Designation: D4074/D4074M – 11 (Reapproved 2015)

Standard Test Method for
Bitumen and Aggregate Content of Bitumen-Aggregate Mixtures From Roofing Samples[1]

1. Scope

1.1 This test method covers the determination of the bitumen content of adhered aggregate surfacing on a roof, and the approximate mass per unit area of the flood coat and adhered aggregate.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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 and regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
D71 Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)
D2829 Practice for Sampling and Analysis of Existing Built-Up Roof Systems

3. Summary of Test Method

3.1 The proportions of bitumen and aggregate in a mixture are determined from their relative densities and the relative density of their mixture.

4. Significance and Use

4.1 This test method offers a convenient alternative to solvent extraction for the approximate determination of top-coating bitumen and adhered aggregate in roofing samples, particularly when the bitumen is coal tar pitch.

5. Apparatus

5.1 *Beaker,* 500-mL minimum capacity, without a pour spout.[3]

5.2 *Glass Cover Plate,* 127 by 127 by 3 mm [5 by 5 by 0.12 in.].

5.3 *Balance,* 1000 ± 0.1-g capacity.

6. Materials

6.1 *Isopropyl Alcohol,* $(CH_3)_2$ CHOH, commercial grade.

6.2 *Paper Cups,* paraffin-coated, 61 mm [2.4 in.] in diameter by 76 in. [3 mm] high, 150-mL [5-oz] capacity.

7. Sampling

7.1 Obtain samples in the field in accordance with Practice D2829.

8. Procedure

8.1 Cut a 100-mm [5⅝-in.] square specimen from the roofing sample and collect any associated loose, bitumen-free aggregate in a tared paper cup.

8.2 Add additional loose, bitumen-free aggregate to the cup from the remaining sample, if necessary, to obtain a 100 to 200-g specimen of the aggregate. Weigh the aggregate to the nearest 0.1 g and record as M_a.

8.3 Place the roofing specimen on aluminum foil or release paper and carefully remove the adhered aggregate and top coating with a hot knife or scraper without damaging the top felt.

NOTE 1—This will usually leave 200 to 400 g/m^2 [4 to 8 lb/100 ft^2] of bitumen on the surface of the roofing felt.

8.4 Collect the adhered aggregate and top coating removed in 8.3 in a tared paper cup and add any associated loose, bitumen-coated aggregate. Weigh to the nearest 0.1 g and record as M_m.

8.5 Overfill the clean 500-mL beaker with isopropyl alcohol and carefully slide the glass cover plate over the top so as to exclude air. Blot the excess alcohol from the exterior of the beaker. Weigh the assembly to the nearest 0.1 g and record as T.

8.6 Remove the glass cover plate and place the aggregate specimen from 8.2 in the beaker. Again, overfill the beaker with alcohol, and carefully replace the cover plate. Blot the excess alcohol from the exterior of the beaker. Weigh the assembly to the nearest 0.1 g and record as W_a.

8.7 Discard the contents of the beaker and rinse with alcohol. Place the adhered aggregate and top coating specimen from 8.4 in the beaker. Overfill with alcohol, replace the cover plate, and blot the exterior as before. Weigh the assembly to the nearest 0.1 g and record as W_m.

8.8 Recover a 10 to 20-g specimen of the top coating bitumen from the remaining roofing sample. Prepare cast cubes and weigh them suspended in air and suspended in isopropyl alcohol in accordance with Sections 8 and 9 of Test Method D71, using alcohol in place of water. Record the weight in air as a, and the weight in alcohol as b.

Note 2—If a clean aggregate or bitumen sample cannot be obtained, use relative densities of 3.36 for gravel, 3.18 for slag, 1.30 for asphalt, and 1.65 for coal-tar pitch.

9. Calculation

9.1 Calculate the relative density of the aggregate (S_a) as follows:

$$S_a = M_a/(T + M_a - W_a) \qquad (1)$$

where:

M_a = weight of the aggregate in air, g,
T = weight of the covered beaker filled with alcohol, g, and
W_a = weight of the covered beaker containing the aggregate and filled with alcohol, g.

9.2 Calculate the relative density of the aggregate-bitumen mixture (S_m) as follows:

$$S_m = M_m/(T + M_m - W_m) \qquad (2)$$

where:

M_m = weight of the mixture in air, g,
T = weight of the covered beaker filled with alcohol, g, and
W_m = weight of the covered beaker containing the mixture and filled with alcohol, g.

9.3 Calculate the relative density of the bitumen (S_b) as follows:

$$S_b = a/(a - b) \qquad (3)$$

where:

a = weight of the bitumen cube in air, g, and
b = weight of the bitumen cube in alcohol, g.

9.4 Calculate the bitumen fraction of the mixture (p) as follows:

$$p = S_b(S_a - S_m)/S_m(S_a - S_b) \qquad (4)$$

9.5 Calculate the approximate mass of top coating bitumen (B) as follows:

$$B = pM_m \qquad (5)$$

9.6 Calculate the mass of adhered aggregate (A) as follows:

$$A = M_m - B \qquad (6)$$

10. Report

10.1 Report the approximate mass per unit area of bitumen. If the 100 by 100-mm specimen was used, multiply B by 100 to get g/m^2. If the 5⅝ by 5⅝-in. specimen was used, B expressed in grams is numerically equivalent to lb/100 ft^2.

10.2 Report the approximate mass per unit area of aggregate. If the 100 by 100-mm specimen was used, multiply A by 100 to get g/m^2. If the 5⅝ by 5⅝-in. specimen was used, A expressed in grams is numerically equivalent to lb/100 ft^2.

10.3 Report the type of bitumen and aggregate if known.

11. Precision and Bias

11.1 The precision of this test method indicates the probable error of a single determination is ±1.4 % of the true value. Duplicate samples should not differ by more than 2 % between laboratories.

11.2 There are no known biases in this test method.

12. Keywords

12.1 aggregate; asphalt; bitumen; built-up roofing; coal-tar pitch