Designation: F 71 – 68 (Reapproved 1999)

An American National Standard

Standard Practice for Using the Morphological Key for the Rapid Identification of Fibers for Contamination Control in Electron Devices and Microelectronics[1]

This standard is issued under the fixed designation F 71; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the rapid identification of nonmetallic, fibrous contaminants by the microscopical examination of their morphology. The procedure is intended either to provide tentative identification or to serve as a supporting test in confirming the identity of suspected fibrous contaminants.[2]

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 276 Method for Identification of Fibers in Textiles[2]

F 25 Test Method for Sizing and Counting Airborne Particulate Contamination in Clean Rooms and Other Dust-Controlled Areas Designed for Electronic and Similar Applications[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *fiber*—a particle longer than 100 µm with a length-to-diameter ratio of greater than 10:1. For this practice, the definition includes organic and inorganic fibers, both natural and synthetic, but excludes metal fibers. See Fig. 1 (*r*).

3.1.2 *medulla*—a distinct center portion of a fiber. See Fig. 1 (*c*).

3.1.3 *lumen*—a canal or central opening in the fiber. See Fig. 1(*b*).

3.1.4 *septs*—walls separating cavities in the fiber. See Fig. 1 (*d*).

3.1.5 *scales*—surface plate-like formations. See Fig. 1 (*a*) and (*h*).

4. Summary of Practice

4.1 This practice comprises the collection and mounting of fibers and their examination by transmitted light. The fiber morphology is observed for its dimensions and external and internal structure and is compared to a morphological key analysis chart for classification.

5. Apparatus

5.1 *Microscope*, approximately 100 and 400× magnification, with mechanical stage, substage illumination, and condenser to provide transmitted light. The optimum equipment is a binocular microscope with mechanical stage, substage illumination, and substage condenser having 10× eyepieces and appropriate objectives to provide approximately 00 and 400× magnification.

5.2 *Microscope Lamp*, required only when substage light source not provided with microscope.

5.3 *Ocular Micrometer Scale.* [4]

5.4 *Stage Micrometer*, standard 0.01- to 01-mm scale.[5]

5.5 *Glass Microscope Slides.*

5.6 *Immersion Oil*, refractive index 1.51.

5.7 *Microscope Slide Cover Glasses.*

6. Sampling

6.1 Sample airborne fibers in accordance with Test Method F 25.

6.2 Sample fibers on surfaces, by removing the fiber from the surface and placing it on a glass microscope slide, using appropriate forceps.

7. Calibration

7.1 Calibrate the ocular micrometer in accordance with the procedure described in Test Method F 25.

8. Specimen Preparation

8.1 If the fiber has been collected directly on a microscope slide, cover it with a cover glass.

8.2 If the fiber has been collected on the surface of a membrane filter, place the filter on a glass microscope slide and render the filter transparent by placing five drops of immersion

---

[1] This practice is under the jurisdiction of ASTM Committee E-21 on Space Simulation and Applications of Space Technology and is the direct responsibility of Subcommittee E21.05 on Contamination.

Current edition approved Aug. 15, 1968. Published October 1968. Originally published as F 71 – 66 T. Last previous edition F 71–66 T.

[2] For more detailed procedures of fiber identification, see Test Methods D 276, which appears in the *Annual Book of ASTM Standards*, Vol 07.01, also M. R. Harris, *Handbook of Textile Fibers*, and H. R. Mauersberger, *Matthew's Textile Fibers*, 6th edition.

[3] *Annual Book of ASTM Standards*, Vol 15.03.

[4] B&L 31-61-01 or equivalent has been found satisfactory for this purpose.

[5] B&L 31-16-90 or equivalent has been found satisfactory for this purpose.

