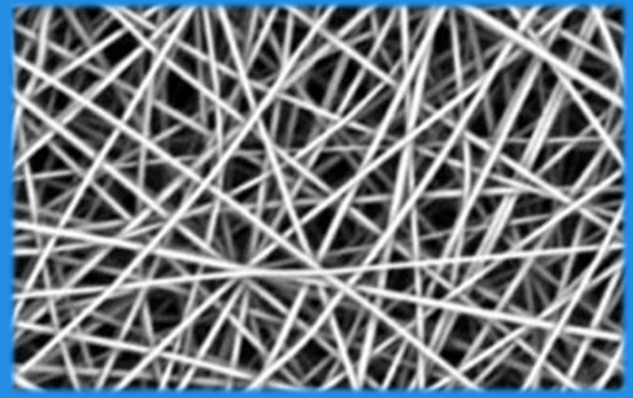
Mostly Polypropylene and other olefins





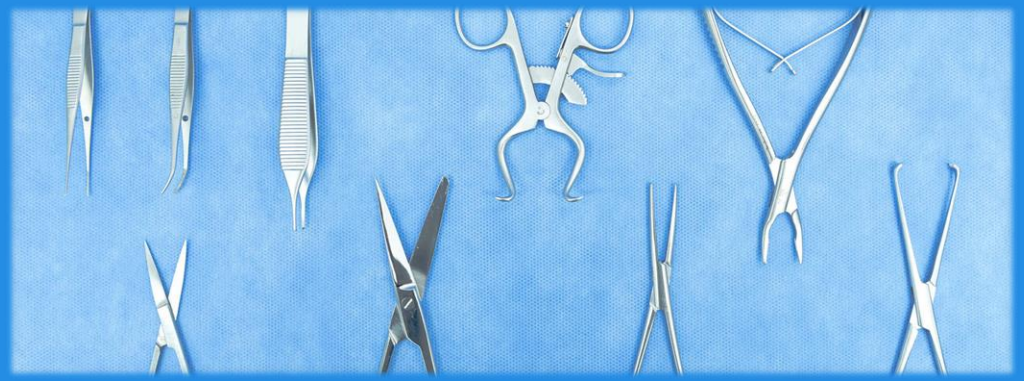
Spunbond

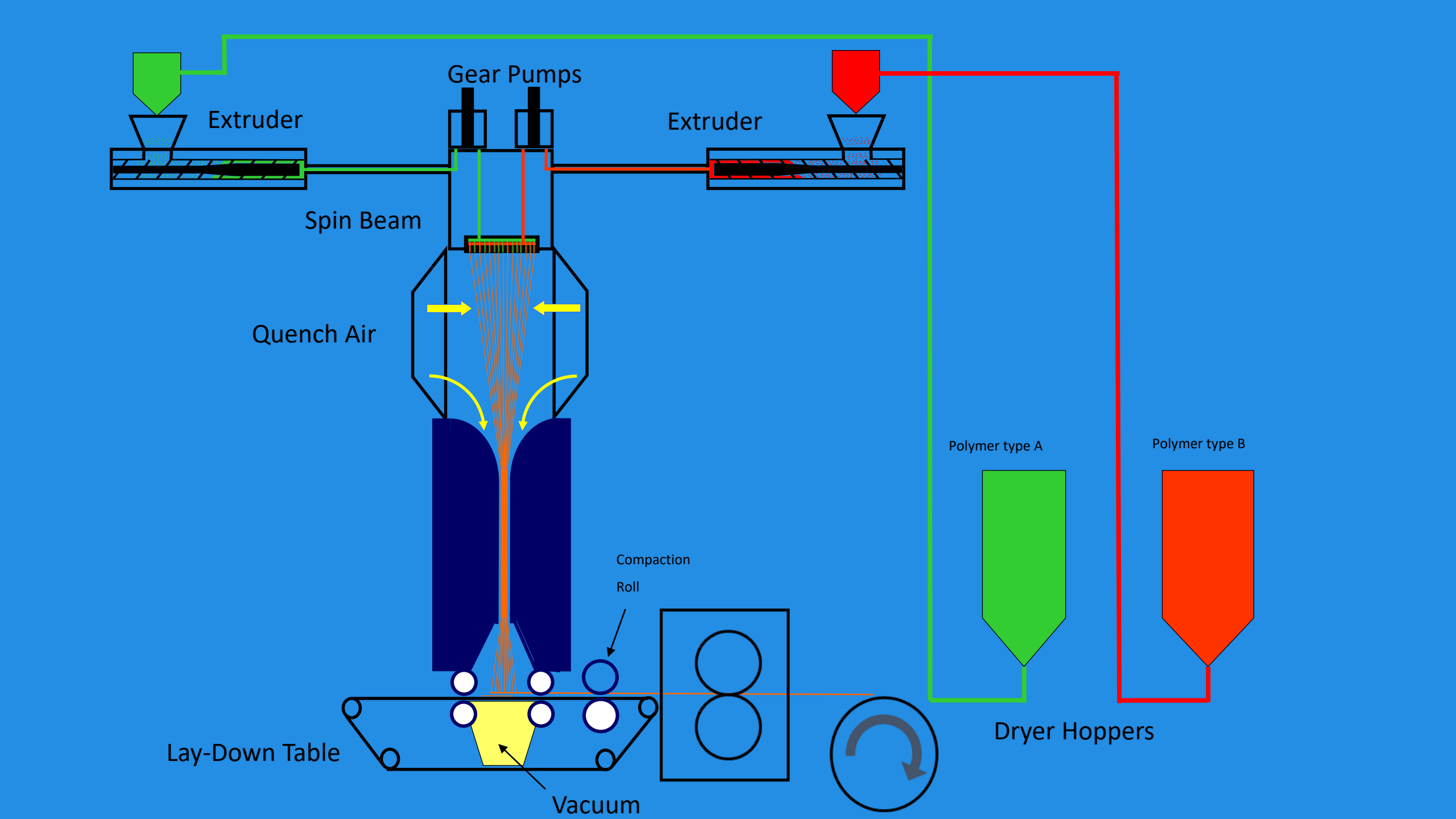
- One step continuous process
- Can make 3 tonnes an hour and more
- Fabrics is made at 600 to 800 MPM or 20-30 MPH
- Various basis weights for multiple applications typically 10 – 75 g/m^2
- $1oz/yd^2 = 28.3\ g/m^2$
- Fiber sizes 15-20 Microns
- Oriented fibers with significate strength
- Naturally hydrophobic
- Can coat with chemicals for added functionality
- Fiber Orientation distribution is very uniform
- Very economical

