

# BREATHABILITY

A study on functional clothing, including sportswear

# WHAT DOES IT MEAN?

- Breathable garments have a capacity to transfer the moist vapour through their pores
- If there isn't any breathability, moisture is trapped in the microclimate of between the garments and the skin, causing discomfort/clamminess
- However, in certain situations, multilayered clothing is required for thermal protection





Water-resistant and moisture-permeable materials may be divided into three main categories :-

- High-density fabrics
- Resin-coated materials
- Film-laminated materials

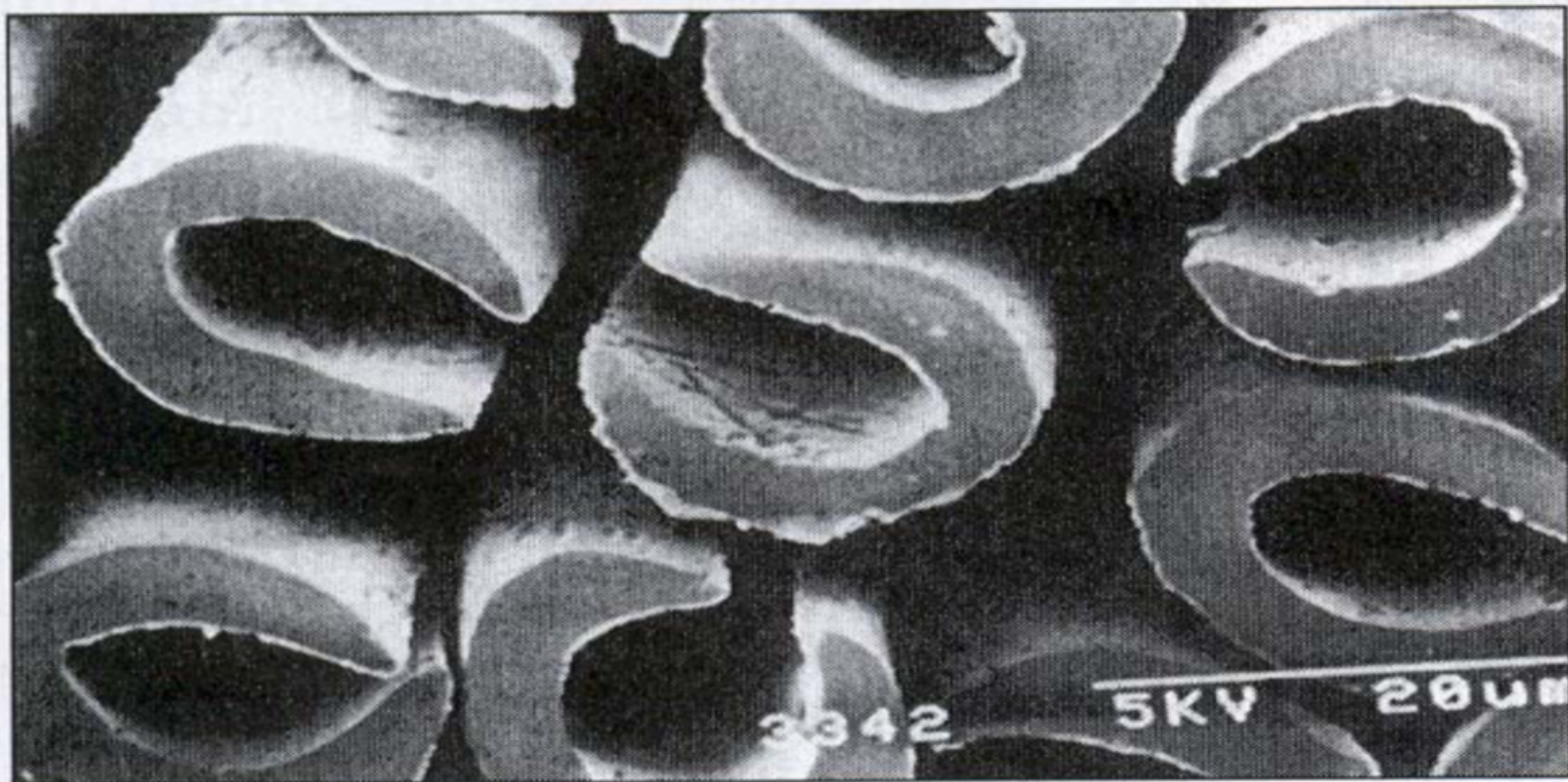


# HIGH DENSITY

- Compacted weave structure, usually Oxford Weave
- When fabric surface is wetted by water the cotton fibres swell transversely reducing the size of pores in the fabric and requiring very high pressure to cause penetration. Therefore waterproof is provided without the application of any water-repellent finishing treatment.

