

S3.6.3 CHARACTERISING THE WORLD'S SMALLEST APERTURE SIZE SQUARE MESH FILTER

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Stainless steel square woven meshes are attractive as filter media because they have a high open area, which optimises flow rate, they are mechanically strong and can easily be cleaned, and the aperture sizes can be accurately controlled. They are therefore very attractive both as filter media for cleaning particles from air or liquid suspensions and for classifying particles into narrow size distribution fractions.

The basic principle of weaving has changed very little over several hundred years. What has changed is the high tolerances that are now possible and the ability to accurately manufacture very fine wires that are strong enough to survive the rigours of the weaving process (some looms are capable of weft speeds exceeding the speed of sound).

One of the biggest issues in the characterisation of these fine weaves is producing data that is traceable to international standards such as NIST. Unless every element in the microscope analysis is certified, the data is unreliable and not proven.

This paper analysed a 16 micron mesh produced from a 16 microns wire, which with a layup of 795 wires per inch, had an estimated open area of up to 25%. Using the Whitehouse PoreSizer, aperture dimensions in the X and Y direction as well as individual maximum and minimum sizes independent of orientation were recorded. Furthermore, the wire count per inch and the open area were also measured. Of particular interest was the high aperture count per square centimetre, which was over 100,000. Using an ultrahigh magnification of 0.08 microns per pixel, the aperture sizes and wire diameter was confirmed at 16 microns. The PoreSizer was also able to measure the Geometric Mean and the Cut Point of the mesh. The uncertainty of measurement, which were all traceable to NIST, was typically less than 1%. These absolute measurements were then used to determine the accuracy and reproducibility of Porometers used to estimate pore sizes based on air flow.