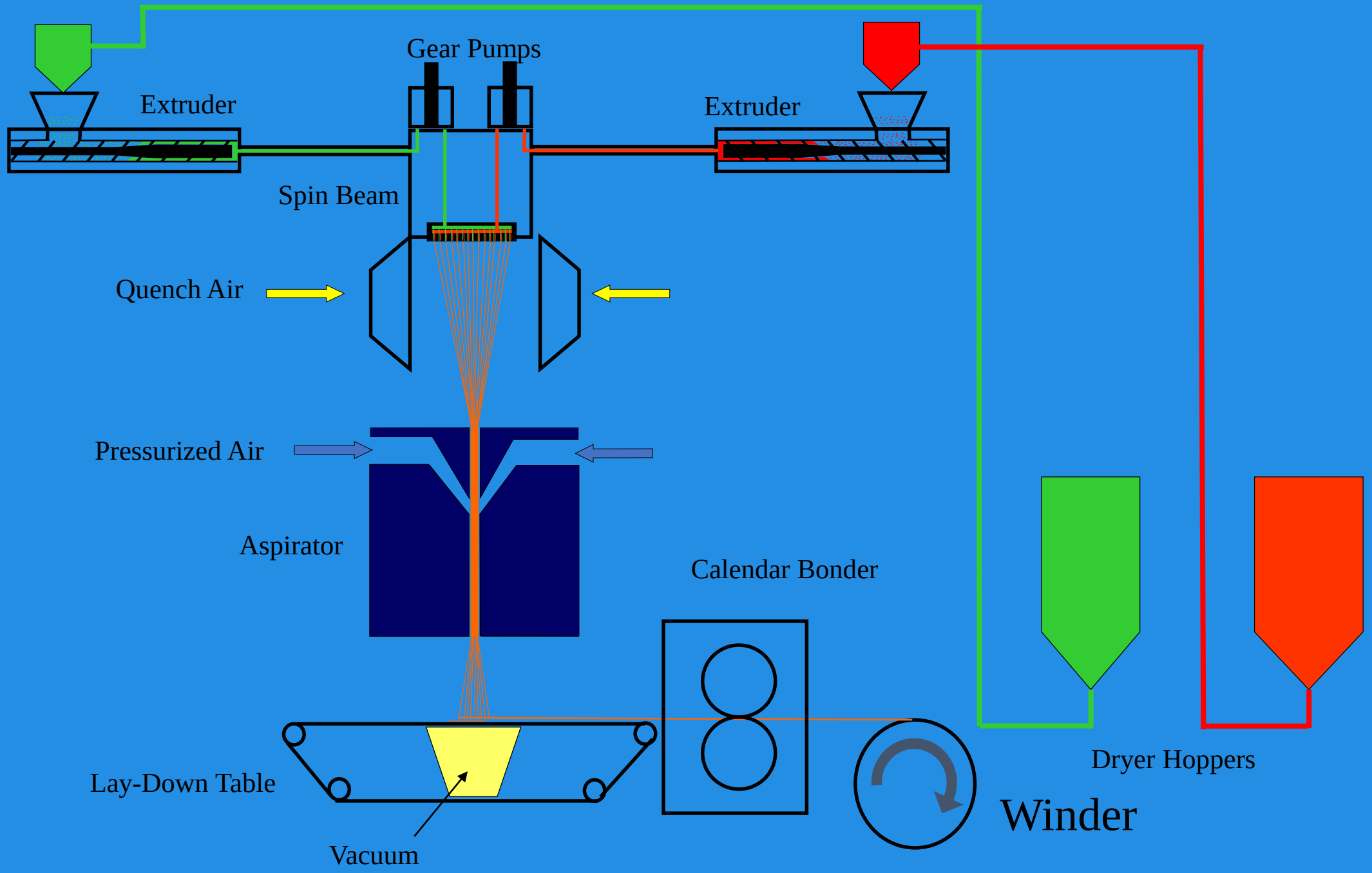


Spunbond

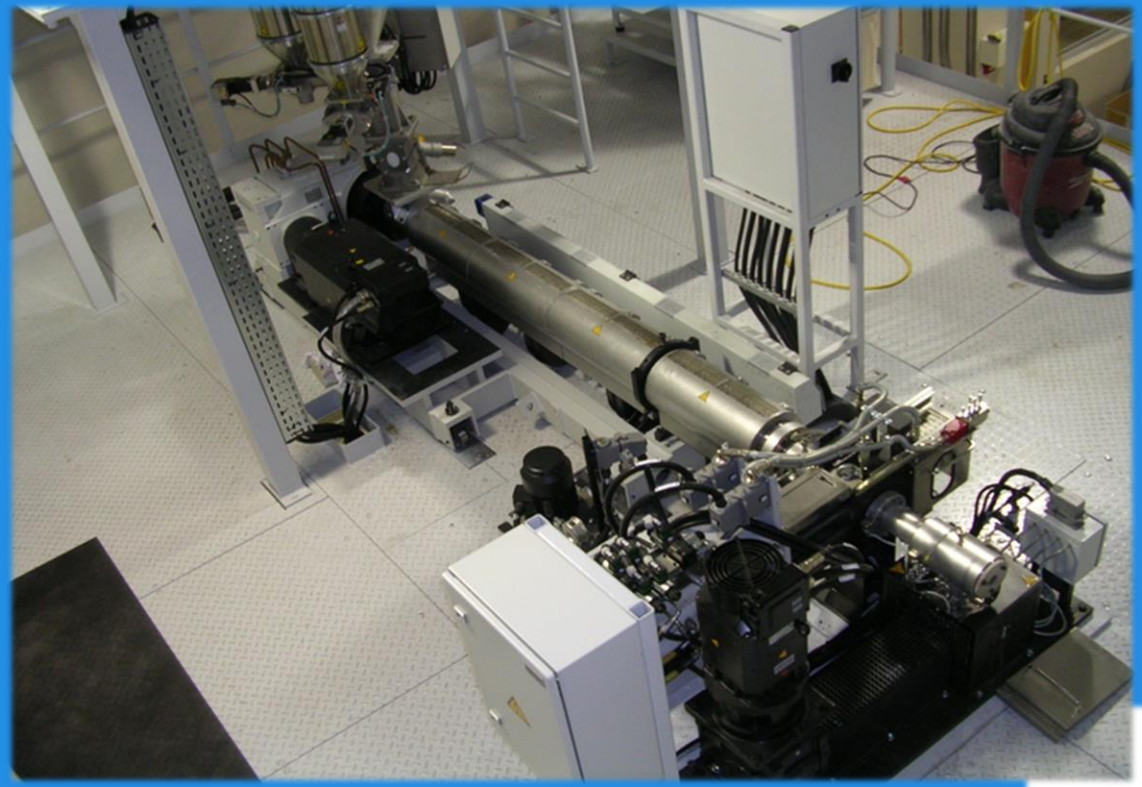
- Can be stitched or ultrasonically bonded to for conversions
- Examples
  - Hygiene
  - Medical
  - Geotextile
  - Furnishings

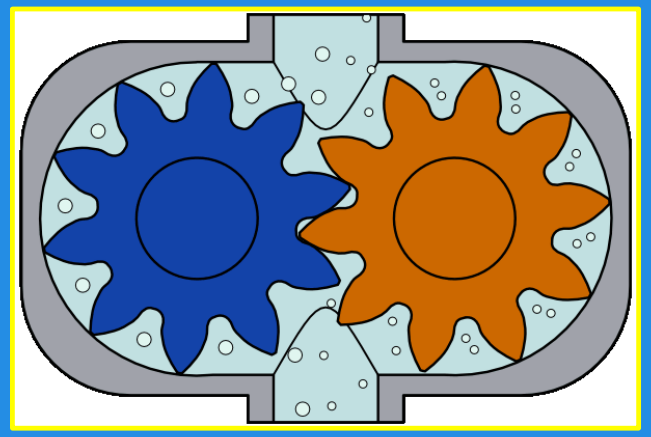


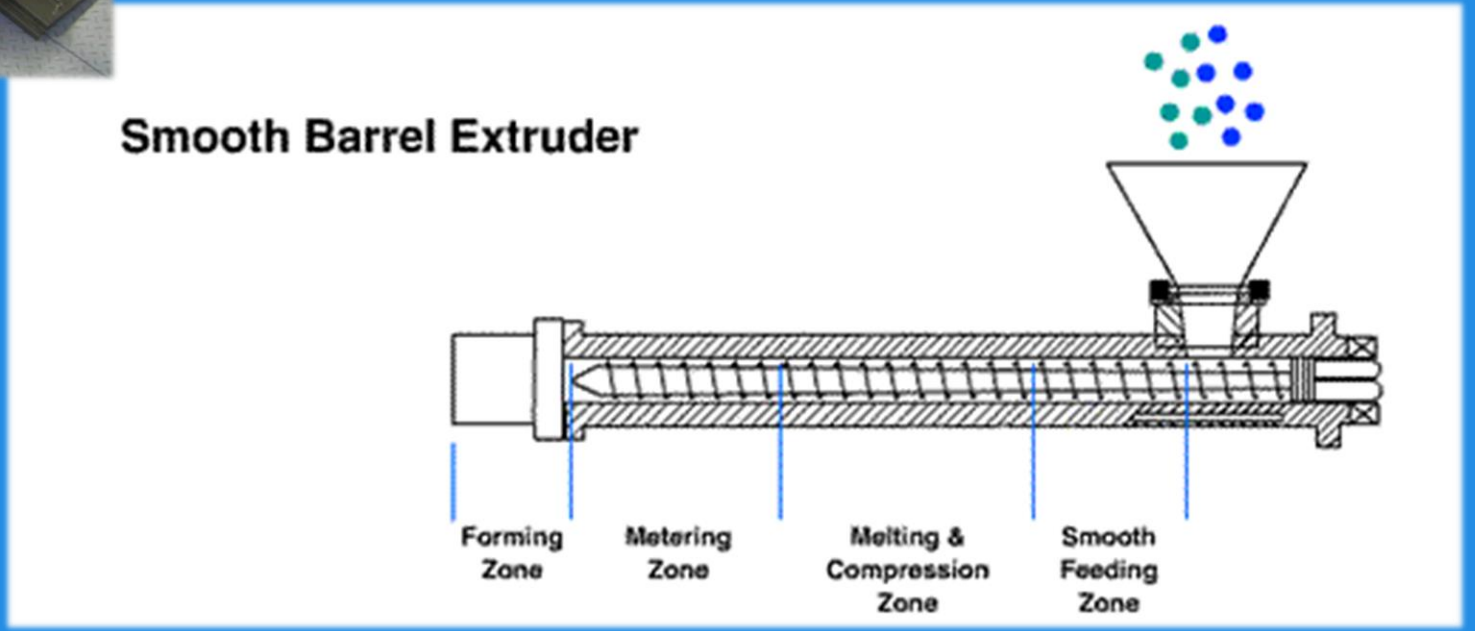

Gear Pumps
Extruder
Extruder
Spin Beam
Quench Air
Polymer type A
Polymer type B
Compaction
Roll
Dryer Hoppers
Lay-Down Table
Vacuum


Gear Pumps
Extruder
Extruder
Spin Beam
Quench Air
Pressurized Air
Aspirator
Calendar Bonder
Dryer Hoppers
Lay-Down Table
Vacuum
Winder

