



Standard Test Method for Sinter Index of Electrical Grade Magnesium Oxide for Use in Sheathed Heating Elements¹

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1. Scope

1.1 This test method covers the determination of sinter index which predicts the sintering characteristics of electrical grade magnesium oxide for use in manufacturing sheathed heating elements.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:

C 266 Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles²

D 2755 Test Method of Sampling and Reduction to Test Weight of Electrical Grade Magnesium Oxide³

D 3347 Test Method for Flow Rate and Tap Density of Electrical Grade Magnesium Oxide for Use in Sheathed-Type Electric Heating Elements³

E 220 Method for Calibration of Thermocouples by Comparison Techniques⁴

3. Terminology

3.1 Descriptions of Terms Specific to This Standard:

3.1.1 *sinter index, n*—a number that characterizes the degree of sintering and numerically equals the weight in grams that causes a specially shaped probe to penetrate the sintered body of a fired magnesium oxide specimen to a prescribed depth.

3.1.2 *sintering, n*—the welding together and growth of contact area between two or more initially distinct particles at temperatures below the melting point, but above one-half of

the melting point. The rate of sintering is greater with smaller particles than with larger particles.

4. Summary of Test Method

4.1 The specimen of magnesium oxide is placed in a magnesium oxide combustion boat and exposed to an elevated temperature in an oxidizing atmosphere for a specified time. It is then cooled and subjected to a weighted, specially shaped, probe that penetrates the body of the specimen.

5. Significance and Use

5.1 The degree of sintering of the magnesium oxide at elevated temperatures experienced in manufacturing sheathed heating elements is important to the user. A high degree of sintering increases the tendency of the insulation to fracture during bending of the heating element but a low degree of sintering reduces the thermal conductivity.

6. Apparatus

6.1 *Electric Furnace*, capable of heating the entire combustion boat (6.3), to $1093 \pm 5^\circ\text{C}$ ($2000^\circ \pm 9^\circ\text{F}$). The furnace shall be provided with a power supply and control to permit adjustment and maintenance of the desired test temperature. The use of a nonswitching-type power supply is optional. The furnace shall be of one of the following types:

6.1.1 *Tube Furnace*, having a minimum 305 mm (12 in.) uniform heat zone, with a straight bore, open-ended, ceramic combustion tube measuring approximately 32 mm (1¼ in.) in outside diameter, by 25.4 mm (1 in.) in inside diameter, by 610 mm (24 in.) in length.

6.1.2 *Muffle Furnace*, having a minimum internal dimension of 133-mm (5¼-in.) width by 203-mm (8-in.) depth and 95-mm (3¾-in.) height, and capable of heating twelve combustion boats simultaneously. The furnace cavity should be checked to ensure a uniform heat pattern.

6.2 *Combustion Plate*, 102-mm (4-in.) by 203-mm (8-in.) by 13-mm (½-in.) thick to support boats in the muffle furnace. The combustion plate must be capable of withstanding the temperature and thermal shock associated with the test.

6.3 *Combustion Boat*,⁵ refractory type, magnesium oxide, 95 mm (3¾ in.) long, and having a flat bottom for at least half its

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² *Annual Book of ASTM Standards*, Vol 04.01.

³ *Annual Book of ASTM Standards*, Vol 10.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.03.

⁵ Magnesium oxide combustion boats are available from Saxonburg Ceramics, 100 Isabella St., Saxonburg, PA 16056.

7.1 Obtain a 75 to 100-g sample of magnesium oxide in

