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Standard Guide for Packaging of Unbound Respirable Silicon Carbide Whiskers[1]

This standard is issued under the fixed designation E 1516; 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 guide covers the packaging of unbound respirable silicon carbide (SiC) whiskers and materials containing respirable silicon carbide whiskers. Airborne respirable silicon carbide whiskers are considered a potential health hazard.

1.2 All applicable federal, state, county, local or other regulations must be complied with when this guide is used.

1.3 *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:*

E 1437 Practice for Handling Silicon Carbide Whiskers[2]

E 1451 Guide for Disposal of Wastes Containing Respirable Silicon Carbide Whiskers[2]

E 1718 Guide for Administrative and Engineering Controls for Silicon Carbide Whisker Work Areas[2]

2.2 *ANSI Standard:*

ANSI Z9.2-1979, Fundamentals Governing the Design and Operation of Local Exhaust Systems[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *respirable silicon carbide whiskers, n*—a crystalline silicon carbide fiber, approximately cylindrical in shape, with a diameter less than 3.0 μm and an aspect ratio equal to or greater than 5:1.

3.1.2 *unbound silicon carbide whiskers, n*—whiskers and fibers with the potential to become airborne.

4. Significance and Use

4.1 Packaging of unbound respirable SiC whiskers, and materials containing unbound respirable SiC whiskers, may result in a potential respirable exposure to SiC whiskers.

4.2 This guide is intended for use by health and safety professionals as well as packaging specialists in preparing procedures for safe packaging, and in preparing relevant documentation.

5. Material Characteristics to Be Considered in Packaging Design

5.1 Silicon carbide whiskers can be electrostatically charged; therefore, packaging capable of generating electrostatic charges may attract and hold whiskers on the outside surface, eventually allowing contamination of areas outside the immediate work area during subsequent container handling.

5.2 The aerodynamic equivalent diameter of unbound silicon carbide whiskers is such that they easily become airborne.

5.3 Angles as steep as 70° may be necessary to ensure flow of some unbound whiskers or unbound whisker-containing materials.

6. Packaging Recommendations to Limit Potential Personnel Exposure

6.1 Rigid, non-porous, tightly-sealing containers with smooth inner surfaces are preferred to rough or porous containers. Examples of these preferred containers include plastic drums, fiber drums coated internally, metal drums, metal drums coated internally, and bulk containers. Containers having porous or rough surfaces, such as uncoated fiberboard (paper) drums, which may entrap whiskers, should not be used when the container will be in contact with the silicon carbide whiskers.

6.2 Bags, plastic or other, when used as container liners allow whisker release during opening and closing of the bags. Plastic bags should be used only inside a supporting container for either product transfer or waste disposal.

6.3 The inside and outside surfaces of a reusable container should be wet-wiped or vacuumed to remove any adhering loose SiC whiskers and the cleanup residue disposed according to Guide E 1451.

6.4 The container openings for removal or transferring of silicon carbide whiskers should be as small as practicable for the process in question.

6.5 A bag or container of respirable SiC whiskers should be opened/closed, and all transferring of materials should occur, in a manner that minimizes whisker-release and allows capture

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[2] *Annual Book of ASTM Standards*, Vol 11.03.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th floor, New York, NY 10036.

of released whiskers such that exposure is below the airborne contamination limits described in Practice E 1437. This may require handling equipment and practices that minimize air inrush/expelling into/out of the bag or container. The equipment should include mechanical ventilation such as a drum-shroud, laboratory hood, downdraft hood, or other ventilation device(s) appropriate to the packaging and handling method employed. The ventilation should be designed and applied in a manner consistent with the guidelines in Guide E 1718, ANSI Z9.2-1979, ACGIH Manual,[4] or other similar guideline applicable to the packaging task.

6.6 To reduce the potential for airborne contamination, silicon carbide whiskers may be shipped wet, but this requires careful coordination with customer's requirements and must be considered when selecting the containers. Some wetting agents must comply with transportation regulations.

6.7 Containers with contrasting colors to the silicon carbide whiskers should be used to assist in detecting whiskers and decontaminating the container.

NOTE 1—Use of totally enclosed packaging, transfer, and processing systems is recommended.

7. Packaging and Product Quality Concerns

7.1 Packaging should not contain loose foreign materials or easily abraded surfaces that would lead to product contamination.

8. Labeling

8.1 Attach one or more labels showing the following information:

8.1.1 Contents of the container,

8.1.2 Any information required by federal, state, local, or other regulations, and

8.1.3 The information shown on the label in Fig. 1.

9. Used Containers and Liners

9.1 Containers and liners intended for reuse should be considered to be contaminated with SiC whiskers. They should be thoroughly washed, wet-wiped, or vacuumed on the inside and outside prior to storage or reuse.

9.2 Used containers and liners should be disposed in accordance with Guide E 1451.

10. Keywords

10.1 carcinogen; ceramic; container; fiber; health hazard; man-made mineral fiber (MMMF); packaging; respirable; silicon carbide whisker; whisker

CAUTION: CONTAINS SILICON CARBIDE WHISKERS

CAN CAUSE NOSE, THROAT, SKIN AND EYE IRRITATION. PROLONGED EXPOSURE TO RESPIRABLE SiC WHISKERS MAY RESULT IN PROGRESSIVE AND IRREVERSIBLE LUNG DISEASE. THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) CONCLUDED THAT INHALED CERAMIC FIBERS ARE POSSIBLY CARCINOGENIC TO HUMANS.

AVOID CREATING OR BREATHING AIRBORNE WHISKERS

FIRST AID: If inhaled and symptoms of pulmonary involvement develop (coughing, wheezing, shortness of breath), remove from exposure area to fresh air immediately. If symptoms persist, seek medical attention.

To avoid adverse health effects, read Material Safety Data Sheet (MSDS) for Silicon Carbide Whiskers.

(Include name and address of manufacturer on this label)

FIG. 1 Example Label

[4] *Industrial Ventilation, A Manual of Recommended Practice*, American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadows Dr., Cincinnati, OH 45240.