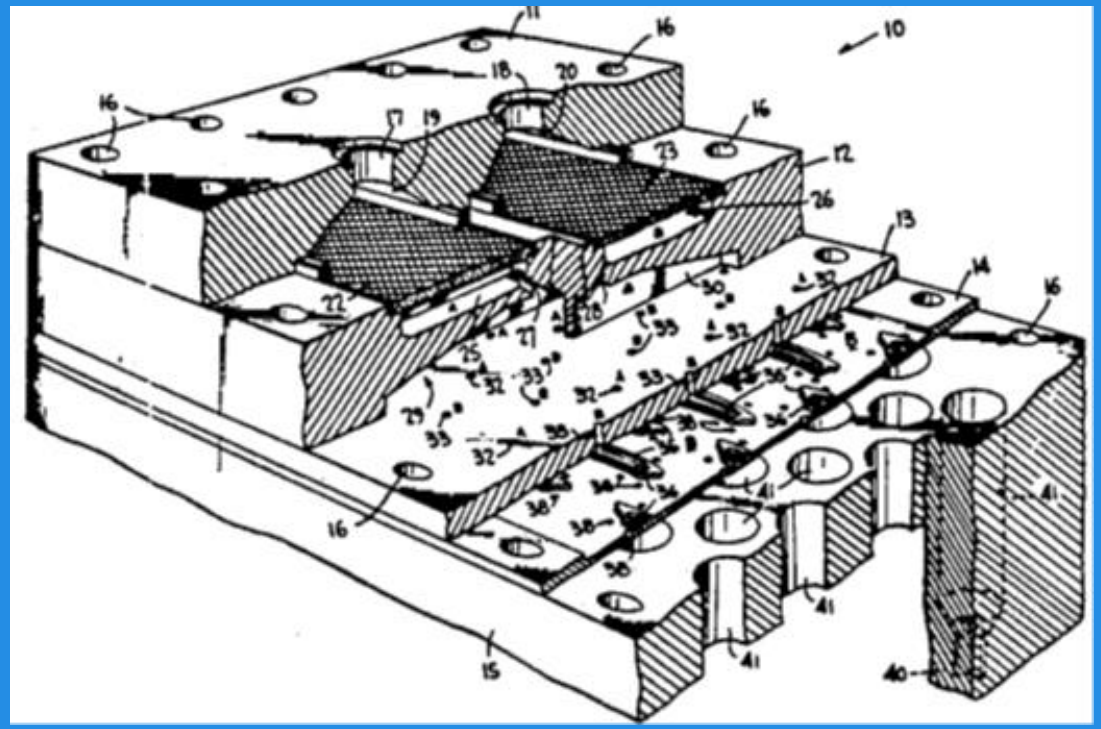
Quick note on extrusion

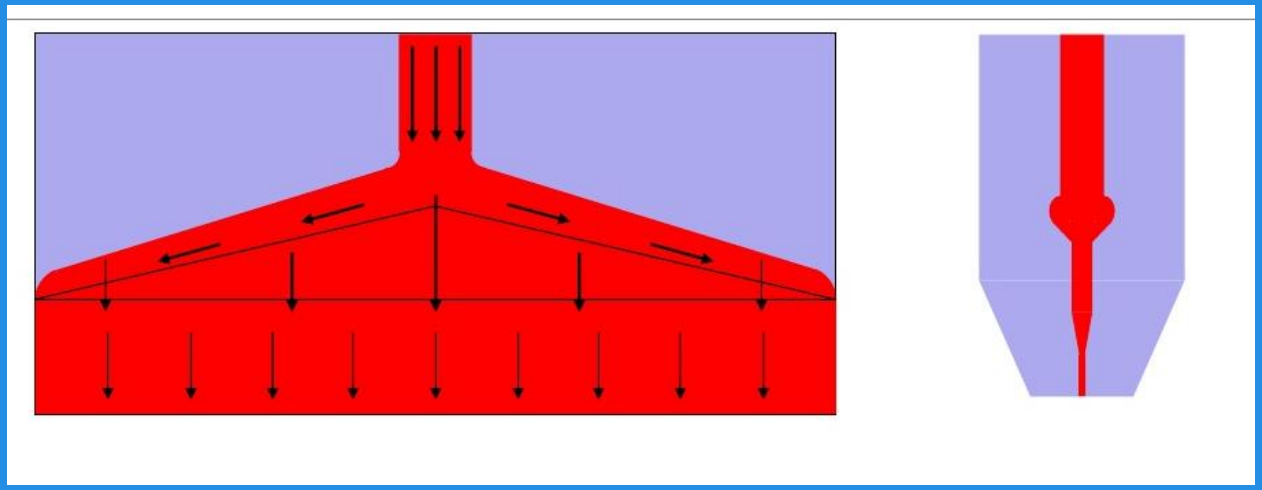






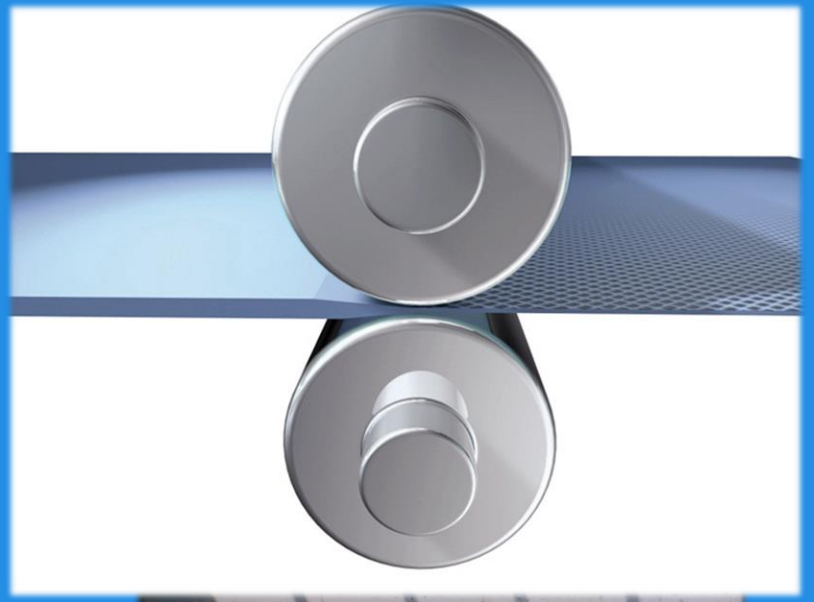
Quick note on extrusion

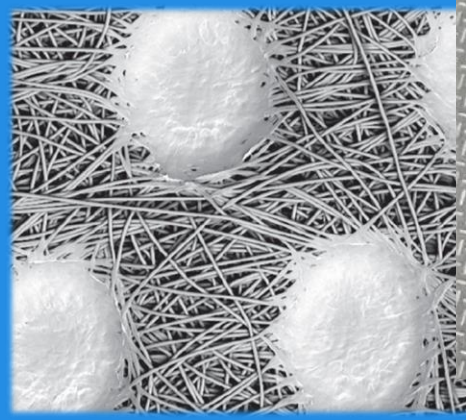


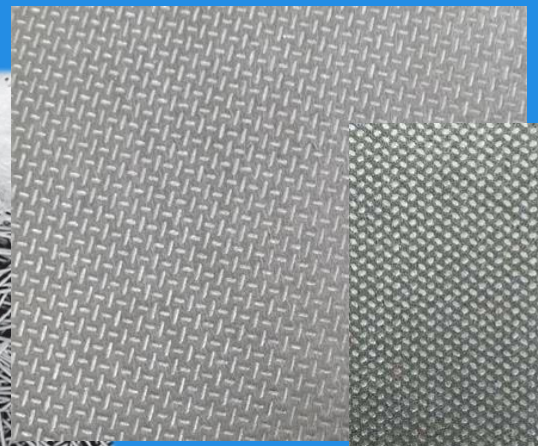


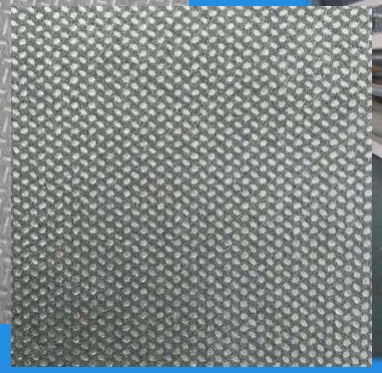
Quick note on bonding

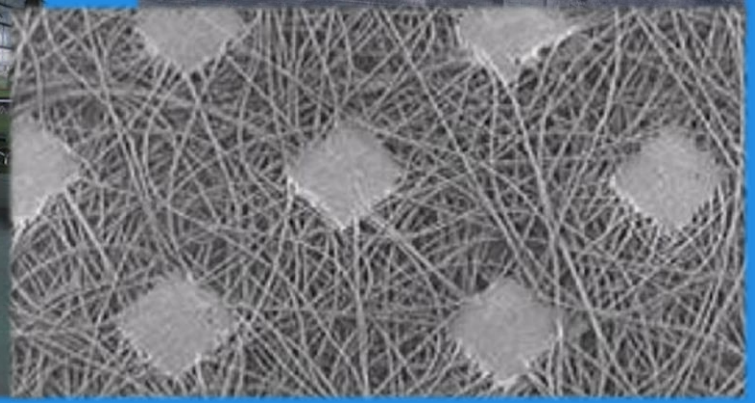
- Pont bonding
- 13-15%
- Heat and pressure
- Precise pressure along a wide roll
- Flatter calender, porosity goes down, filtration goes up









