

Wool insulation... how it works

WOOLCOOL

Wool insulation is not just a simple 'barrier' like other types of insulation which reduce the time taken for heat transfer between objects of different temperatures; Wool is one of nature's most amazing 'smart fibres', with a complex structure and natural properties that cope with extremes of cold and heat. Wool fibres are hygroscopic, which means they can absorb and release moisture and air creating a natural thermostat that maintains stable temperatures.

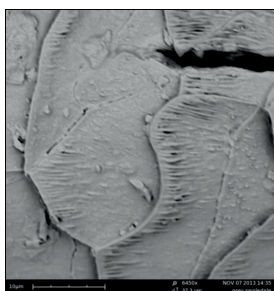


Figure 1

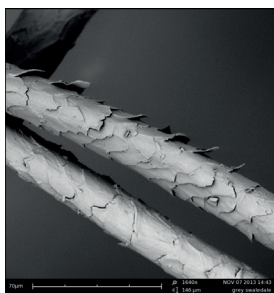


Figure 2

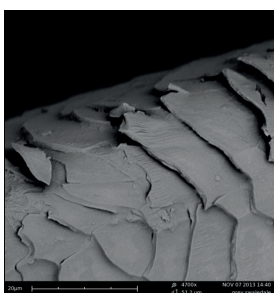


Figure 3

The epicuticle is the outermost part of the fibre; it is a thin water repellent membrane and is the only non-protein part of the fibre. This is the structure that controls the water content of the fibre and this can be easily damaged by mechanical manipulation or processing. It is permeated by many microscopic pores through which water vapour can penetrate into the interior of the fibre, allowing the fibre to absorb moisture from the atmosphere.

The scales, beneath the epicuticle membrane, are a hard shingle-like layer of overlapping cells which give the fibre strength and protection. These are the first line of defence against all forms of damage and act as a protective barrier for the softer inner structure. The scales and epicuticle together form the cuticle of the fibre.

Figure 1: In this image you can see the microscopic pores of the epicuticle covering the scales.

In addition to this the scales can lift to take in the moisture or air. This is very similar to mammals whose fur fluffs up to create air pockets between individual hairs, helping to further insulate the body. The opposite action occurs when the body is too warm; the hairs lie flat and in the case of the wool fibres, the cuticles lie flat which allows heat to leave.

Figure 2: This image shows clearly how far the scales can lift from the fibre body.

Our wool is sourced and processed specifically for making Woolcool to ensure it doesn't contain additives, such as borate or polyester, found in other types of wool insulation. Fleeces are washed and scoured in accordance with PPC regulations and ISO14001 environmental management systems, without the need for extreme temperatures, chemical treatments or additives.

We've cleverly harnessed the smart fibre properties for Woolcool by felting and sealing pure wool in breathable film which allows the 'smart' wool fibres to absorb humidity and create a more hygienic environment.

Figure 3: SEM image of wool fibre.

WOOL - THE AMAZING SMART FIBRE



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2018

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Material Advantages

- Wool is natural, renewable and sustainable
- Absorbs and breaks down indoor air pollutants, such as formaldehyde, nitrogen dioxide and sulphur dioxide
- Zero ozone depletion potential
- Wool is perfectly safe to touch and requires no specialised safety clothing or equipment, making it easy to work with and is naturally resistant to mould
- It causes no irritation to the eyes, skin or lungs and wool fibres present no hazard to your health
- Wool is considered by the medical profession to be hypoallergenic, and has natural anti-microbial properties because bacteria tend to be attracted to smooth positively charged surfaces like those of synthetic fibres rather than the scaly, neutrally charged surface of the wool fibre. Hospital studies have shown that bacterial colonies are common in cotton sheets while not present on Merino blankets subjected to the same environmental conditions
- Wool is self-cleaning due to lanolin's anti-fungal and antibacterial properties. Besides being antimicrobial, the natural lanolin in wool aids in repelling dust mites and mildew. Another reason mildew and dust mites find it hard to survive in wool is due to its dry, porous nature
- Wool fibres are 'breathable', meaning they can absorb and release moisture, whilst absorbing and releasing this moisture this creates energy and therefore thermal buffering

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Material Advantages (continued)...

- During transportation and storage of meat, two factors that may lead to the growth of spoilage organisms are elevated temperatures and moist conditions, due to humidity and condensation. As described above, wool will absorb and release moisture, controlling elevated temperatures and humidity, reducing condensation and therefore reducing the growth of these spoilage organisms
- Wool fibres are hygroscopic by nature, meaning they can absorb up to 30-40% of their own weight without feeling wet to the touch
- Wool is resistant to static electricity, and is still used in ammunition boxes for this reason
- Wool does not settle due to the high elasticity of the wool fibres ensuring no loss of performance over time
- It does not burn, but instead singes away from fire and extinguishes itself (Wool has a very high inflammation point of 560°C due to its high Nitrogen content of ~16%) Wool is self-extinguishing because of its high Limiting Oxygen Index (LOI=25.2), which means to completely burn wool an oxygen content of 25.2% is necessary whereas air only has 21%

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