

The background of the image is a close-up, macro shot of a dark, textured surface covered with numerous water droplets of varying sizes. The droplets are bright and reflective, creating a shimmering effect against the dark, slightly grainy background. The lighting is soft, highlighting the spherical shape of the droplets.

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# **Membranes for Textile and Garment Applications**

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Stand number: A 39



# Why use Membranes

- Membranes are used inside a garments
  - Typically they are laminated to the outer fabric with an adhesive
- They are used to make the garment:
  - Waterproof/ Windproof
    - Offer protect against the winter elements to keep you warm and dry
  - Breathable
    - so perspiration (sweat) can move through the membrane to the outside of the garment
    - allowing the user to feel comfortable



# Why use Membranes

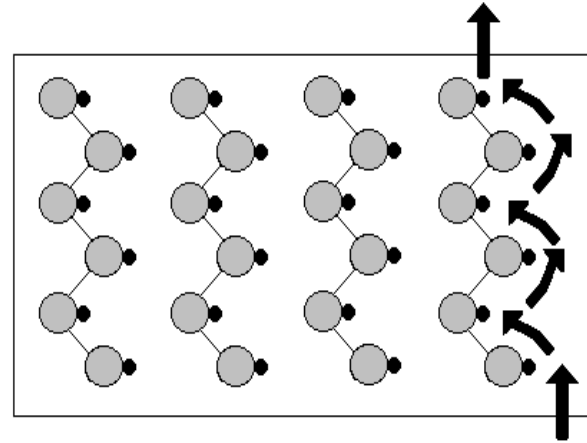
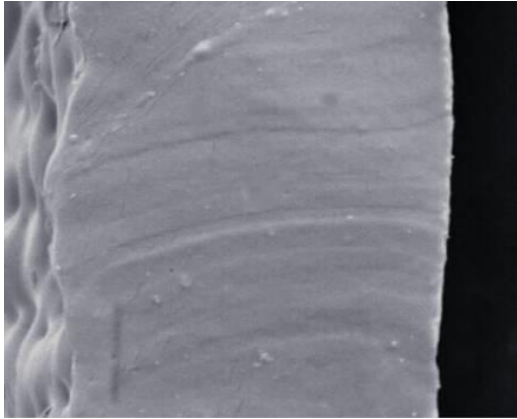
- A secondary use of membranes is that they can be used to provide other functionalities such as:
  - Protection against chemicals
  - Protection against blood borne pathogens and viruses

# Why use Membranes

- They also need to be compliant with other requirements so they do not detract from the performance criteria of the garment e.g.
  - Flame resistance
  - Thermal heat resistance
  - Cold flex resistance
  - Durable
  - Stable to repeat washing or auto-clave

# Types of membranes

- Hydrophilic – solid membrane



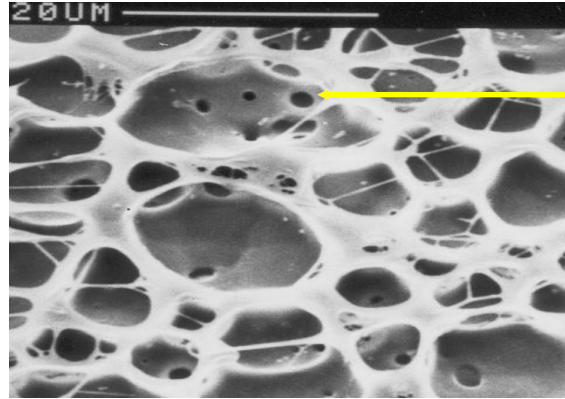
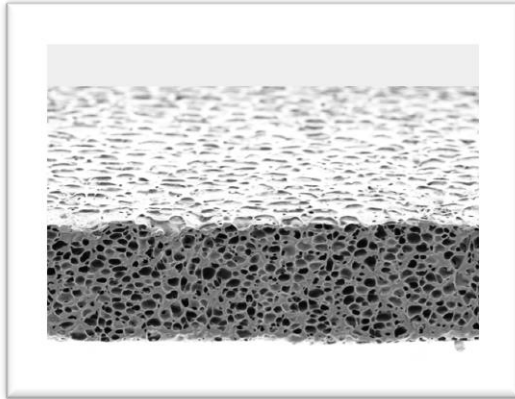
- Breathe through a process of absorption and migration driven by heat and high humidity.
- Chains of chemical groups which attract water vapour molecules.
- Water vapour molecules use the chains as stepping stones to travel from one site to the other.

