Designation: E 1435 – 98

Standard Practice for Handling Densified Articles of Aluminum Oxide Reinforced with Silicon Carbide Whiskers[1]

This standard is issued under the fixed designation E 1435; 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 recommended procedures to reduce health and safety problems which may arise during the handling of densified articles made from nonfibrous aluminum oxide reinforced with silicon carbide (SiC) whiskers.

1.2 The information in this practice may be considered for use in a manufacturer's material safety data sheet (MSDS) for densified articles of aluminum oxide reinforced with SiC whiskers.

1.3 This practice applies to finished articles where neither SiC whiskers nor aluminum oxide are released during use in excess of the limits of this practice.

1.4 Other materials may be included in the article (for example, sintering aids); information specific to these additional materials should be included in each manufacturer's MSDS.

1.5 *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.* For specific hazard and precaution statements, see Sections 5, 7, 9 and 10.

2. Referenced Documents

2.1 *ASTM Standards:*

E 1437 Practice for Handling Respirable Silicon Carbide Whiskers[2]

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

2.2 *American National Standards Institute (ANSI) Standard:*[3]

ANSI Z9.2—1979 Fundamentals Governing the Design and Operation of Local Exhaust Systems

2.3 *Occupational Safety and Health Administration (OSHA) Standard:*[4]

OSHA 8-hour Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for alpha-Alumina from U.S. Code of Federal Regulations (CFR) 29 CFR 1910.1000, Air Contaminants, Table Z-1, 1994

3. Terminology

3.1 *Definitions:*

3.1.1 *aspect ratio, n*—ratio of whisker length to whisker diameter.

3.1.2 *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.

4. Significance and Use

4.1 Handling or use of densified articles of aluminum oxide reinforced with SiC whiskers is not expected to be hazardous due to the presence of SiC whiskers unless the whiskers are released through a material removal process, such as (re)grinding.

4.2 This practice provides guidance, characteristics and data for handling and use of densified articles of aluminum oxide reinforced with SiC whiskers. It also provides guidance for determining when (re)finishing or other processing of densified articles of aluminum oxide reinforced with SiC whiskers will generate potentially hazardous conditions, and provides reference to relevant standards. If SiC whiskers are released, the implementation of Practice E 1437 may be required.

4.3 This practice is intended for use by health and safety professionals in determining whether an excessive exposure exists, in preparing procedures to establish a safe work environment, and in preparing relevant documentation.

5. Hazardous Ingredients/Identity Information

5.1 *Densified Articles*—Densified articles of aluminum oxide reinforced with silicon carbide whiskers are not expected to produce exposures which are hazardous to health. However

[1] This practice is under the jurisdiction of ASTM Committee E34 on Occupational Health and Safety and is the direct responsibility of Subcommittee E34.70 on Single Crystal Ceramic Whiskers.

Current edition approved April 10, 1998. Published June 1998. Originally published as E 1435 – 91. Last previous edition E 1435 – 91.

[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.

[4] Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(re)finishing the article as discussed in Section 10 will produce fine particles of potentially hazardous ingredients which can be inhaled, swallowed or come in contact with the skin or eyes.

5.2 *Hazardous Ingredients (specific chemical identity—common name(s))*:

5.2.1 *Silicon Carbide (SiC) Whiskers*—An acicular form of silicon carbide, which is Chemical Abstract Service (CAS) 409-21-2. A CAS number specific to SiC whiskers has not been assigned. OSHA PELs for SiC whiskers have not been established. American Conference of Governmental Hygienists (ACGIH) Threshold Limit Values (TLVs) have not been established. Manufacturers currently use the following exposure limits for respirable SiC whiskers:

5.2.1.1 A short term exposure limit (STEL) for respirable SiC whiskers of 2 fibers/cc as averaged over a sampling period of 30 minutes;

5.2.1.2 A long term exposure limit for respirable SiC whiskers of 0.2 fibers/cc 8-h TWA.

5.2.2 *alpha-Alumina (aluminum oxide)*—CAS 1344-28-1. The OSHA TWA-PELs are 15 mg/m^3 total dust and 5 mg/m^3 respirable fraction. The ACGIH TLV-TWA is 10 mg/m^3 total dust.[5]

6. Physical/Chemical Characteristics

6.1 The following data are relevant when preparing an MSDS for densified articles of aluminum oxide reinforced with SiC whiskers:

6.1.1 *Boiling Point*—Not applicable.

