Designation: F1425 – 06 (Reapproved 2011)

Standard Test Method for Determining the Tribocharge of Two-Component Developer Materials[1]

This standard is issued under the fixed designation F1425; 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 test method describes a technique for measuring the tribocharge or charge-to-mass ratio of a sample of developer material.

1.2 This test method determines the concentration of toner in a sample of developer material.

2. Referenced Documents

2.1 *ASTM Standards:*[2]
F335 Terminology Relating to Electrostatic Imaging

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *charge to mass ratio*—the quantity of charge per unit of mass. In xerography, the tribocharge per unit of mass of the toner.

3.1.2 *tribocharge*—the general term for the electric charge of a material whose charge is created by the tribo electric effect, or the rubbing of unlike surfaces together.

3.2 Terms and definitions used in this test method may be found in Terminology F335.

4. Summary of Test Method

4.1 Two component developer materials used in the xerographic process are charged by the tribo electric effect. Xerographic developers are commonly made up of two materials: toner and carrier. Toners are typically under 38 µm in size while carriers are several times larger. This size difference is used in the measurement of tribocharge.

4.2 The sample cell contains a very fine screen (400 mesh), which allows toner to pass through and blocks carrier from passing through. The sample cell is held in an insulated block with an electrical connection between the sample cell and the electrometer. The electrometer measures the charge on the cell as the toner is blown off the carrier by a highpressure air stream. From the difference in weight of the cell before and after the blow-off, and the electrometer charge measurement, the charge to mass ratio and percent toner concentration of the developer material can be calculated.

5. Significance and Use

5.1 This test method measures a fundamental property of a toner and developer mix used in copiers and printers. This test method is used for quality control purposes and to determine the ability of the toner and developer materials to develop onto the photoreceptor.

5.2 This test method may be used to measure the chargeto-mass ratio of new developer mixes.

5.3 This test method may be used to measure the chargeto-mass ratio of developer material samples taken from a machine.

5.4 This test method may be used to measure the toner concentration of new developer mixes.

5.5 This test method may be used to measure the toner concentration of developer material samples taken from a machine.

6. Interferences

6.1 Any differences in this test method used to charge the toner that would effect the frequency of collisions of toner and carrier, such as rolling the container of developer material in a container of different size or at a different rate, may cause variation in the results.

6.2 Any differences in the material that the container used to roll the developer material is made from could cause variations in the results.

6.3 The environmental conditions (temperature, humidity) can effect the results because some toners and carriers absorb water onto their surfaces. The water content of the compressed air can effect the results for hydroscopic materials.

[1] This test method is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.04 on Electrostatic Imaging Products.

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[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.

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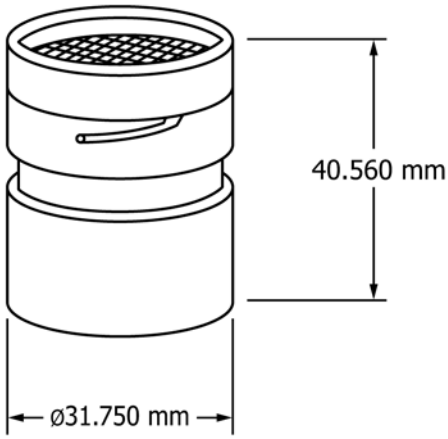

