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

AEROSPACE MATERIAL SPECIFICATION

AMS 3880A
Superseding AMS 3880
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CRYSTALLIZED GLASS CERAMIC

1. SCOPE:

1.1 Form: This specification covers one type of crystallized glass ceramic in the form of cast and pressed shapes.

1.2 Application: Primarily for high-temperature, high-frequency applications in the electronics field, such as radomes, microwave antennas, and antenna covers.

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 C329 - Specific Gravity of Fired Ceramic Whiteware Materials
ASTM C674 - Flexural Properties of Ceramic Whiteware Materials
ASTM D116 - Testing Vitrified Ceramic Materials for Electrical Applications
ASTM D150 - A-C Loss Characteristics and Dielectric Constant (Permittivity) of Solid Electrical Insulating Materials
ASTM D2520 - Complex Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials at Microwave Frequencies and Temperatures to 1650 C
ASTM E228 - Linear Thermal Expansion of Rigid Solids with a Vitreous Silica Dilatometer
ASTM E384 - Microhardness of Materials

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-749 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material and Fabrication: The product shall be cast or pressed shapes of a semicrystalline material consisting essentially of fine crystals of cordierite dispersed in a minor proportion of a glassy phase.

3.2 Condition: The product shall be homogeneous in appearance from point to point and from piece to piece. Surfaces shall be smooth and free from microcracks.

3.3 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified ASTM methods:

3.3.1	Modulus of Rupture, (See 4.5.1), min		ASTM C674
	Individual Specimens	18 000 psi (124 MPa)	
Ø	Average of 5 Specimens	20 000 psi (138 MPa)	
3.3.2	Modulus of Elasticity	(15.6 - 19.0) x 10^6 psi	ASTM C674
Ø		(108 - 131 GPa)	
3.3.3	Hardness	663 - 733 HK100	ASTM E384
		588 - 650 HK500	
3.3.4	Specific Gravity at 77° /77° F (25° /25° C)	2.59 - 2.63	ASTM C329
3.3.5	Mean Linear Coefficient of		ASTM E228
	Thermal Expansion, 77° - 572° F	(31 - 33) x 10^{-7} in. per in. per F deg	
Ø	(25° - 300° C)	((56 - 59) x 10^{-7} mm/mm/C deg)	
3.3.6	Pore Volume, max	0.00	ASTM D116
3.3.7	Dielectric Constant (9.375 GHz)		ASTM D2520
	At 77° F (25° C)	5.4 - 5.6	
Ø	At 932° F (500° C)	5.3 - 5.7	
3.3.8	Loss Tangent (9.375 GHz)		ASTM D150
	At 77°F (25°C)	0.0005	
Ø	At 932°F (500°C)	0.002	
3.3.9	Dielectric Strength		ASTM D116
	at 68°F (20°C), min	205 V per mil	
		(8070 V/mm)	

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

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsibility 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 product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to modulus of rupture (3.3.1), specific gravity (3.3.4), dielectric constant (3.3.7), and loss tangent (3.3.8) requirements are classified as acceptance tests.

4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests.

4.2.2.1 For direct U.S. Military procurement, 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; a lot shall be all product from a single production run made from the same batch of raw materials under the same fixed conditions and submitted for vendor's inspection at one time:

4.3.1 Acceptance Tests: One specimen from each lot for the following requirements:

Requirement	Paragraph Reference
Modulus of Rupture	3.3.1
Specific Gravity	3.3.4
Dielectric Constant	3.3.7
Loss Tangent	3.3.8

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

4.4 Approval:

4.4.1 Sample material shall be approved by purchaser before material for production use is supplied, unless such approval be waived. Results of tests on production material 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 material which are essentially the same as those used on the approved sample material. 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 material. Production material made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Abrasion of Modulus of Rupture Specimens: Specimens shall be abraded to a degree equivalent to that produced by rolling round rod specimens, 10 at a time, in a 2-qt (1.89-dm^3) ball mill with 200 cm^3 of 30 grit silicon carbide grains at 100 rpm ± 5 for 15 min. ± 0.2.

4.6 Reports:

4.6.1 The vendor of the product 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 product conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision number, vendor's material designation, form and size or part number, and quantity.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, supplier's material designation, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

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

5. PREPARATION FOR DELIVERY: