Association of Rotational Molders

Test Method for Particle Size of Rotational Molding Powders

Version 2.5

December 2015

Contents:

Association of Rotational Molders
Test Method for Particle Size
of Rotational Molding Powders

Version 2.5 – December 2015

This test was developed by the Association of Rotational Molders (ARM) from a variety of sources; all of which ARM and its members believe to be reliable. While ARM has made reasonable efforts to confirm the completeness and accuracy of the data on which this test method is based, ARM and its members make no guarantees, warranties, or other representations as to the data's completeness and accuracy, nor do ARM and its members assume any responsibility or liability for any loss or damage suffered from the use of this test.

As with any procedure of this nature, use appropriate safety devices. Good safety practices and compliance to OSHA standards are the responsibility of the tester.

1. Scope

1.1 This test method is used to evaluate the particle size distribution of powders for the purpose of rotational molding. Experience over many decades indicates that rotational molding powders need acceptable particle characteristics to be handlable and rotomoldable.

1.2 The test method is based on ASTM D1921 with conditions adapted and refined to be specific for use in rotational molding.

1.3 The test method is based on the use of sieve stack and mechanical shaking device of specified characteristics.

1.4 Units are stated in both SI and those normally used in United States.

1.5 *This standard does not purport to address all of the safety or environmental problems, if any, associated with its use. It is the responsibility of the user of the standard to establish appropriate safety, health and environmental practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standard
D 1921-12 Standard Test Methods for Particle Size (Sieve Analysis) of Plastics Materials

3. Summary of Test Method

3.1 This test method consists of measuring the quantity of different particle fractions in a standard quantity of powder.

4. Significance and Use

4.1 This test method does not purport to interpret results or measurements. Such interpretation is left to the parties involved in the commissioning and reporting of the test results.

4.2 This test method is intended to provide an indication of the performance of rotomolding powders with respect to their handling and their performance during the rotomolding process.

4.3 Particle size characterizes the handling properties of a finely divided plastic material. It provides a measure of the readiness with which such materials will flow through hoppers and feeding devices and deliver uniform weights of material.

4.4 Particle size also characterizes the rotomolding properties of a finely divided plastic material. It provides a measure of the readiness with which the powder flows

4.5

4.6

4.7 evenly across all surfaces of the mold. A rotomolding powder with poor particle size distribution may create defects in the final molded product such as bridging, uneven wall thickness, rough internal surface, pinholing and pigment swirling.

4.8 Conditions that can affect particle size results include: tapping frequency, tapping time, screen surface condition, weld integrity and wire diameter.

5. Definitions

5.1 *Sieve* - An apparatus containing a wire cloth containing holes of a given size for powder to pass through. Also sometimes known as a screen.

5.2 *Sieve Stack* - A collection of sieves (typically 8 including cover and pan).

5.3 *Pan* - The bottom sieve/container in a sieve stack.

5.4 *Particle Size* – a measure of the size of the particles in a standard quantity of material.

5.5 *Particle Size Distribution*– a measure of the weights of the particle fractions remaining on each of the screens in a sieve stack.

5.6 *Powders* – may include pulverized material, microspheres and other small particles suitable for rotomolding.

6. Apparatus

6.1 Mechanical Shaking Device and Time Switch – a mechanical sieve shaking device equipped with an automatic time switch. This device shall be capable of imparting a uniform rotary motion and a tapping action at a rate of 150 +/- taps per minute. WS Tyler is one manufacturer of such apparatus and available from their rotomolding industry distributor, Plastics Consulting Inc. 772-781-6699.

6.2 Six 8 inch (203 mm) full height sieves, a cover and a pan. The sieves and wire cloth may be brass or stainless steel or a combination of both.

10.1.1. The sieves are to comply with ASTM E 11 specifications. Sieves with wavy wire cloth or broken welds may not be used.

10.1.2. Caution: Cleaning the sieves with compressed air can damage the wire cloth welds. Brushes designed for cleaning the sieves and a vacuum cleaner should be used with care.

6.3 Laboratory balance with 0.1 gram accuracy. A 500 gram scale is typically large enough to weigh the sieve with the retained powder.

6.4 In place of a timer on the sieve shaker a stop watch may be used.

6.5 Cleaning brushes and vacuum cleaner. A nylon 3 inch wide paint brush, with the bristles shortened to about 1 ½ inches, will work well and will not damage the sieves.

7. Safety Precautions

7.1 As with any procedure of this nature, use appropriate safety equipment and devices. Good safety procedures and compliance to OSHA standards are the responsibility of the tester.

7.2 Working with polymers finely ground to powder can be harmful if inhaled and can be an explosion hazard. Prevent airborne dust when performing this test, cleaning the sieves and handling the powder.