# Types of membranes

- Hydrophilic – solid membrane
- Examples include:
  - Polyurethane membranes – film formed by coating of a polymer solution on to a substrate
  - TPU membranes – film formed by extrusion of a melt polymer
  - Copolyester – block copolymer of polyester and polyether – film formed by extrusion of a melt polymer
  - Issues in processing can be controlling the uniformity/ thickness of the film
- Advantages:
  - Light weight (10 g/m<sup>2</sup>)
  - Soft, flexible and quiet

# Types of membranes

- Hydrophobic – microporous membrane



micron-pore < 1 μm

- Breathes by allowing sweat in the form of water vapour molecules to pass through interconnecting micro-pores driven by heat and high humidity
- Passage of water droplets prevented by the micro-pores (that are 100 times smaller than a water droplet) and by surface tension effect due to hydrophobic character of the membrane i.e. repels water droplets



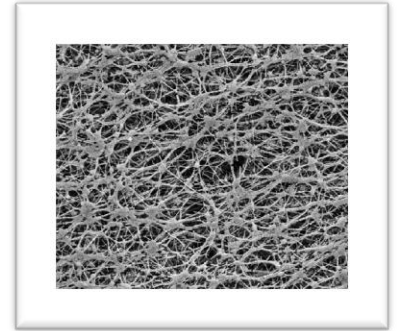
# Types of membranes

- Hydrophobic – microporous membrane
- Examples include:
  - Polyurethane membranes - produced by coagulation of polymer solution in water onto a carrier
  - Issues in processing can be controlling the structure to balance waterproofness versus breathability
- Advantages:
  - Dry feel for comfort
  - Good wash performance at high temperatures
  - Good cold flex properties

# Types of membranes

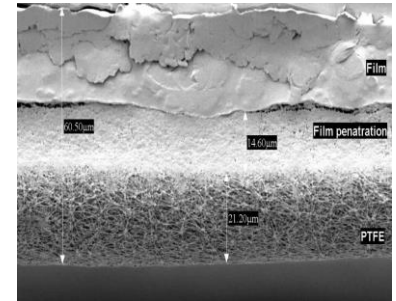
- PTFE – based on a microporous membrane

- Monolithic PTFE



- Coated PTFE

- Structure is coated with a solid polymer – typically a very breathable polyurethane.



# Types of membranes

- Coated PTFE – microporous membrane
- Manufactured by:
  - Microporous PTFE manufactured by biaxial stretching of PTFE film/ PU coating applied as solution
  - Issues in manufacture can be uniformity of PTFE membrane/ delamination of PU coating from PTFE
- Advantages:
  - Excellent cold flex properties
  - Excellent heat resistant properties

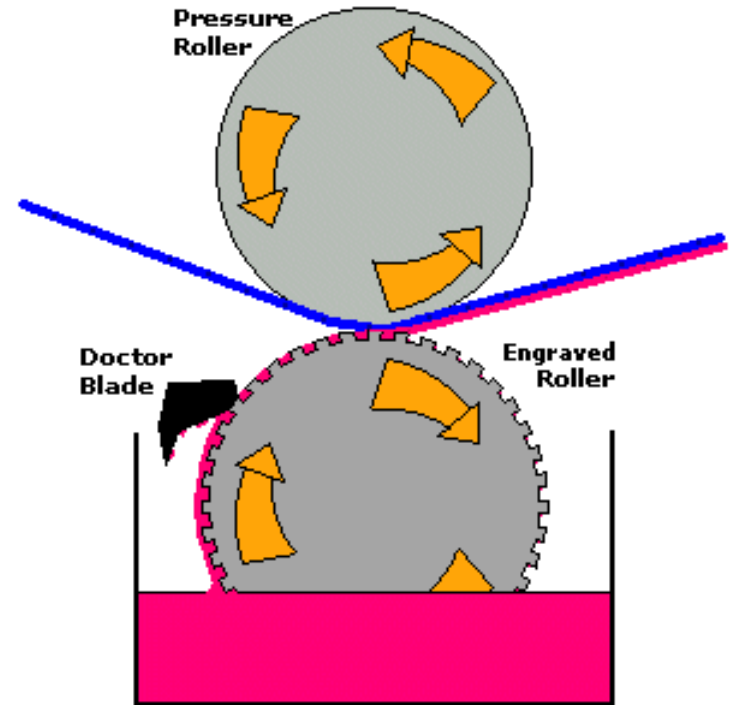
# Lamination of membranes

- Membranes can be laminated with adhesive to a vast range of textile substrates to form functional composites.
- Typically these laminates are 2 or 3 layers
- Adhesive weight needs to be optimised and should be applied in a discontinuous pattern (e.g. dots). This ensures higher breathability and softness/ flexibility of the final laminate
- Some key manufacturing methods for lamination:
  - Gravure Roller
  - Rotary Screen
  - Heated Roller with joiner film



