

Wool Testing Services Info-bulletin

Fibre diameter

What is fibre diameter?

We all think we know what fibre diameter is - after all, it's probably the most important factor affecting price for most wool types.

However, it's not at all that simple. Wool fibres are not perfectly cylindrical straight rods all the same size. They are curved and twisted, they have enormously different sizes, they are more elliptical than circular in cross section, and some are hollow.

What we think of in terms of diameter - 22 microns for example - is the mean fibre diameter - the average of all the fibres in the sample, individually often varying from less than 10 microns to more than 35 microns in this example. Also, unfortunately, the mean fibre diameter will vary slightly depending on the way in which it's measured.

How is it measured?

If there were only one way to measure diameter nobody would care how it's measured. However, life isn't that easy.

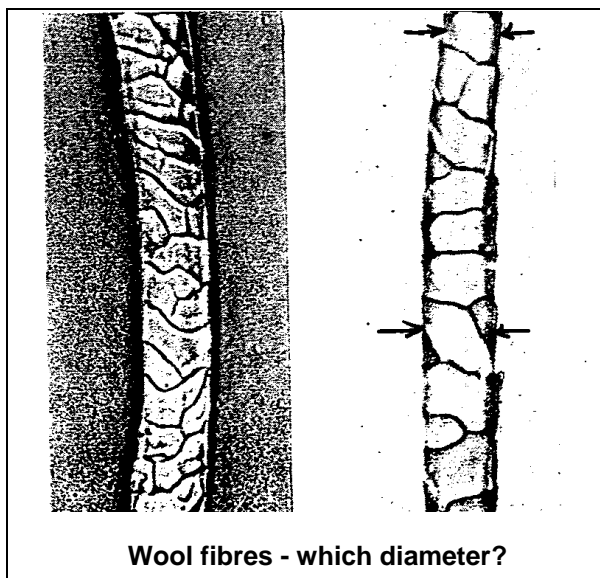
The primary or reference method of measuring fibre diameter is the Projection Microscope. As the name suggests, an image of fibre snippets is magnified and projected onto a screen, from which the apparent diameter is measured. Since there is a lot of variation in size of individual fibre snippets, it's necessary to measure a lot of them to get a reasonably precise answer.

The x500 magnification used creates focusing difficulties, so the measurement is operator-sensitive. All in all, the measurement is tedious, expensive, and not very precise. Nevertheless it remains the reference method and is still used on a regular basis in Europe and North America.

Since "sale by sample" was introduced, the Airflow method was the main technique used in producer countries and by many topmakers. In commercial laboratories the preparation and measurement methods have been streamlined such that the procedure is rapid and repeatable.

However, whilst the method is ultimately calibrated by reference back to the projection microscope, since it is an indirect method it relies on the calibration and measured materials having similar physical properties. For some wool types (such as medullated types and lambswool), the method gives different results to the projection microscope method. It also only gives the mean fibre diameter, not the distribution of diameters (which has recently assumed greater importance than was previously the case).

More recently two higher technology methods have been introduced. The Laserscan has evolved from the Fibre Diameter Analyser (FDA), an instrument developed three decades ago by CSIRO. It measures the amount of shadow cast by snippets transported in water or an alcohol-water mix



Wool fibres - which diameter?

through a laser beam, and shares some similarities with the projection microscope method, against which it is calibrated.

The OFDA was developed in the early 1990's, and this instrument utilises an automated microscope and image analysis system to mimic the projection microscope method. Once again, the system is calibrated against the projection microscope.

Both the newer methods give fibre diameter distribution data as well as mean fibre diameter.

Are there any significant issues?

On average, all four methods give similar answers for mean fibre diameter, especially on processed wool. The newer instruments are capable of being calibrated with internationally-traceable standards of metrology (rather than with wools measured on the projection microscope). However, until the anomalies between these calibrations and the reference method are resolved, it will not be possible to move away from a wool-based calibration process.

The methods all give slightly different answers on some wool types, especially for raw wool. For these types it is important to identify the test method which is used to avoid any confusion. In general terms the two newer methods and the projection microscope tend to be in better agreement on tops than any combination with the airflow (see also Info-bulletins 3.3 and 3.5). However, the airflow remains the method used for trading certification for most coarse wools.

Australia took the decision to move towards implementing the Laserscan system as the default diameter measurement from the beginning of the 2000 wool season. Both airflow and OFDA certificates are also available. New Zealand subsequently adopted the Laserscan as default, for merino wools only, and then South Africa for all wools in 2006. Other countries are moving slower because in general they cover wider ranges of wools than are generally available in Australia, and the issues are less well defined.