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/m²
- 1oz/yd² = 28.3 g/m²
- 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
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 1-5 Microns
- 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
BIAX Meltblown

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

Spunbond

Meltblown

Spunbond

Calendar Bonder

Winder
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 risks per AAMI specifications

<table>
<thead>
<tr>
<th>ANSI/AAMI PB70 barrier performance</th>
<th>Anticipated Risk Of Exposure</th>
<th>Examples of Procedures</th>
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<tr>
<td></td>
<td>Fluid Amount</td>
<td>Fluid Spray or Splash</td>
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<tr>
<td>Level 1</td>
<td>Minimal</td>
<td>Minimal</td>
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<tr>
<td>Level 2</td>
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<tr>
<td>Level 3</td>
<td>Moderate</td>
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<tr>
<td>Level 4</td>
<td>High</td>
<td>High</td>
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</tbody>
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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

Questions

• Join us next time for overview of filtration