- Capillary action is determined by two fundamental properties of the capillary:
  1. Its diameter
  2. Surface energy of its inside face.
- The smaller the diameter or the greater the surface energy, the greater the tendency of a liquid to move up the capillary. In textile structures, the spaces between the fibres effectively form capillaries. Hence, the narrower the spaces between these fibres, the greater the ability of the textile to wick moisture.
- Such constructions include fabrics made from micro fibres, which are packed closely together
- However, capillary action ceases when all parts of a garment are equally wet





*Fig 2 : Killat N hollow nylon fibre*



# COATED/LAMINATED WATERPROOF BREATHABLE FABRICS

The coatings are of two types: -

- Micro porous membranes. the coating contains very fine interconnected channels much smaller than finest raindrop but larger than water vapour molecules.
- Hydrophilic membranes. transmits vapour through mechanism involving adsorption-diffusion and desorption



- It is generally agreed that fabrics with moisture wicking properties can regulate body temperature, improve muscle performance and delay exhaustion. While natural fibres such as cotton may be suitable for clothing worn for low levels of activity, synthetic fabrics made of nylon or polyester are better suited for high levels of activity
- In removing the liquid sweat from the skin, some textile manufacturers claim that moisture absorbency of the fibre is important and hence cotton or viscose is a necessary component for the sportswear, which is next to skin.
- In fact, so far as cotton is concerned, the synthetics should be preferred in clothing of active sports as they do not retain moisture and this has the advantage of keeping garments lighter than the cotton when it is wet. Also synthetic fibres have some added advantage of quick dry and good shape retention property.

# ADVANTAGES

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- Terephthalate fabric is used, which has a special shape that enhances the capillary action.
- Capillary action is usually at 2 places : a hole/ pore in the fibre cross section or the empty gaps in between fibres
- Better evaporation means wearer spend less energy to cool his body, which increases his performance and endurance.

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# MULTILAYERED FABRIC

- Push-pull fabrics are bicomponent materials composed of a non-absorbent hydrophobic material on the inside-worn next to the skin-and an absorbent hydrophilic material on the outside. Usually, the hydrophobic material is polyester, and the absorbent hydrophilic material nylon
- This is because the absorbent material on the outside draws the moisture away from the skin while the nonabsorbent material keeps the skin dry.

- Sportswool is a hybrid material composed of a fine Merino wool sub-layer for Insulation and a polyester exterior which draws moisture away from the wool layer to the surface.
- The wool fibre next to the skin attracts perspiration vapour molecules, before they have the chance to condense into liquid, and disperses them into the atmosphere. The fabric has attracted the attention of top Australian athletes and the Manchester United soccer team. Its major drawback, however, is that it takes longer to dry because of its wool content.



# ADVANCEMENTS

- Field Sensor2 I: Field Sensor is a very popular high performance fabric from Toray, which employs a multi-layer structure that not only absorbs perspiration quickly but also trans. ports it up to the outer layer of fabric very rapidly using principle of capillary action. It is composed of coarser denier yarn on the inside surface (in direct contact with skin), and fine denier hydrophobic polyester yarn in a mesh construction on the outer surface to accelerate quick evaporation of sweat
- In addition, Toray has developed “H2OFF” made up of polyester microfiber fabric with a unique high-density weave structure comprising millions of microcrimped fiber loops. It also feature superb and durable water repellency, superior breathability and wind-chill resistance and attractiveness with soft hand.

# VOORMI

- A small Colorado-based company, Voormi, is touting a technology that produces a waterproof, breathable textile with only a single layer of material. It could be the most significant advancement in outdoor clothing since the first Gore-Tex jacket







- “Our angle is to streamline waterproof breathables into a single-layer construction,” says Timm Smith, Voormi’s marketing director. “So it’s 1978 all over again and we just hit the re-start button.”
- On their own, membranes are pretty fragile. So textile companies laminate the membrane to an outer shell fabric to create a two-layer (2L) textile that can then be cut and stitched into jackets or pants or sleeping bag shells. Most of the time, a third layer—a liner—is added to further improve durability, usually polyester tricot

- Voormi's new technique gets rid of the lamination altogether. "Rather than glue a membrane to a fabric, we put the membrane into a knitting machine, knitting a yarn in and around and through the membrane, so we get a single-layer textile with a (membrane) core that's constructed in the process," says Smith. "It's an entirely new platform."
- They can "tune" the membrane's properties—the balance of waterproofness versus breathability, which is a function of the size of the pores in a membrane. If they're designing a fabric for a cold but dry environment, like Voormi's Colorado home, "maybe we cure the membrane back to 70 percent of its waterproofness," he says. "The ability to custom-balance that level is part of the engineering."



- That's why many jackets still have zippered vents. In fact, the standards (led by Gore) on what is truly waterproof are so high that Voormi makes no claim that its garments are 100 percent waterproof. But the company does say that, short of a full-on deluge, they'll keep you dry, and that they're more breathable and comfortable than traditional waterproof shells.