FIG. 1 Sample Cell

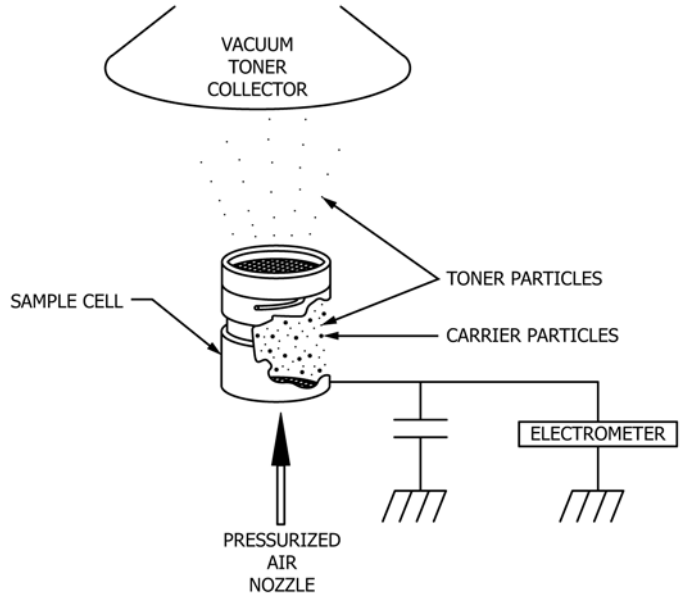

FIG. 2 Tribometer

6.4 The 400-mesh screen of the sample cell can become clogged with material. This is indicated by increasing cell weights. The clogged screen may be able to be cleaned by running a test with the cell empty or by blowing filtered air through the cell from a hand-operated nozzle. If the cell weights indicate that the cell is still clogged, the cell can be cleaned in an ultrasonic cleaner. Be sure the cell is rinsed and dried before use.

6.5 The 400-mesh screen can develop holes or gaps after repeated use. This is evidenced by high percent toner values indicating that the carrier particles have passed through the fine screen, giving lower after blow-off cell weights.

7. Apparatus

7.1 *Sample Cell*— The sample cell contains a very fine screen (400 mesh) supported by a coarse screen. The fine screen allows toner to pass through and blocks carrier from passing through. See Fig. 1.

7.2 *Tribometer,* any device which provides the functions of holding the cell in the proper electrical connection, blowing the air through the cell under controlled conditions of air pressure and time, and collecting the waste toner. See Fig. 2.

7.3 *Vacuum Cleaner,* of a type used in copier service suitable for removal of toner (fine particle filter).

NOTE 1—The hose should be made of material which is resistant to toner, if possible. The vacuum cleaner is used to remove the waste toner.[3]

7.4 *Electrometer,* capable of measuring charge in the range from 10^{-8} to 10^{-6} C.[4]

7.5 *Air Supply Line,* capable of supplying air at a minimum flow rate of 1.6 to 2.0 ft^3/min at 100 psi. The air supplied must be filtered to be free of particulate matter as well as oil (most industrial air systems supply air which includes a minute amount of oil used as a lubricant in air-operated equipment). A5-µm pre-filter and oil coalescing filter will remove particles and oil. Either the air supply line, or the tribometer unit must include an air-pressure regulator.

7.6 *Analytical Balance,* capable of weighing the cell (approximately 85 g) to 0.0001 g.

7.7 *Roller Unit*— A two-roll device where one roll is powered by a motor. The sample container is placed on the two rollers such that when the roller is powered, the sample container rolls on top of the two rollers. The roller unit should be capable of rolling several sizes of containers of developer, and have a variable speed motor with enough torque to roll samples, or developer mixed of weights appropriate to the application. See Fig. 3.

8. Sample Preparation

8.1 Roll commercially prepared developer mixes or previously prepared large batches for at least 30 min at the appropriate speed for the size of the container.

8.2 Roll freshly made large batches for at least 4 h at the appropriate speed for the size of the container.

8.3 Prepare small carrier/toner samples (approximately 100 g) in a glass jar and roll for at least 1 h at the appropriate speed for the size of the container.

8.4 Run samples taken from a copy machine as soon as possible. Take the sample after the machine has been turning the developer unit for at least 10 min, so that the toner has had an opportunity to tribocharge.

8.5 All speeds are relative to the container size. The actual surface speed of the containers in all cases is approximately 90 ft/min.

[3] The sole source of supply of the apparatus (vacuum cleaner 3M Model 496 A G) known to the committee at this time is 3M, 3M Center, St. Paul, MN 55144–1000. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[4] The sole source of supply of the apparatus (Keithley 610C electrometer) known to the committee at this time is Keithley Instruments Inc., 28775 Aurora Road, Cleveland, OH 44139. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

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