



# Standard Test Method for Bulk Density and Volume of Solid Refractories by Wax Immersion<sup>1</sup>

This standard is issued under the fixed designation C 914; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the basic procedure for determining bulk density and volume of refractory shapes. This test is applicable to all refractory shapes or monoliths, burned or unburned, independent of composition or forming method, including materials that slake and hydrate. It is particularly suitable for determining bulk density and volume of complex shapes after forming, since results may be obtained in a matter of minutes.

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.* For a specific hazard statement, see Note 2.

## 2. Significance and Use

2.1 This test method may be used to quickly determine volume and bulk density of a refractory of any shape, provided it has sufficient structural integrity to permit handling. Thus it may be used on unfired or fired, strong or friable shapes.

2.2 Since the test may be performed quickly, it has found application as manufacturing in-process control as well as in characterizing finished refractory products. Also it may be used to examine specimens after other test or service exposure.

## 3. Apparatus

3.1 *Paraffin Wax*, fully refined, that has a known constant density,  $K$ , that does not change after repeated melting and cooling cycles.

NOTE 1—The paraffin waxes generally used are commercially available and have density values in the range 0.87 to 0.91 g/cm<sup>3</sup>. Also, these waxes melt at approximately 135°F (57°C).

3.2 *Wax-Melting Container*, used to melt the wax but should not allow the wax to overheat. A container heated by hot water, preferably thermostatically controlled, is satisfactory. The wax

should be heated to only slightly above the melting point to avoid flashing of the wax vapors and to permit quickly forming a uniform surface coating of wax.

NOTE 2—**Caution:** Vapors given off by molten wax ignite spontaneously at above 400°F (205°C) and should not be allowed to come in contact with the heating element or open flame.

3.3 *Balance*, capable of determining the weights of the specimens to four significant figures. Thus, specimens weighing from 100 to 999 g should be weighed to one decimal place, those from 10 to 99 g should be weighed to two decimal places, and so forth.

## 4. Sampling

4.1 At least five representative specimens should be chosen of the refractory to be characterized. These may be whole shapes or broken pieces, depending on the purpose of the test.

## 5. Procedure

5.1 *Preparation of Specimens*—The test specimens shall be dried to a constant weight by heating to 220 to 230°F (105 to 110°C) to remove entrapped moisture, which would affect the bulk density determination. This drying process may be omitted when specimens are known to be dry or when it is desired to make density determinations on moisture-containing specimens, such as brick shapes, immediately after forming.

5.2 *Initial Weight,  $W$* —Determine the initial weight,  $W$ , of each test specimen in grams to four significant figures.

5.3 *Coating the Test Specimen:*

5.3.1 Coat the specimen with wax by dipping the specimen into the container of melted wax. The coating is easily applied by holding one end of the specimen and immersing one half to two thirds of it. Then, hold the waxed end, and immerse the unwaxed portion plus a small overlap into the wax to provide a complete coating.

5.3.2 Take care not to entrap air bubbles under the wax. If found, press these bubbles out so the wax conforms exactly to the surface of the specimen. Close holes in the wax coating by additional dipping in wax so the surface can be completely sealed.

5.4 *Wax-Coated Weight,  $P$* —Determine the weight of the wax-coated specimen,  $P$ , in grams to four significant figures.

5.5 *Suspended Weight,  $S$* :

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.03 on Physical Tests and Properties.

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