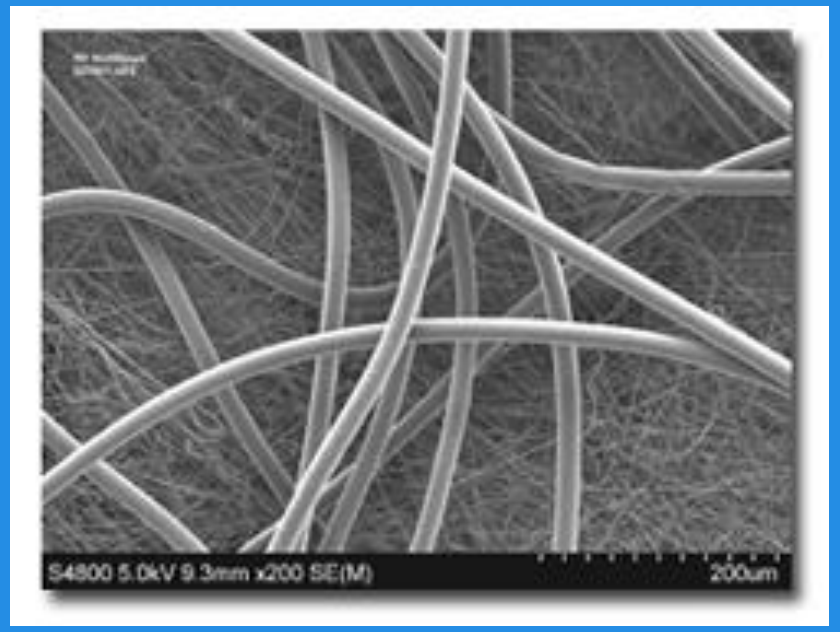


Flashspun(Tyvek)

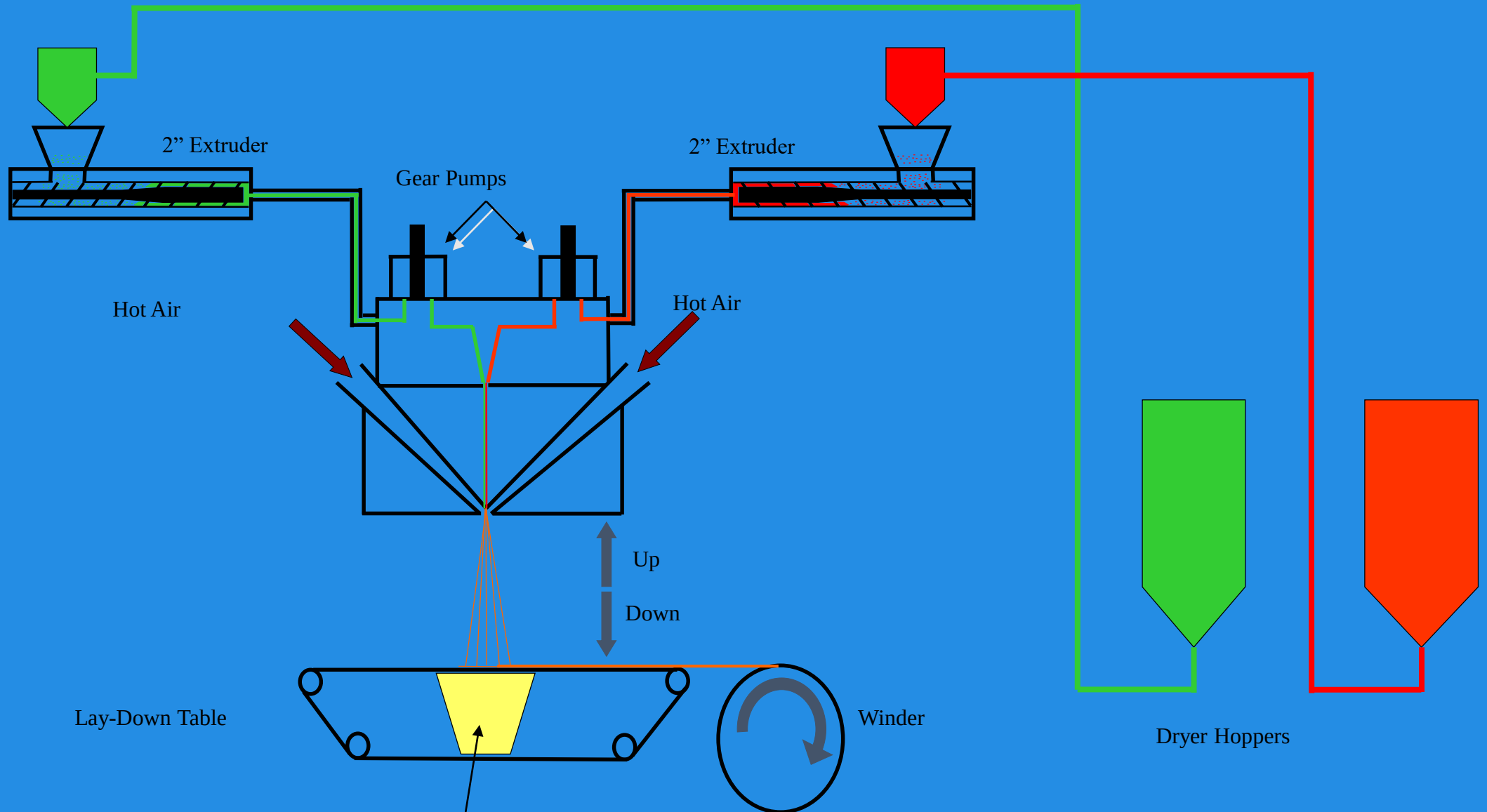
- HDPE
- In solvent
- Rapid expansion from nozzle makes .5 to 10 micron fibers
- High density fabric has good barrier properties and breathability with high tear strength
- Can be plasma treated for printing
- DuPont keeps a tight cover on the process

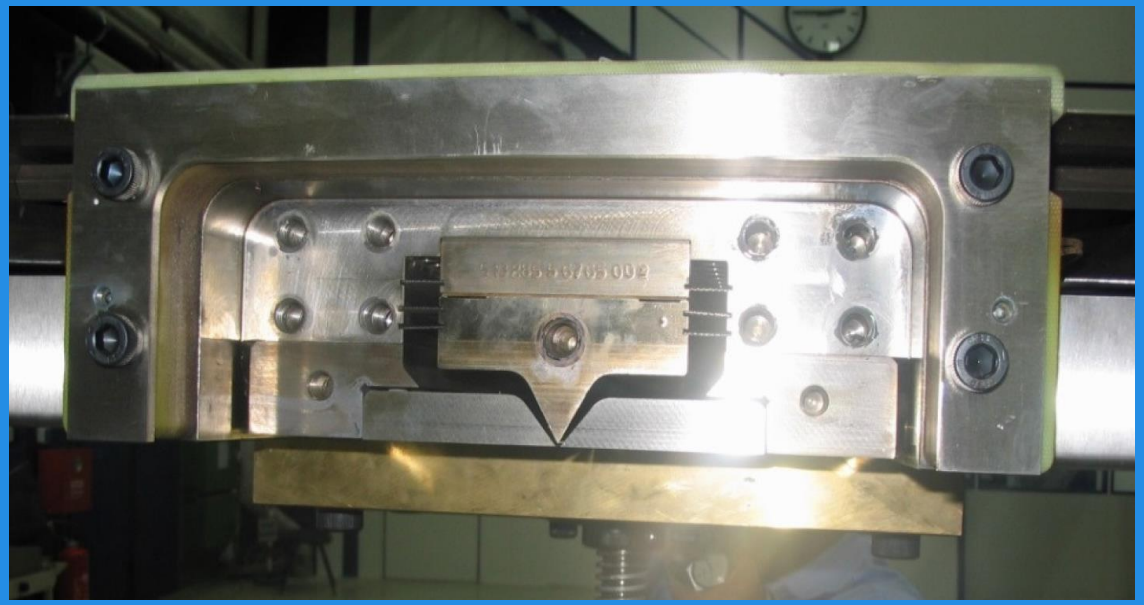
Meltblown

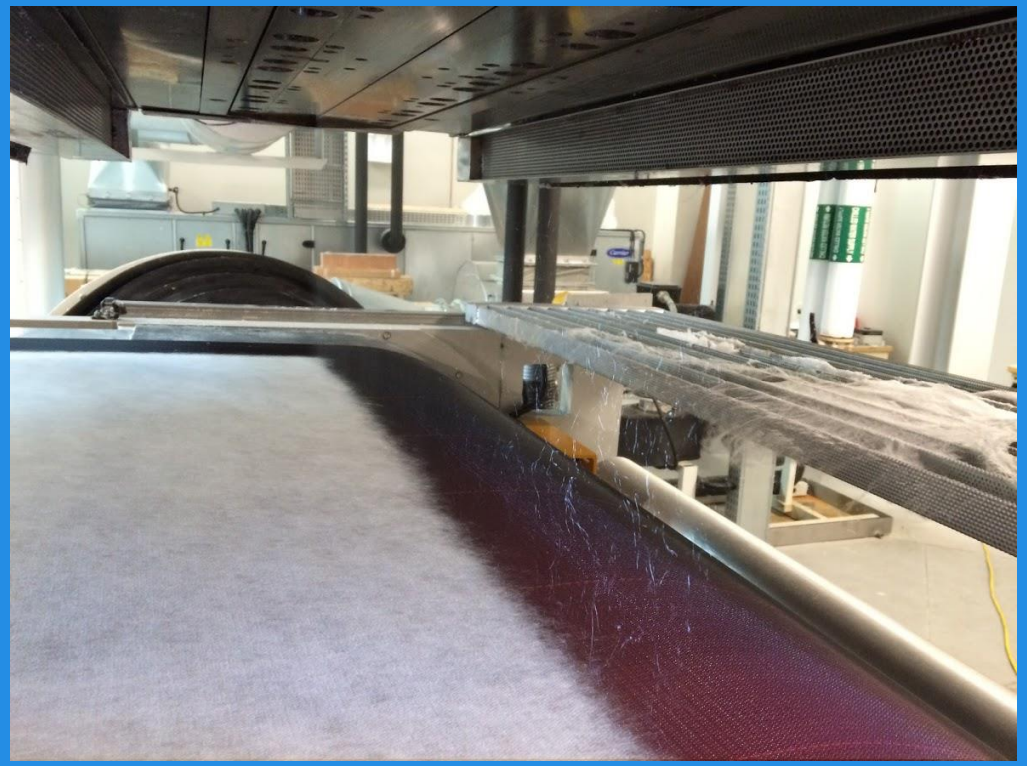
- Low caliper
- Fine fibers 1-5Microns
- Fiber Orientation distribution is very uniform
- Uniform porosity Porosity 80-90%
- Barrier properties, Hydrohead typically 40-70 cm H2O
- Oil sorbents
- Filters
- Invented by Exxon