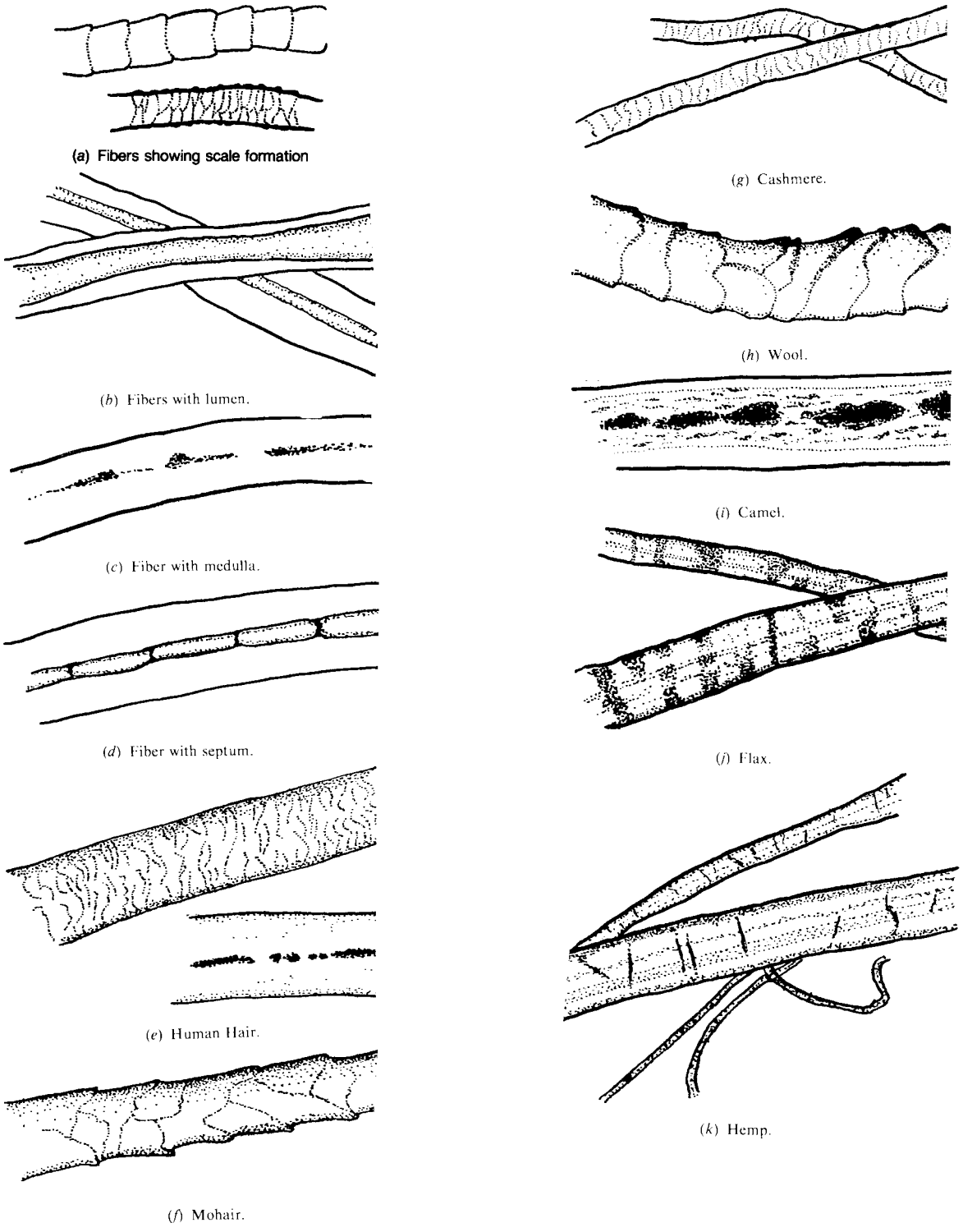


FIG. 1 Examples of Fibers (100× Magnification)

oil on top of the slide and then placing the filter on top of the immersion oil. Cover the saturated filter with a microscope cover glass.

9. Procedure

9.1 Using a magnification of 100× and the calibrated ocular micrometer with transmitted light, measure the fiber diameter. For fibers with nonuniform diameters or for multifilament fibers, make the measurements at several different points along a single fiber or on several different fibers and calculate an average diameter.

