Designation: ~~D4373 – 02 (Reapproved 2007)~~ D4373 – 14

Standard Test Method for Rapid Determination of Carbonate Content of Soils[1]

This standard is issued under the fixed designation D4373; 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~~ Scope*

1.1 This test method covers the determination of carbonate content of soils and soft rock which can be readily broken down by mechanical effort. It is a gasometric method that ~~utilizes~~uses a simple portable apparatus. Results should be clearly stated as the calcite equivalent in percent because different carbonate species cover a wide range of percent calcite equivalent as shown below for a number of carbonates:

Species	Cation	Calcite Equivalent, %
Magnesite	Mg	117.0
Dolomite	Ca, Mg	108.6
Calcite	Ca	100.0
Aragonite	Ca	100.0
Rhodocrosite	Mn	87.1
Siderite	Fe	86.4
Smithsonite	Zn	79.8
Witherite	Ba	50.7
Cerrusite	Pb	37.5

For example, a 100 % dolomite would be expected to yield 108.6 % calcite equivalent while 100 % siderite would yield only 86.4 % calcite equivalent. Calcite and aragonite reactions will typically complete within about 10 ~~min.~~minutes. This method does not distinguish between the carbonate species and such determination must be made using quantitative chemical analysis methods such as atomic absorption.

1.2 *Units*—The values stated in SI units are to be regarded as the standard.

1.3 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.3.1 The procedures used to specify how data are collected/recorded or calculated, in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analytical methods for engineering design.

~~1.4 The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. How one applies the results obtained using this standard is beyond its scope.~~

1.4 *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 precaution statements, see Section 8.

2. Referenced Documents

2.1 *ASTM Standards*:[2]

C25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime

D653 Terminology Relating to Soil, Rock, and Contained Fluids

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.06 on Physical-Chemical Interactions of Soil and Rock.

Current edition approved ~~Sept. 1, 2007~~May 1, 2014. Published ~~October 2007~~June 2014. Originally approved in 1984. Last previous edition approved in ~~2002~~2007 as ~~D4373 – 02.~~D4373 – 02 (2007). DOI: ~~10.1520/D4373-02R07.~~10.1520/D4373-14.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

D3042 Test Method for Insoluble Residue in Carbonate Aggregates
D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
D6026 Practice for Using Significant Digits in Geotechnical Data
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves
E145 Specification for Gravity-Convection and Forced-Ventilation Ovens

3. Terminology

3.1 *Definitions*—For definitions of common technical terms used in this ~~standard see~~ standard, refer to Terminology D653.

4. Summary of Test Method

4.1 The carbonate content (calcite equivalent) of soil is determined by treating a 1-g dried soil specimen with hydrochloric acid (HCl) in an enclosed reaction cylinder (reactor). Carbon dioxide (CO_2) gas is evolved during the reaction between the acid and carbonate fraction of the specimen. The resulting pressure generated in the closed reactor is proportional (see Fig. 1) to the calcite equivalent of the specimen. This pressure is measured with a suitable pressure gauge, or equivalent pressure-measuring device, that is pre-calibrated with reagent grade calcium carbonate.

5. Significance and Use

5.1 This test method is used to determine the presence and quantity of carbonate in a soil specimen in terms of the calcite equivalent. The method is generally intended for use as an index of approximate carbonate content to assist with characterizing marine soils. Other test methods exist (such as Method C25 and Test Method D3042) to evaluate calcium carbonate equivalency for purposes of characterizing use of calcareous materials as soil modifiers or agricultural lining materials.

5.1.1 Calcium carbonates ($CaCO_3$) are known cementing agents, are water soluble at pH < 7, and are soft on the Mohs' scale compared to other soil minerals.

5.2 This test method has limitations as follows:

5.2.1 If low carbonate contents (calcite equivalents) are measured, the user does not know whether the soil is low in carbonate content or contains cerrusite, witherite, ~~etc.,~~ and the like, which are carbonate species whose reactions with hydrochloric acid are either very slow or limited.

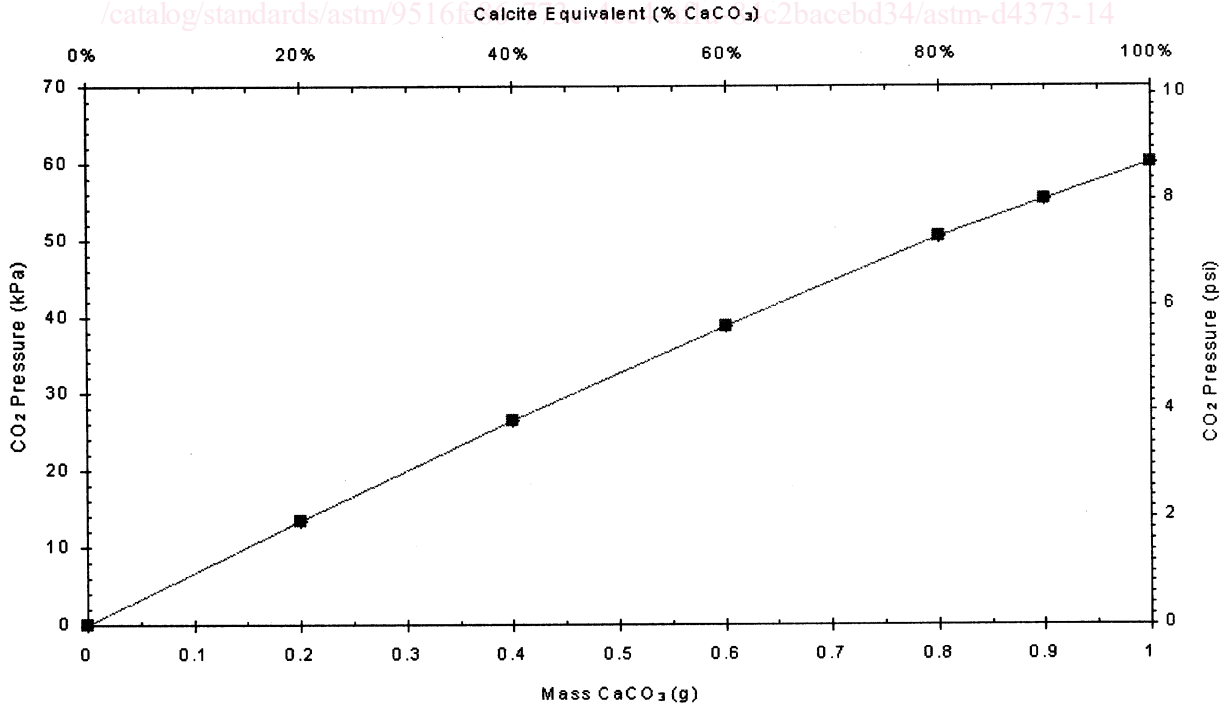

FIG. 1 Typical Calibration Curve for 0.374L Test Cell and 70 kPa (10 psi) Pressure ~~Gage~~Gauge