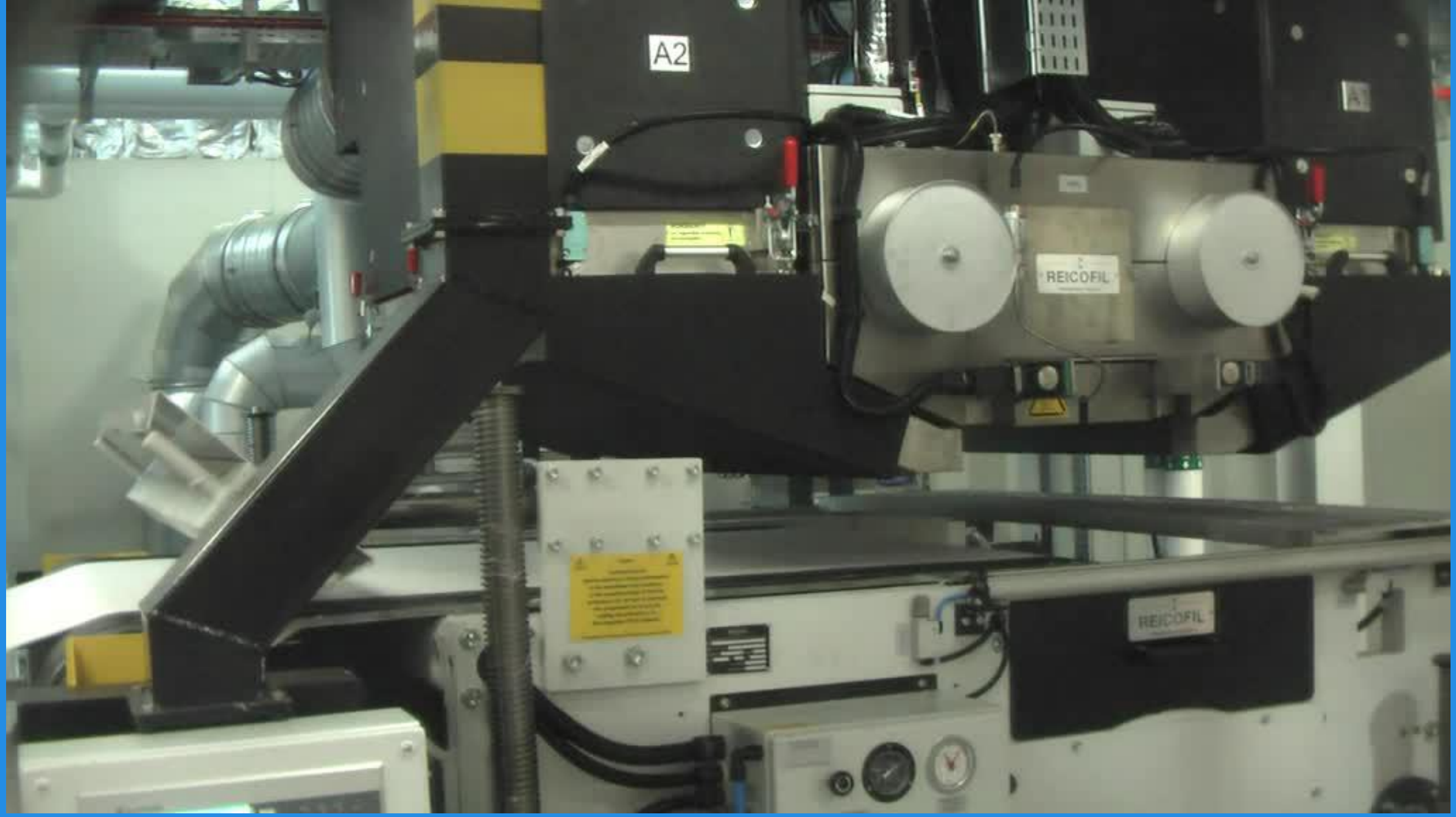


Meltblown


2” Extruder
2” Extruder
Gear Pumps
Hot Air
Hot Air
Up
Down
Lay-Down Table
Winder
Dryer Hoppers






A2
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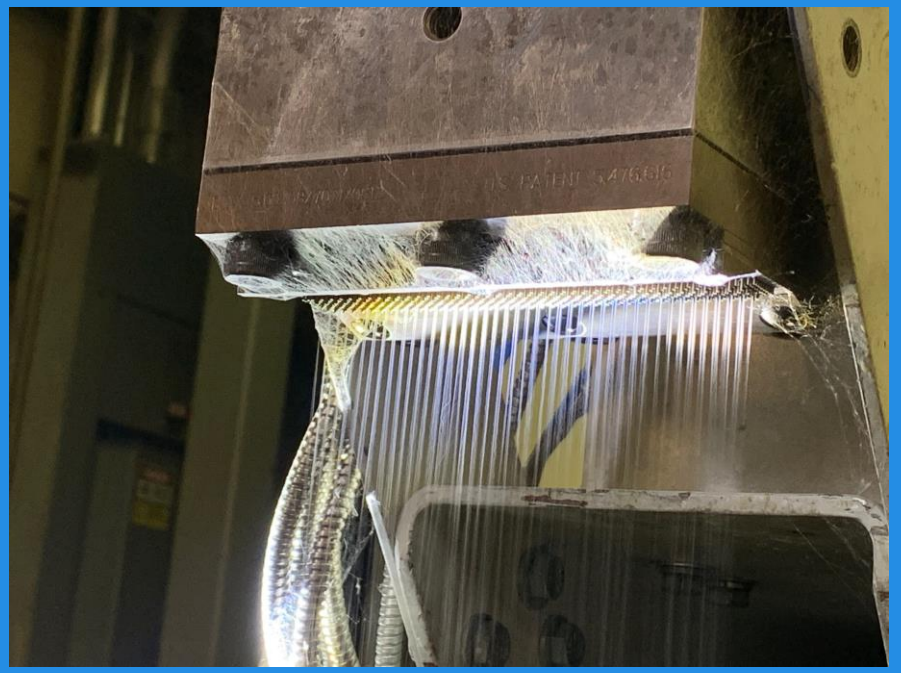
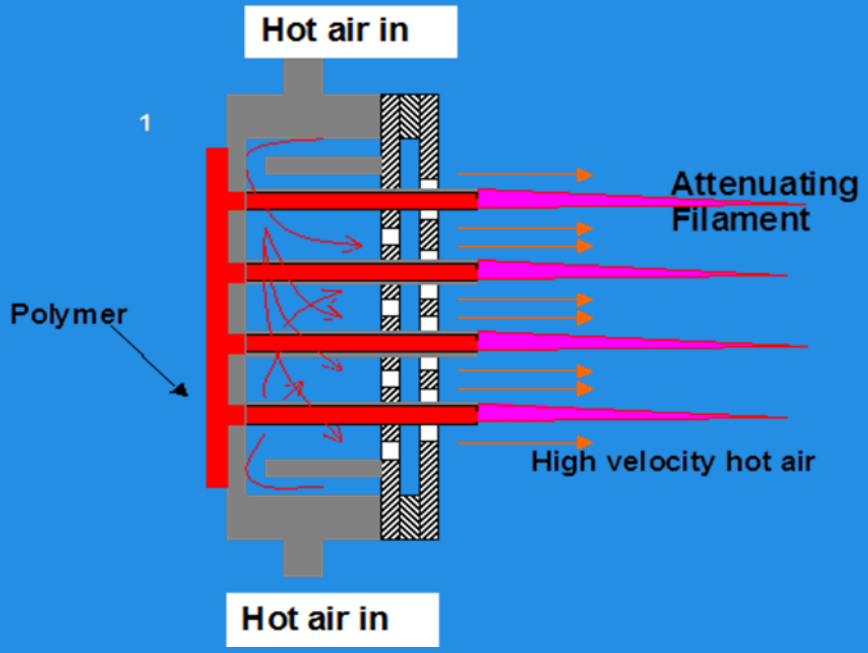
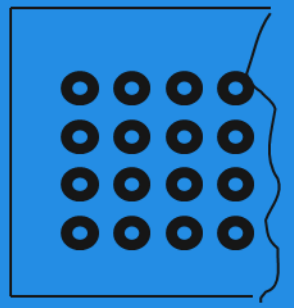
BIAX Meltblown