7.3 Moving parts on the shaker device can be pinch points.

7.4 Noise levels of 85 dB are common. Proper precautions should be taken to reduce dB level to required levels for expected exposure times.

8. Sampling and Conditioning

8.1 Samples for particle size should be taken from the bulk in a way that prevents any segregation or sorting of powder fractions that would affect its homogeneity. Note that powder particles tend to separate during transportation and any type of movement or vibration. The powder sample is to be representative of entire container. Multiple “thief” samples from cartons work well. Brass grain thieves or grain probes are readily available.

8.2 If the powder sample is warm, it should be allowed to cool before its’ particle size is measured; it should be within the range of 20 - 25°C (68 - 77°F) when tested. Rapid cooling may be promoted by spreading the powder sample out in a thin layer, provided subsequent homogeneity of the sample is preserved. Where possible, the powder should be conditioned to the humidity and air temperature in the laboratory.

8.3 The addition of flow promoters, or any other additives and reagents, to the powder sample is not in accordance with this standard, which is intended to test the quality of the powder supplied to the rotomolding process.

9. Preparation of the Apparatus

9.1 Thoroughly clean and inspection of the sieves is required. During inspection, pay particular attention to the cloth around the outside diameter weld and check for rips/tears.

9.2 Weigh each sieve and pan. Record the weight of each sieve and the pan. Typically, this weight is recorded on the outside diameter of each sieve and the pan with a “Sharpie” pen. This step is required one time.

10. Procedure

10.1 Stack the sieves with the largest opening on top to the smallest opening on the bottom.

10.1.1. The sieves should be stacked in descending opening size. A typical sieve stack is provided below:

10.1.1.1	Cover
10.1.2.1	30 mesh (600 micron)
10.1.3.1	35 mesh (500 micron)
10.1.4.1	40 mesh (425 micron)
10.1.5.1	60 mesh (250 micron)
10.1.6.1	80 mesh (180 micron)
10.1.7.1	100 mesh (150 micron)
10.1.8.1	Pan

Note: The Stack can also be made up of any combination of sieves. Alternate sieve stack examples are contained in Appendix A.

10.2 Weigh 100 ± 0.1g of the powder to be tested into a suitable container.

10.3 Remove the sieve stack cover and pour the 100g sample into the top sieve.

10.4 Replace the cover and place the sieve stack into the shaker apparatus.

10.5 Start the shaker and allow it to shake the sieve stack for 10 min ± 15 sec.

10.6 Carefully remove the sieve stack including pan from the shaker apparatus. Sequentially separate each sieve from top to bottom of stack and record the weight (retained powder and sieve).

10.7 Subtract the tare weight of each sieve and pan and record the retained powder weight

10.8 Appendix B contains a useful data collection and calculation form. Note that the cumulative weight of the retained powder should be 98-100g.

11. Report

11.1 Report the sample identification, sample size and test machine used.

11.2 Report the amount of material retained on each sieve and the pan. Appendix B contains a useful data collection and reporting form.

Appendix "A"
Alternate Sieve Stacks Examples

Sieve Size	35 US Mesh Powder	35 US Mesh Powder	35 US Mesh Powder	35 US Mesh Powder	20 US Mesh Powder	20 US Mesh Powder
Sieve 1	Cover	Cover	Cover	Cover	Cover	Cover
Sieve 2	30 mesh	30 mesh	30 mesh	30 mesh	16 mesh	16 mesh
Sieve 3	35 mesh	35 mesh	35 mesh	35 mesh	20 mesh	20 mesh
Sieve 4	40 mesh	50 mesh	50 mesh	40 mesh	40 mesh	35 mesh
Sieve 5	60 mesh	60 mesh	60 mesh	60 mesh	60 mesh	50 mesh
Sieve 6	80 mesh	80 mesh	80 mesh	80 mesh	80 mesh	60 mesh
Sieve 7	100 mesh	100 mesh	120 mesh	100 mesh	100 mesh	100 mesh
Sieve 8	Pan	Pan	Pan	Pan	Pan	Pan

Appendix "B"

Data Collection form

Powder Amount - 100 grams **Particle Size Distribution**

Shake Time - 10 minutes

	Sample ID:					**Date:**
	Additional Information:					
Screen Size (US Mesh)	**Weight of Screen (A) grams**	**Weight of Screen and Retained Powder (B) grams**	**Weight of Retained Powder (B minus A) grams**	**Percent Retained wt%**	**Dry Flow seconds**	**Bulk Density g/cc**
30						
35						
40						
60						
80						
100						
Pan						
			Sum (target 98-100 g)			