Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3751A
Superseding AMS 3751
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MICROSPHERES, HOLLOW GLASS

1. SCOPE:

1.1 Form: This specification covers hollow glass microspheres.

1.2 Application: Primarily as a filler material in syntactic foam shapes or parts for dielectric applications.

1.3 Classification: The hollow glass microspheres are classified according to nominal bulk density and designated as 100 times the nominal weight in grams of a cubic centimetre of the microspheres.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D1214 - Sieve Analysis of Glass Spheres
ASTM D2840 - Average True Particle Density of Hollow Microspheres
ASTM D2841 - Sampling Hollow Microspheres
ASTM D3100 - Alkalinty of Hollow Glass Microspheres
ASTM D3101 - Bulk Density and Packing Factor of Hollow Glass Microspheres

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: The hollow microspheres shall be manufactured from high-purity, electrical-grade glass, forming hollow spheres 1.00 mm (0.039 in.) in diameter or smaller. Ø

3.2 Finish: Unless otherwise specified, microspheres shall not be finished or coated. When specified, microspheres shall be finished for electrical compatibility with the resin system to be used. Ø

Printed in U.S.A.

3.3 Properties: The product shall conform to the requirements of Table I; tests shall be performed on the product supplied and in accordance with specified test methods.

TABLE I

ø	Requirement	Class Designation 15	22
	Bulk Density, g/cm^3	0.13 - 0.17	0.19 - 0.24
	Particle Density, g/cm^3	0.20 - 0.25	0.30 - 0.36
	Size Determination, Sieve Analysis		
	Weight retained on No. 80 mesh (180 µm) screen, %, max	6.0	6.0
	Weight passing through No. 400 mesh (38 µm) screen, %, max	40.0	30.0
	Surface Alkalinity, meq/g(1), max	0.50	0.40
	Sinkers by volume, %, max	20.0	24.0

(1) meq = milliequivalent

3.4 Quality: The product shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from imperfections detrimental to fabrication, appearance, or performance of parts.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of microspheres shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the microspheres conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 ø Acceptance Tests: Tests to determine conformance to requirements for particle density, size distribution, sinkers, and quality are classified as acceptance tests and shall be performed on each lot.

4.2.2 ø Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and shall be performed on the initial shipment of microspheres to a purchaser, when a change in material or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 ø For direct U.S. Military procurement, substantiating test data and, when requested, qualification test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Each lot of microspheres shall be sampled in accordance with ASTM D2841 at random throughout the lot to provide sufficient material to perform all required tests. The number of specimens for each test shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all microspheres produced in a continuous production run from the same batch of raw materials under the same fixed conditions and submitted for vendor's inspection at one time. An inspection lot shall not exceed 800 lb (365 kg) of microspheres and may be packaged in small quantities as noted in 5.1.1 under a basic lot approval as long as the lot identification is maintained.

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) for the microspheres have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6.1 shall state that such plan was used.

4.3.2 For Qualification Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample microspheres shall be approved by purchaser before microspheres for production use are supplied, unless such approval be waived. Results of tests on production microspheres shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production microspheres which are essentially the same as those used on the approved sample microspheres. If any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and processing and, when requested, sample microspheres. Production microspheres made by the revised procedures shall not be shipped prior to receipt of reapproval.

4.5 Test Methods: Shall be as follows; sinker determination shall be as in 4.5.1:

Bulk Density	ASTM D3101
Particle Density	ASTM D2840
Size Distribution, Sieve Analysis	ASTM D1214
Surface Alkalinity	ASTM D3100

4.5.1 Sinker Determination:

4.5.1.1 Pour a sample of the microspheres, taken in accordance with ASTM D2841, into a 100 mL graduate. Tap the graduate and add microspheres until the level remains constant at the 50 mL mark.

4.5.1.2 Add water to the 100 mL mark.

4.5.1.3 Shake the graduate without losing material until all glass microspheres have been completely wetted. Add additional water to 100 mL mark if necessary and reshake the graduate.

4.5.1.4 Allow the graduate to stand undisturbed for 10 min. ± 1.

4.5.1.5 Read the volume of the spheres that have settled to the bottom of the graduate; these are the "sinkers."

4.5.1.6 Calculate the volume of the sinkers as a percentage of the original volume of spheres, as follows:

$$\text{Sinker Volume, \%} = \frac{\text{sinker volume, mL}}{50} \times 100$$

4.5.1.7 Report the average of three determinations.

4.6 Reports: The vendor of microspheres shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the microspheres conform to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's product designation, lot number, date of manufacture, and quantity.

4.7 Resampling and Retesting: If any sample used in the above tests fails to meet the specified requirements, disposition of the microspheres may be based on the results of testing three additional samples for each original nonconforming sample. Failure of any retest sample to meet the specified requirements shall be cause for rejection of the microspheres represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 The microspheres shall be packed in sealed, moisture-resistant, plastic bags.

5.1.2 Each package shall be identified using characters of such size as to be clearly legible and which will not be obliterated by normal handling. The markings shall show not less than the following information:

HOLLOW GLASS MICROSPHERES, _____ g/cm^3 NOMINAL BULK DENSITY
AMS 3751A
MANUFACTURER'S MATERIAL DESIGNATION _____
PURCHASE ORDER NUMBER _____
DATE OF MANUFACTURE _____
LOT NUMBER _____
QUANTITY _____

5.1.3 Individual bags shall be packed in an exterior container capable of protecting the microspheres adequately, during shipment and storage, from damage and exposure to weather or any other normal hazard.

5.1.4 Each exterior shipping container shall be legibly marked with not less than the following information in such a manner that the markings will not smear or be obliterated during normal handling or use:

HOLLOW GLASS MICROSPHERES, _____ g/cm^3 NOMINAL BULK DENSITY
AMS 3751A
MANUFACTURER'S MATERIAL DESIGNATION _____
PURCHASE ORDER NUMBER _____
DATE OF MANUFACTURE _____
LOT NUMBER _____
QUANTITY _____