- AKA Concentric Meltblown
- ~10 Microns
- Lower fabric density then Exxon MB
- Can process more unique polymers

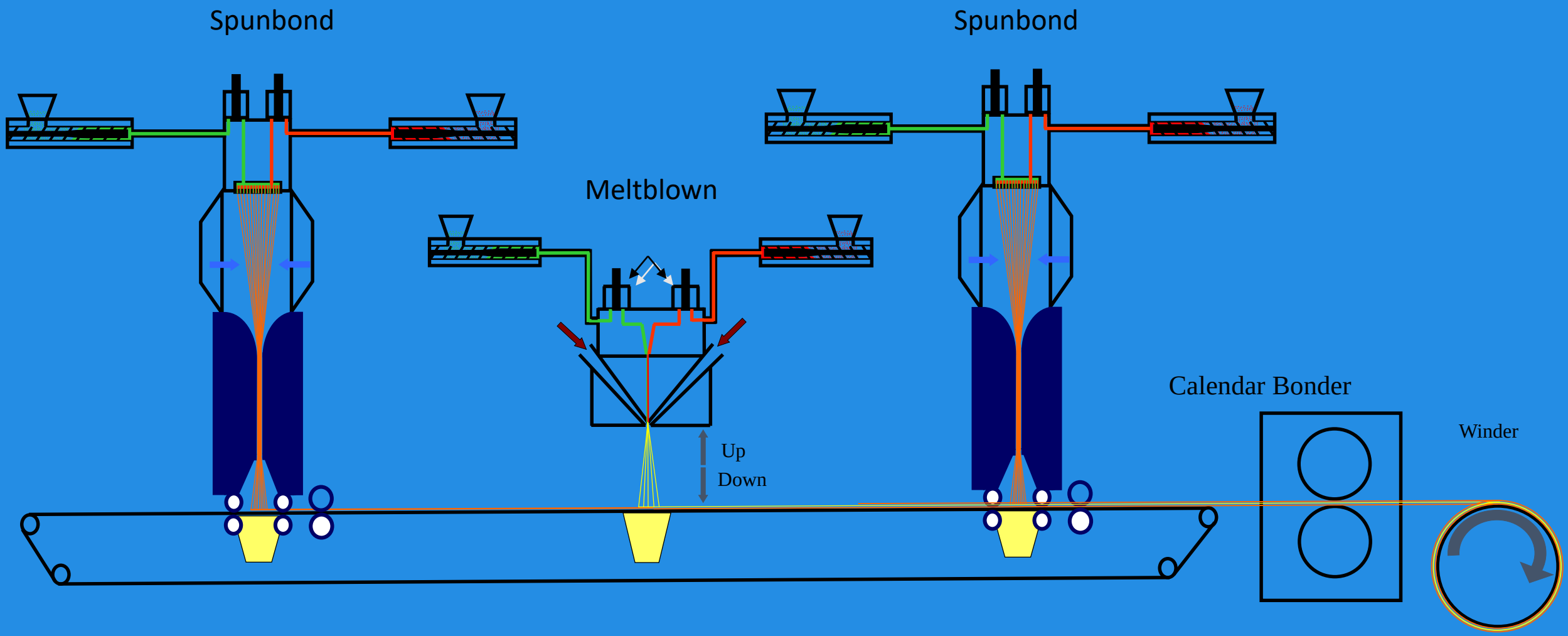






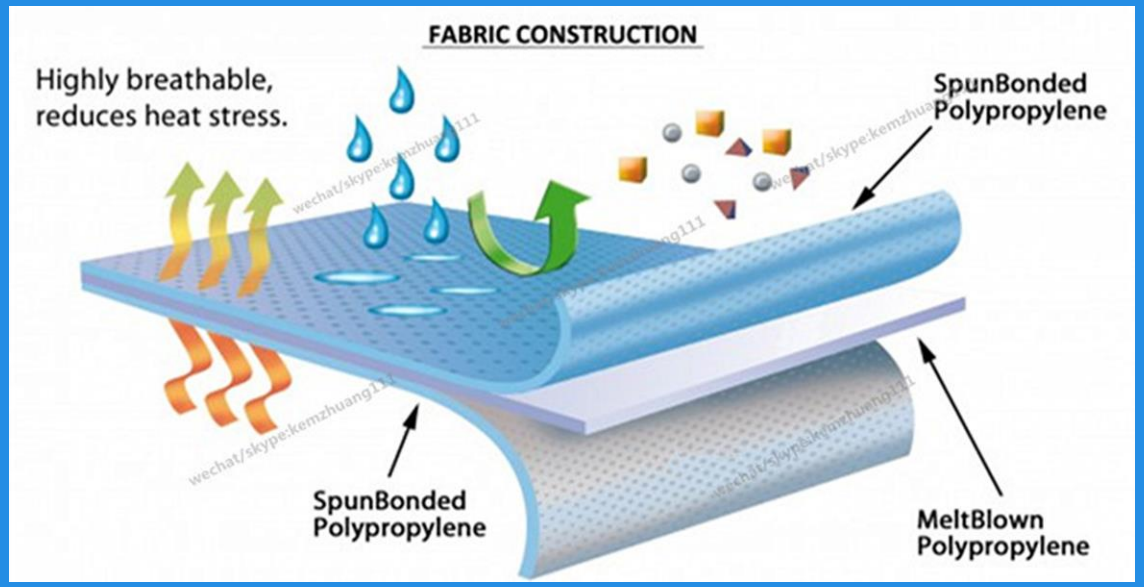
SMS

Spunbond-Meltblown-Spunbond AKA Barrier



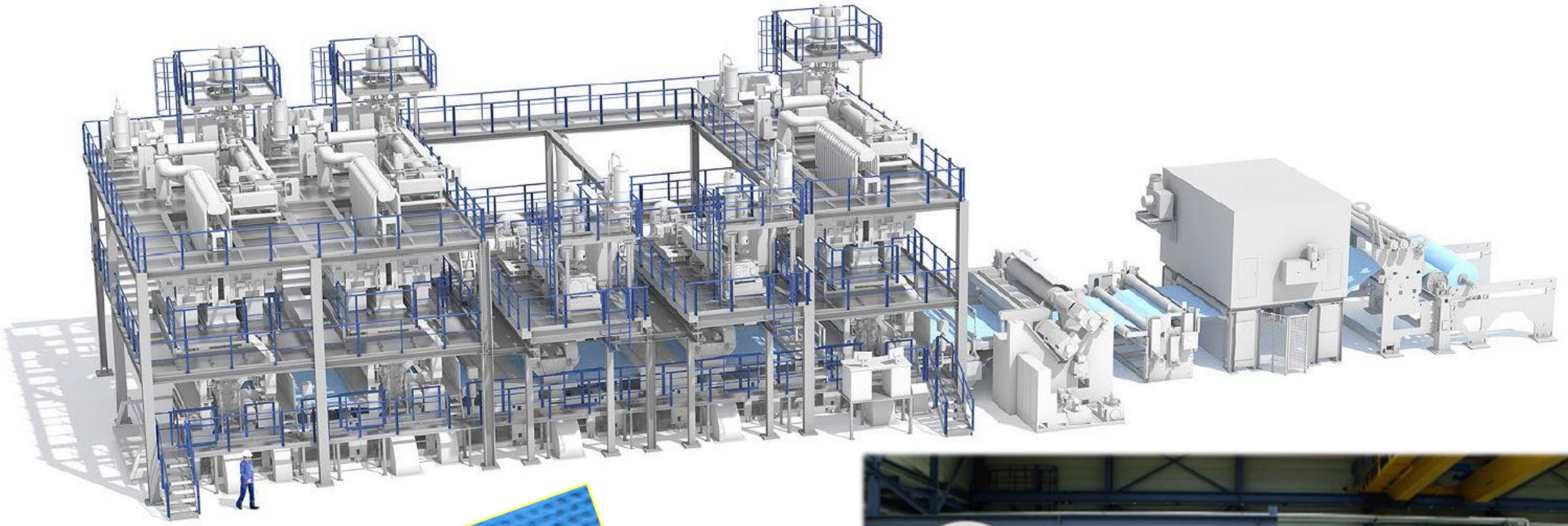
SMS

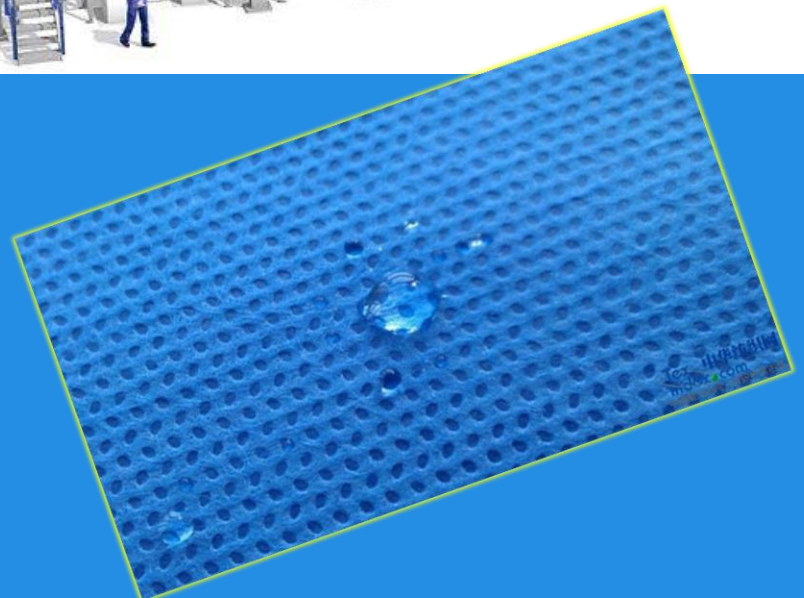
- Best of both worlds
- Meltblown barrier properties
- Spunbond strength and flexibility
- Super hydrophobic, Flurochemicals and Silicon
- Radiation sterilization
- Also treated for alcohol repellency and antistatic chemicals
- Water, blood and alcohol splash and impact resistant