9.2 Examine the fiber at 100× magnification for the following features:

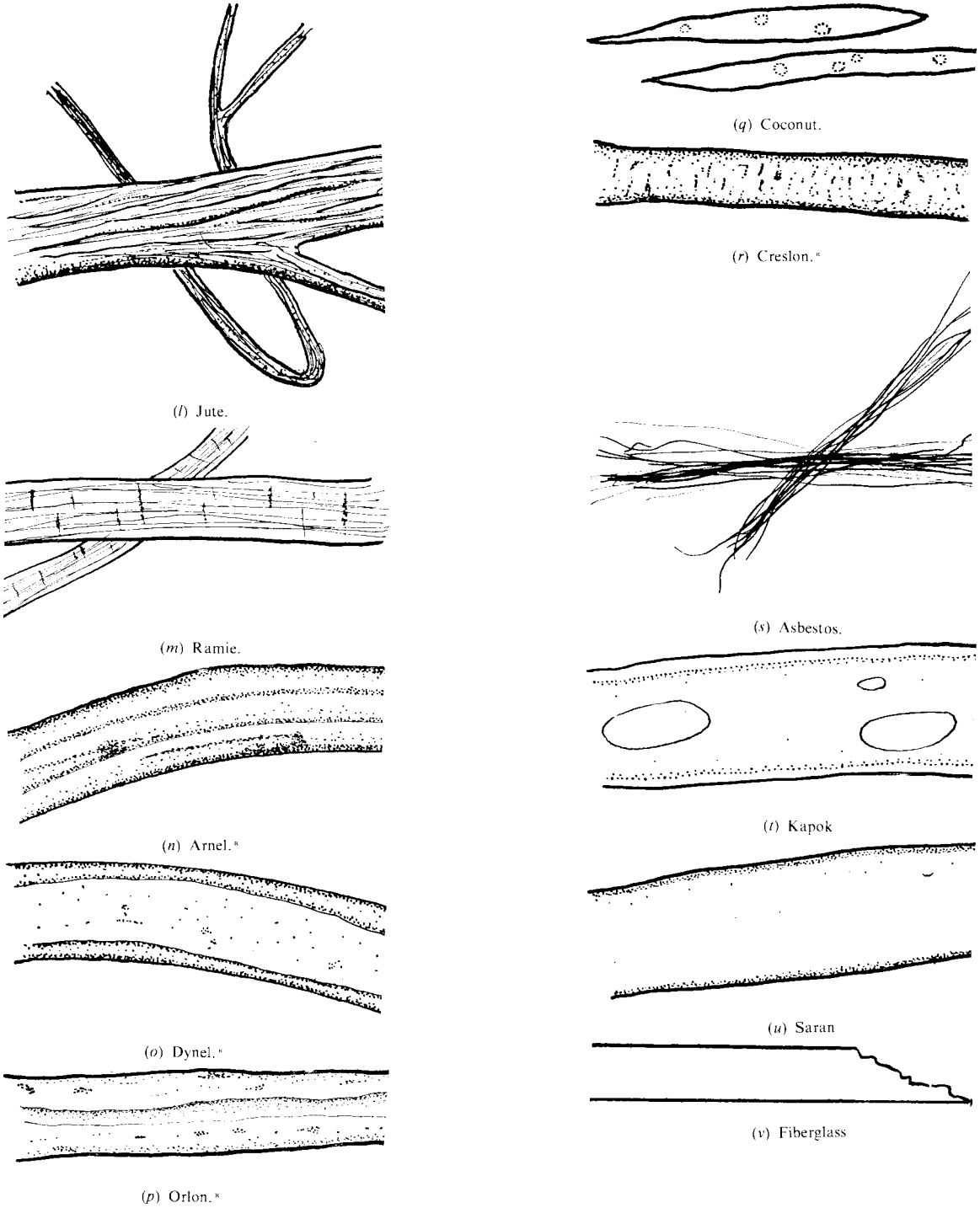


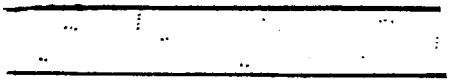
FIG. 1 *(continued)*

9.2.1 Surface scales,
9.2.2 Lumen,
9.2.3 Cross markings or longitudinal striations,
9.2.4 Fiber wall appearance,
9.2.5 Fibers in bundles, and
9.2.6 Appearance of fiber ends.

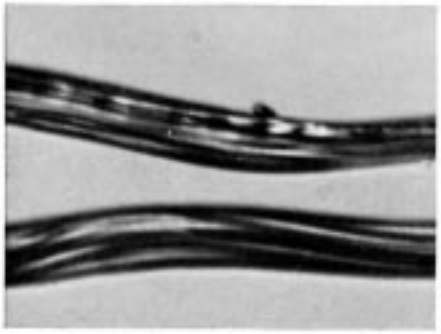
9.3 When features cannot be clearly distinguished at a magnification of 100×, examine the fiber at 400×. Use the morphological key of Table 1 to classify fibers according to the characteristics listed in 9.2. These characteristics are illustrated in Fig. 1.

10. Keywords

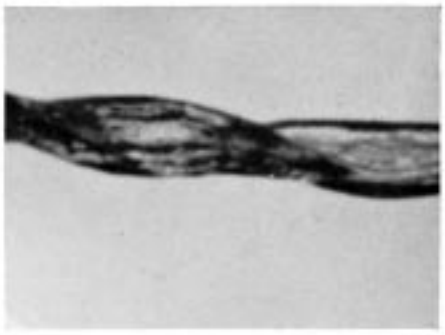
10.1 contamination control; contaminants; morphology



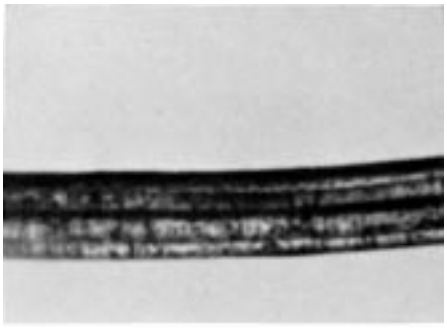
(*w*) Nylon



(*x*) Viscose



(*y*) Cotton



(*z*) Acetate

FIG. 1 *(continued)*

TABLE 1 Morphological Key Fiber Identification Chart

NOTE 1—As used in this chart, *lumen* includes matter having the appearance of lumen.