wool fibre technology

Sheep are a sustainable production system for fibre

Wool is a fibre crop
- natural
- renewable
- useful

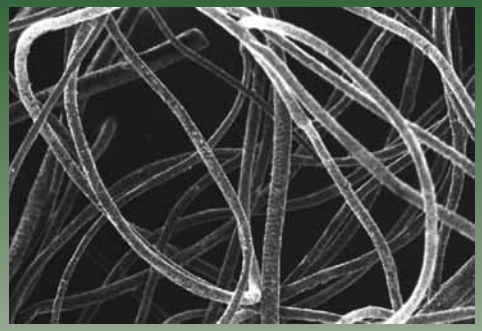
Wool fibres can be combined with other natural fibres, such as hemp, with synthetic fibres or with different resin types to expand the range of woven and non-woven products – as textiles, composites, filters, and films....

Woven and non-woven applications for many sectors:
aerospace... transport... environmental... marine...
safety... medical... construction... packaging...

The Sheep Trust, Biology - Area 8, University of York, PO Box 373, YO10 5YW
www.thesheeptrust.org

THE SHEEP TRUST
conservation and sustainability

Smart Wool



Functional Fibres

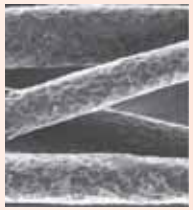
defra

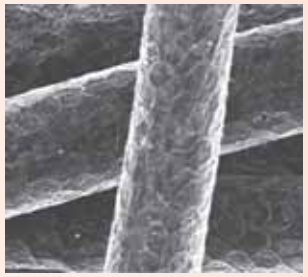
NNFCC

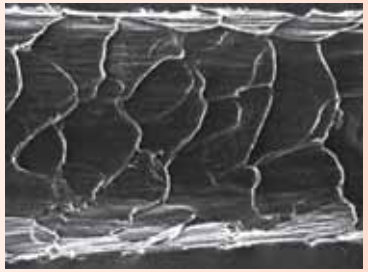
understanding wool fibre

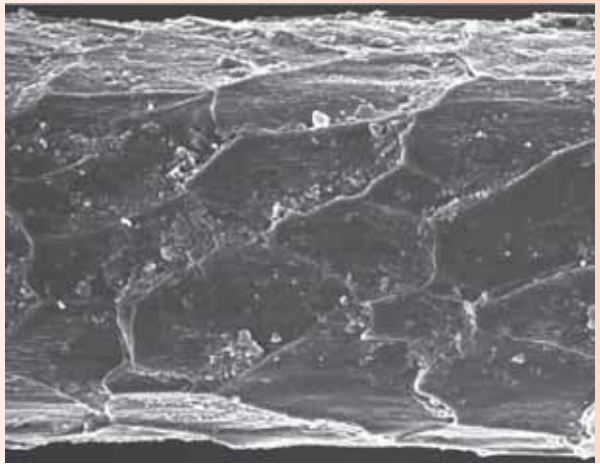
Wool fibres are made of proteins. Each protein is the product of a gene. Many genes encode the different wool proteins and inheritable genetic factors are responsible for the variation in wool characteristics between sheep breeds and individuals in those breeds. Genetic markers are being developed to assess the genetic merit of sheep populations as a tool to improve fleece quality.

The quality of wool is also affected by the environment and by management. Nutrition is very important to provide the essential components of the wool proteins – without the right feed, good quality fibres will not be produced. The proteins determine the structural and mechanical properties of wool fibre. There is intense research into the nature and function of wool proteins, how they are made by the animal and how the fibre can be processed into filaments, powders and films for hi-tech products. For example, proteins can be extracted from wool, spray-dried into a powder and converted with water into transparent protein films that are biocompatible and can be used to support the growth of human cells for medical applications.







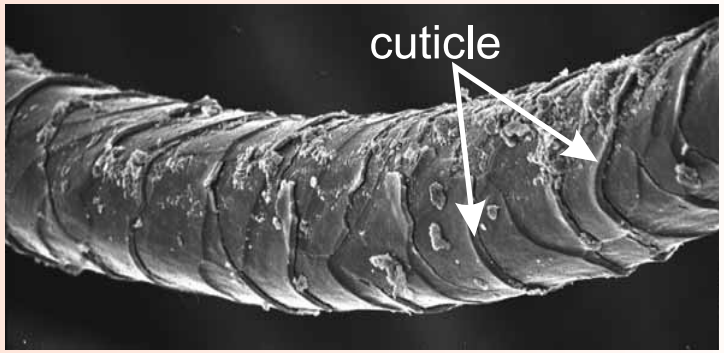


These photographs are fibres of wool from a Herdwick ewe and have been taken using a Scanning Electron Microscope. The images illustrate general features of all wool fibres irrespective of the breed.

As the magnification increases, the details of the fibre surface become visible and the patchwork of individual cuticle cells can be clearly seen.

Each fibre is made of three different types of cortical cells, surrounded by a sheath of cuticle cells forming the external layer of the fibre. The basic building blocks are the alpha-keratin proteins which interact with one another to form intermediate filaments. The assembly of these intermediate filaments and matrix proteins make a composite – that provides the strength, inertness and rigidity of each fibre.

The cuticle is solely responsible for felting – a major problem for wool textiles that shrink in the wash!



If the cuticle is removed, there is no reduction in strength of the fibre, but the wool becomes shrinkproof. Today, shrinkproofing treatments typically use chlorine-based chemicals to remove the cuticle, or synthetic resins to coat the fibre. Researchers are trying to discover new ways of removing the cuticle with processes that are more environmentally friendly. There is evidence that naturally occurring moulds have enzymes that are capable of breaking down the keratins in the cuticle – this treatment, if it can be optimized, offers major advantages.

The study of wool proteins, modifications of the fibre surface and assembly of natural and man-made synthetic fibres all offer improvements in technical performance and functional properties – the future of wool technology.