https://www.golden-nonwoven.com/

https://www.cardinalhealth.com/

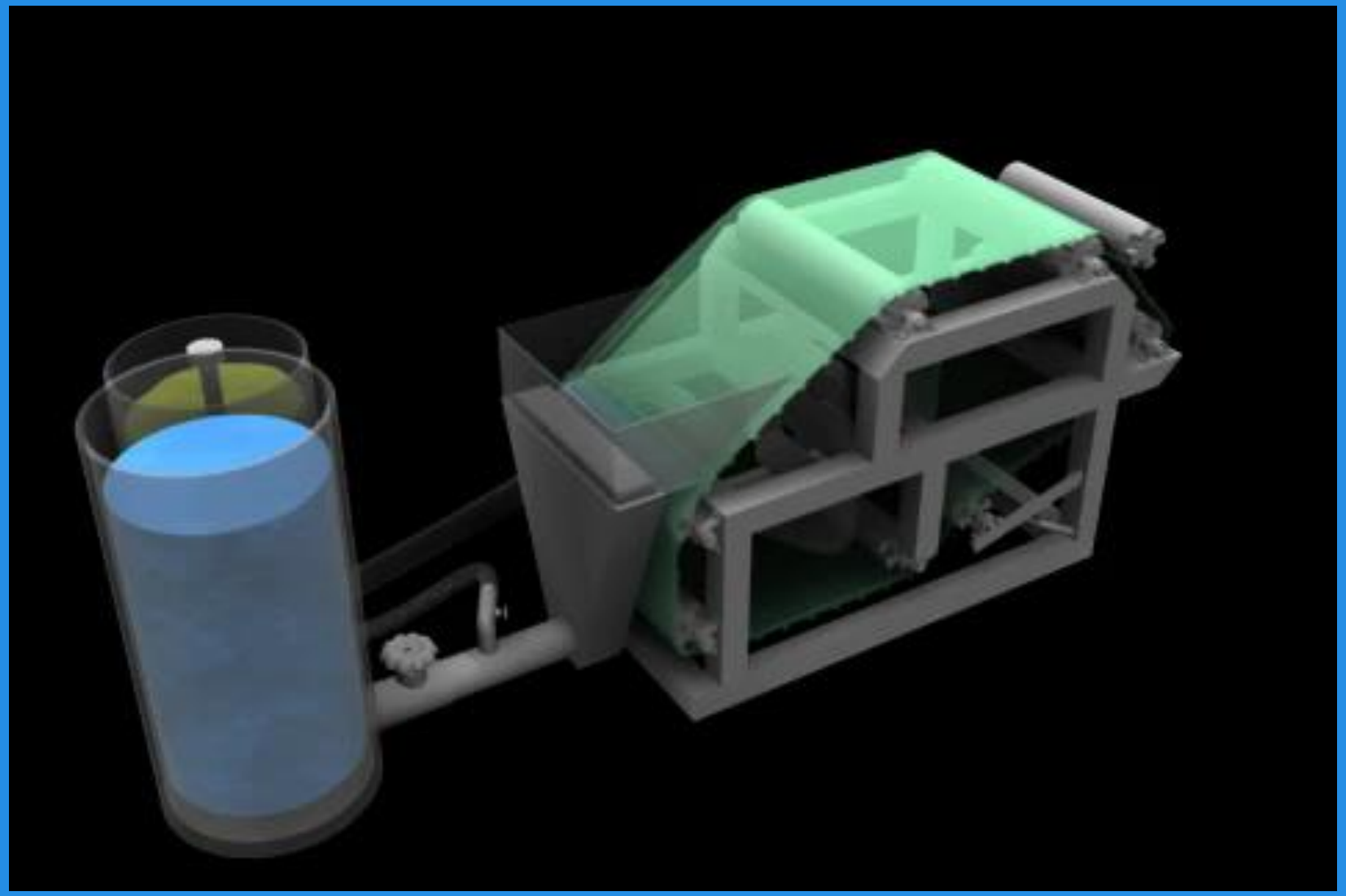




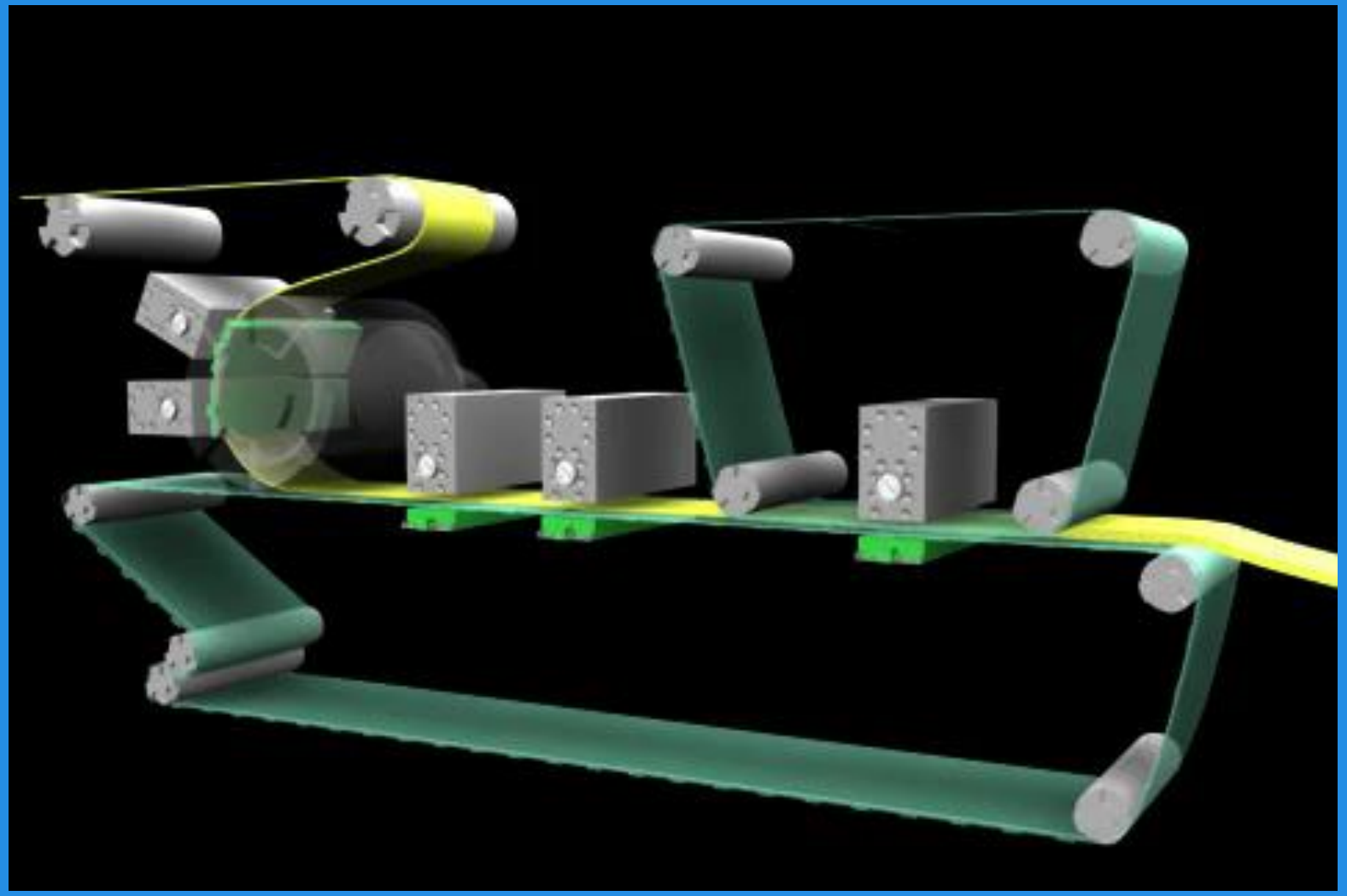
Wet laid

- Like paper making
- Then Hydroentagled
- Level 4 can be PE coated
- Can be made of short PVA, PET, wood pulp fibers
- Treated with fluorocarbons and other treatments for improved barrier properties to blood and fluids