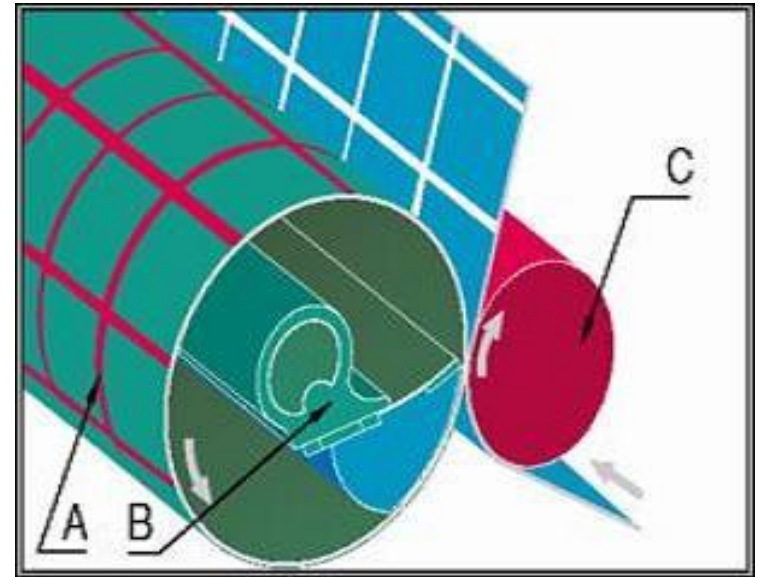
# Lamination of membranes

- Gravure Roller – hot melt dot lamination
- Involves the application of an adhesive to a membrane or substrate applied in a dot pattern
- The adhesive is typically a melted reactive polyurethane adhesive.



# Lamination of membranes

- Rotary Screen
- The adhesive is forced through a rotating roller with a series of small holes and applied the adhesive in a dot pattern
- The adhesive is typically a water based polymer paste which is typically a thermoplastic



A: Screen Mesh  
B: Squeegee  
C: Back Roller

# Lamination of membranes

- Heated Roller with joiner film
- This method thermally bonds the fabric layer to the membrane with an adhesive film using a heated roller
- Can be used for membranes ideally with a discontinuous web adhesive.



# Which is the right membrane to use

- Choice of membrane is dictated by:
  - Standards used in the fabric specification
  - Environment the garment will be used in
  - Additional protection requirements
  - Cost
- Typical tests in a standard for a laminate would include:
  - Waterproofness before and after washing
  - Breathability
  - Abrasion and flex resistance
  - Chemical or viral penetration resistance
  - Bond strength of membrane to fabric



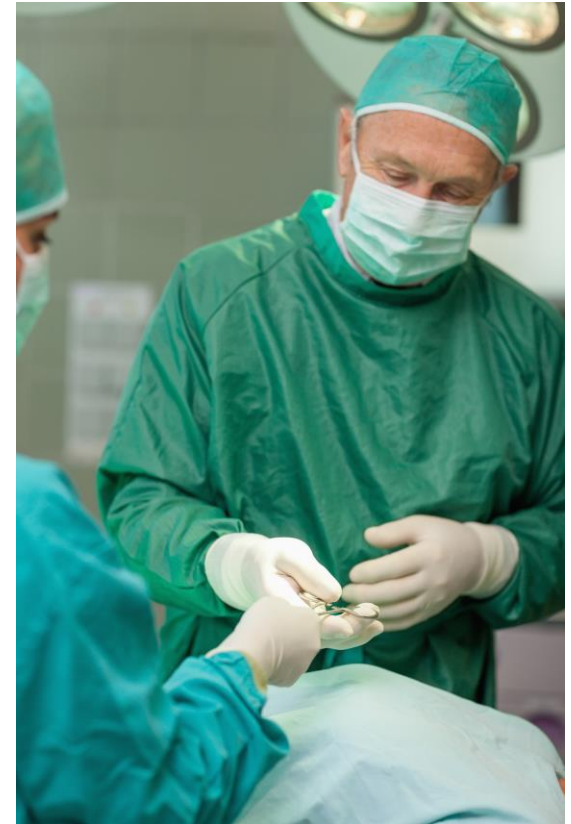
# Membranes for Different Market Segments

- **Fire Fighters**
- The key requirements are
  - Waterproof and breathable
  - Fire retardancy and thermal heat resistance
  - Chemical resistance
  - Blood borne pathogen and viral resistance
- Key Products
  - PTFE bicomponent FR membrane
  - Hydrophilic PU FR membrane (high temperature resistance)



# Membranes for Different Market Segments

- **Medical Gowns and Drapes**
- The key requirements are
  - Waterproof and breathable
  - Blood borne pathogen and viral resistance
  - High temperature wash to kill viruses
  - Repeat wash cycle > 100 cycles
- Key Products
  - Hydrophobic Microporous PU membrane



# Membranes for Different Market Segments

- **Military** – Combat forces
- The Key requirements are
  - Waterproof and breathable
  - Windproof
  - Resistance to prolonged exposure to extreme low temperature
  - Light weight and very durable
- Key products
  - PTFE bicomponent membrane
  - Microporous PU membrane
  - High breathe Hydrophilic membrane



# Membranes for Different Market Segments

- **Industrial**
- The key requirements are
  - Waterproof and breathable
  - Cold weather performance
  - Oil / petroleum protection
  - Chemical protection
  - Cost
- Key products
  - Will depend on what level of protection is required
    - Weather protection
      - Hydrophilic membrane
      - Microporous PU membrane
    - Flame or chemical protection
      - Hydrophilic FR membrane
      - PTFE bicomponent FR membrane





# PIL Membranes offers

- Hydrophilic membranes at 12, 25 and 40 microns
- Microporous membranes at 30, 45 and 55 microns
- Fire retarded membranes both hydrophilic and microporous
- High chemical resistant hydrophilic membranes
- PTFE bi components , standard, fire retarded and anti static



# porelle®

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