6.1.2 *Vapor Pressure (mm Hg)*—Not applicable.

6.1.3 *Vapor Density (Air = 1)*—Not applicable.

6.1.4 *Solubility in Water*—Insoluble.

6.1.5 *Relative Density (specific gravity)*—Variable per supplier.

6.1.6 *Melting Point*—Variable, above 1700°C.

6.1.7 *pH*—Not applicable.

6.1.8 *Evaporation Rate (butyl acetate = 1)*—Not applicable.

6.1.9 *Appearance and Odor*—Variable, no odor.

7. Fire and Explosion Hazard Data

7.1 The following data are relevant when preparing an MSDS for densified articles of aluminum oxide reinforced with SiC whiskers:

7.1.1 *Flash Point*—Non-flammable.

7.1.2 *Flammable Limits*—Not applicable.

7.1.3 *Lower Explosive Limit (LEL)*—Not applicable.

7.1.4 *Upper Explosive Limit (UEL)*—Not applicable.

7.1.5 *Extinguishing Media*—Not applicable.

7.1.6 *Special Fire Fighting Procedures*—Not applicable.

7.1.7 *Unusual Fire and Explosion Hazards*—Not applicable.

8. Reactivity Data

8.1 The following data are relevant when preparing an MSDS for densified articles of aluminum oxide reinforced with SiC whiskers:

8.1.1 *Stability*—Stable.

8.1.2 *Conditions to Avoid*—None.

8.1.3 *Incompatibility (materials to avoid)*—None under conditions of normal use.

8.1.4 *Hazardous Polymerization*—Will not occur.

9. Health Hazard Data

9.1 *General*—There is no known health hazard of the densified article as supplied for its intended use. However, as indicated by the conditions of use, employ mechanical guards, protective clothing and safety glasses to prevent burns or other injury to the body or eyes from hot parts, flying particles, or chips. If the densified article is to be (re)finished, see Sections 5 and 10.

9.2 *Emergency First Aid Procedures*—Symptomatic for the conditions present.

10. Precautions for Safe Handling and Use

10.1 *Steps to Be Taken in Case Material is Released or Spilled*—Not applicable for the article as supplied.

10.2 *Waste Disposal Method*—Landfill as approved by federal, state, county, and local agencies.

10.3 *Precautions to Be Taken in Handling and Storing*—Not applicable to the article as supplied.

10.4 *Other Precautions*—None under conditions of normal use. During (re)finishing of the article itself, such as (re)grinding, (re)cutting, (re)polishing, (re)machining, (re)fabricating, or during other (re)processing, if there is release of respirable silicon carbide whiskers in concentrations that exceed the exposure limits of 5.2.1, consult Practice E 1437 for guidance.

11. Personal Protective Equipment and Control Measures

11.1 *Respiratory Protection*—None under conditions of normal use (see 10.4).

11.2 *Eye Protection*—As required for other conditions present.

11.3 *Ventilation*—The ventilation system should be designed and applied in a manner consistent with the guidelines in Guide E 1718, ANSI Z9.2—1979, ACGIH manual—*Industrial Ventilation*,[6] or similar guidelines applicable to the ventilation task.

11.3.1 *Local Exhaust*—As required to maintain airborne exposure levels as stated in Section 5.

11.3.2 *Mechanical (General)*—As required to minimize migration of whiskers out of the controlled area.

11.4 *Personal Protective Equipment*—As required for other conditions present.

11.5 *Work and Hygienic Practices*—As required for other conditions present.

[5] ACGIH TLV-TWA for alpha-Alumina (aluminum oxide) from ACGIH *TLV/BEI 1997 Booklet;* see also *Documentation of the Threshold Limit Value and Biological Exposure Indices*, 6th ed., 1995, American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadow Dr., Cincinnati, OH 45240.

[6] *Industrial Ventilation, A Manual of Recommended Practice*, ACGIH, 1330 Kemper Meadow Dr., Cincinnati, OH 45240.

12. Keywords

12.1 advanced ceramic; alumina; aluminum oxide; ceramic; composite; fiber; man-made mineral fiber (MMMF); material safety data sheet (MSDS); silicon carbide; whisker