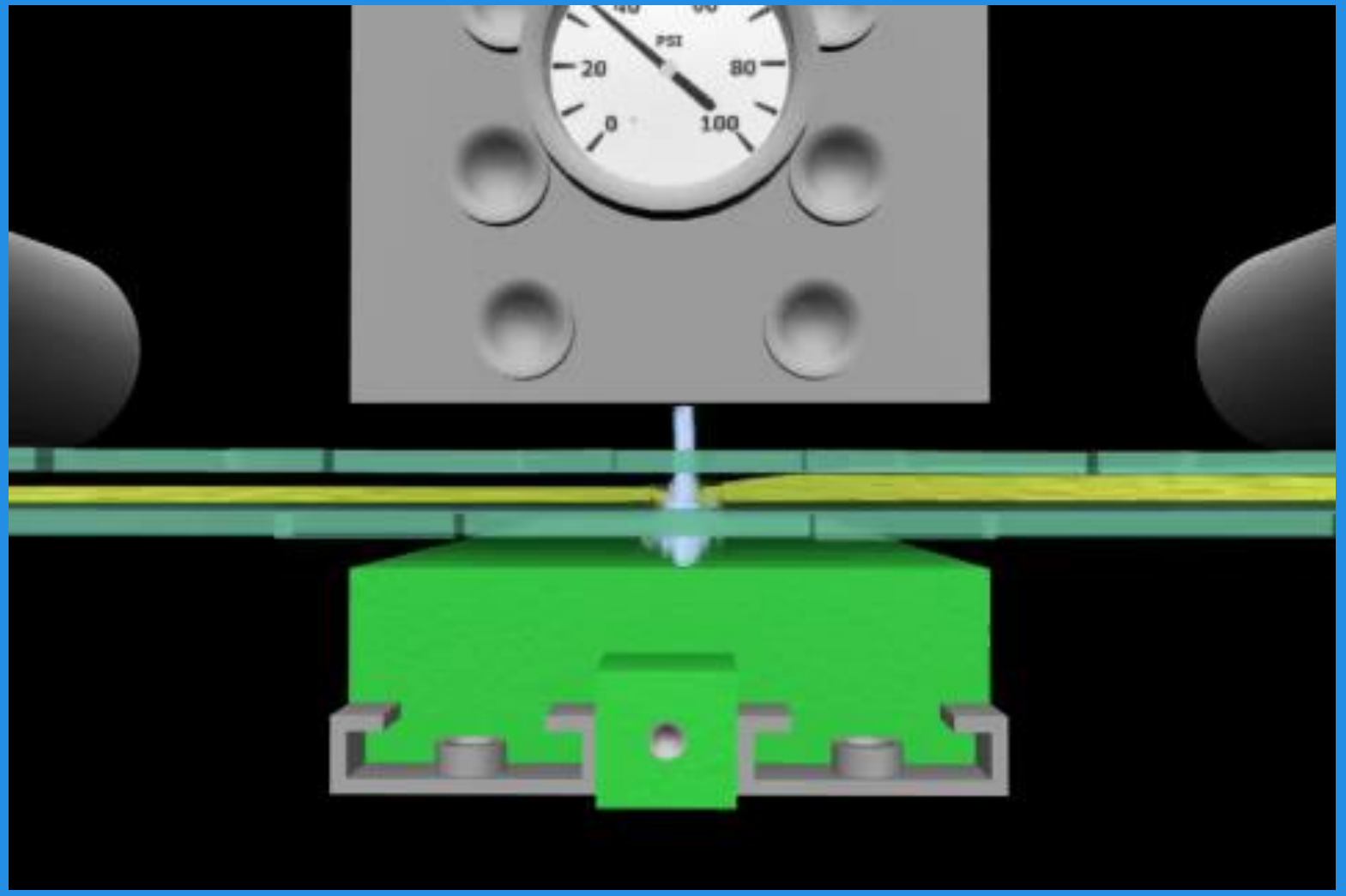
Wet laid



Hydroentangling



Hydroentangling



Barrier levels of protection

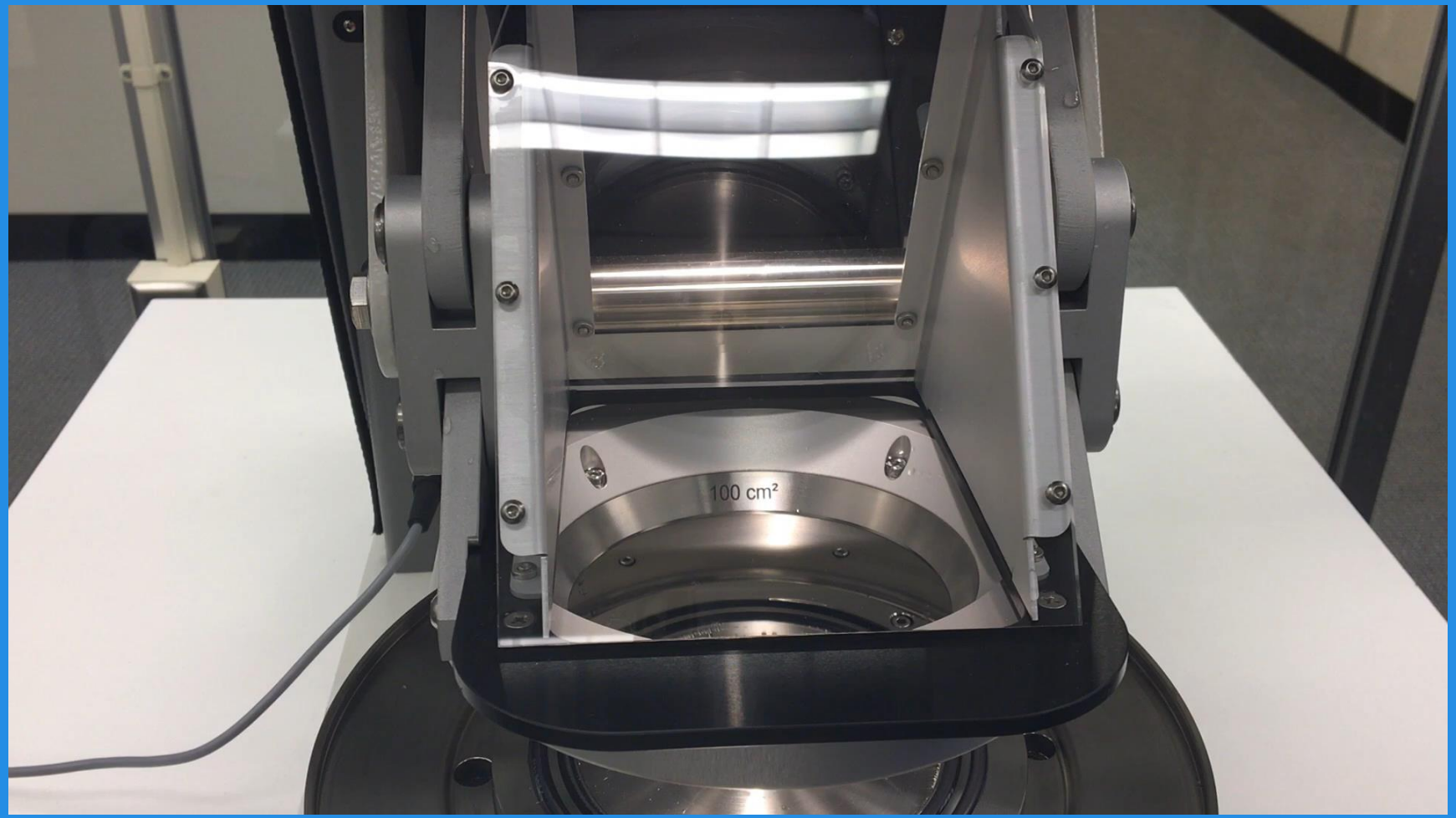
General Relationships between barrier performance and anticipated exposure ricks per AAMI specifications				
ANSI/AAMI PB70 barrier performance	Anticipated Risk Of Exposure			Examples of Procedures
	Fluid Amount	Fluid Spray or Splash	Pressure on Gown or Drape	
Level 1	Minimal	Minimal	Minimal	Simple excisional biopsies Excision of "Lumps and Bumps" Ophthalmological procedures Simple ear, nose and Throat procedures
Level 2	Low	Low	Low	Tonsillectomies and adenoidectomies Endoscopic gastrointestinal procedures Simple orthopedic procedures with tourniquets
Level 3	Moderate	Moderate	Moderate	Mastectomies Arthroscopic orthopedic procedures Endoscopic urological procedures Open gastrointestinal and genito-urinary procedures
Level 4	High	High	High	Any procedure where surgeons' hands and arms are in body

https://www.aami.org/news-resources/covid-19-updates/coronavirus-resources-for-the-field

https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/medical-gowns

Testing of barrier properties

Hydrohead



Courtesy AATCC, Join AATCC for webinars on details of test methods 5/28 an 6/3

https://www.aatcc.org/events/online/webinars/

Testing of barrier properties

Impact testing

Courtesy AATCC, Join AATCC for webinars on details of test methods 5/28 an 6/3
https://www.aatcc.org/events/online/webinars/

Face masks/respirators

- Not SMS per se
- 3-5 Layers, layered at assembly
- Spunbond top and bottom
- Meltblown in middle layer
- Sometime activated carbon layer
- Sometimes carded dirt holding layer
- Best masks have multiple layers that have decreasingly smaller fibers
- Electrostatics
- Surgical masks do not provide full protection from inhalation of airborne pathogens, such as viruses. Do have fluid resistance

Face masks

- https://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf
- https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/face-masks-and-surgical-masks-covid-19-manufacturing-purchasing-importing-and-donating-masks-during

Questions

- Join us next time for overview of filtration