



# T 1016 om-10

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## Average fiber diameter of fiber glass mats

### 1. Scope

This method covers the determination of the average fiber diameter (or distribution of diameters) of fibers used in nonwoven fiber glass mats.

### 2. Summary

Samples of glass fiber extracted from the mat are cut into short lengths. The fibers are then mounted onto a glass slide and placed on a gridded microscope stage. Fiber diameters are recorded for each sample and the average fiber diameter is recorded as the average of these readings.

### 3. Significance

The fiber diameter of the fiber glass used in the nonwoven fiber glass mat has a bearing on the properties of the finished mat product. This method permits the determination of that diameter, or distribution of diameters if more than one fiber size or type is present.

### 4. Definitions

- 4.1 Fiber diameter: the distance in microns across the circular cross section of the glass fiber.
- 4.2 Nonwoven fiber glass mat: randomly distributed glass fiber, bonded together with a polymeric binder system.
- 4.3 Binder: the polymeric agent used to bond the glass fibers to one another in the mat.
- 4.4 Sigma: sum of components in a set.

### 5. Apparatus

- 5.1 *Microscope*, capable of 1000 magnification with an objective lens of 40X, an eyepiece lens, viewing screen, and a millimeter grid.
- 5.2 *Furnace*, muffle furnace capable of maintaining a temperature of  $1157^{\circ} \pm 45^{\circ}\text{F}$  ( $625^{\circ} \pm 25^{\circ}\text{C}$ ).

Approved by the Standard Specific Interest Group for this Test Method



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5.3 *Miscellaneous:* scissors, crucible, microscope slide, cover glass, certified refractive index liquid 1.610, dissecting needle.

## 6. Sample preparation

6.1 Place dry mat in the crucible and then place the crucible in the muffle furnace at a temperature of not more than  $1157^{\circ} \pm 45^{\circ}\text{F}$  ( $625^{\circ} \pm 25^{\circ}\text{C}$ ), for  $15 \pm 0.5$  min, or until all the carbonaceous material has disappeared. Remove from furnace and allow to cool.

6.2 Hold several strands in a bundle and using scissors, cut 1/16 in. to 1/8 in. (1.59 mm to 3.18 mm) samples onto a clean microscope slide. Add five drops of certified refractive index liquid (1.610) to the slide and, using the dissecting needle, mix until all fibers are thoroughly wetted. Fibers should be arranged until they are approximately parallel to each other (a low power microscope facilitates). Place one edge of a cover glass in contact with the slide and allow it to settle slowly on the sample to facilitate removal of air bubbles.

## 7. Procedures

7.1 Place the prepared slide on the micrometer stage. Examine the fibers at 1000X magnification.

7.2 Locate a specific fiber and focus so as to obtain a thin black line on both sides of the fiber. Align the grid with the fiber. Set the grid line on the outside edge of the black fiber edge line and take a reading at the outside edge of the other black fiber edge lines. Record reading. Repeat this step for all fibers visible at a single location on the slide.

7.3 When all fibers have been measured and recorded, move the micrometer stage to bring a new area of the slide into view. Repeat above measurements until at least 100 individual fibers have been measured and recorded.

7.4 Repeat the process for each separately identifiable fiber type if more than one type of fiber is present.

## 8. Calculation and report

Report the average diameter as:

$$\text{Average fiber diameter in microns} = \sum X / \sum Y$$

where

$X$  = micron reading for diameter  
 $Y$  = number of occurrences for each reading

If more than one fiber type is present, report the results for each identifiable type. If a wide distribution of diameters is present, report the distribution and range of diameters in lieu of the average diameter.

## 9. Precision

9.1 On the basis of studies made in accordance with TAPPI T 1200 "Interlaboratory Evaluation of Test Methods to Determine TAPPI Repeatability and Reproducibility" test results, each representing an average of 50 determinations from the same sample (commercial 2.00 lb/100 ft<sup>2</sup> fiberglass mat), are expected to agree within the amounts stated below. The study included three laboratories.

|     |                        |                   |
|-----|------------------------|-------------------|
| 9.2 | Average fiber diameter | 15.7 microns      |
|     | Repeatability          | 6 % - 0.9 microns |
|     | Reproducibility        | 6 % - 1.0 microns |

## 10. Keywords

Fiber diameter, Fiber glass mats