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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3880C

Issued 15 JUL 1961
Revised 1 JAN 1993

Superseding AMS 3880B

Submitted for recognition as an American National Standard

CRYSTALLIZED GLASS CERAMIC

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of July, 1992. It is recommended, therefore, that this specification not be specified for new designs.

This cover sheet should be attached to revision "B" of the subject specification.

"NONCURRENT" refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs. Each of these "NONCURRENT" specifications is available from SAE upon request.

PREPARED UNDER THE JURISDICTION OF AMS COMMITTEE "CP".

AN AMERICAN NATIONAL STANDARD

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AEROSPACE MATERIAL SPECIFICATION

AMS 3880B
Superseding AMS 3880A

Issued 7-15-61
Revised 10-1-84

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 shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 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 Permittivity (Dielectric Constant) 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

Printed in U.S.A.

2.3 U.S. 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 (125 MPa)	
Average of 5 Specimens	20,000 psi (140 MPa)	
3.3.2 Modulus of Elasticity	(15.6 - 19.0) x 10^6 psi (108 - 131 GPa)	ASTM C674
3.3.3 Hardness	663 - 733 HK100 588 - 650 HK500	ASTM E384
3.3.4 Specific Gravity at 25°/25°C (77°/77°F)	2.59 - 2.63	ASTM C329
3.3.5 Mean Linear Coefficient of Thermal Expansion 25° - 300°C (77° - 572°F)	(56 - 59) x 10^{-7} mm/mm per C deg (31 - 33) x 10^{-7} in./in. per F deg)	ASTM E228
3.3.6 Pore Volume, max	0.00	ASTM D116
3.3.7 Dielectric Constant (9.375 GHz)		ASTM D2520
At 25°C (77°F)	5.4 - 5.6	
At 500°C (932°F)	5.3 - 5.7	
3.3.8 Loss Tangent (9.375 GHz)		ASTM D150
At 25°C (77°F)	0.0005	
At 500°C (932°F)	0.002	

3.3.9	Dielectric Strength at 20°C (68°F), min	205 V per mil (8070 V/mm)	ASTM D116

3.4 Quality: The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed 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 requirements for modulus of rupture (3.3.1), specific gravity (3.3.4), dielectric constant (3.3.7), and loss tangent (3.3.8) are classified as acceptance tests and shall be performed on each lot.

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

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant 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: Sufficient product shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement 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 product from a single production run made from the same batch of raw materials under the same fixed conditions and presented for vendor's inspection at one time.

4.3.2 For Preproduction 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 by purchaser. 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 necessary to make any change 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 or processing, or both, 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 L) ball mill with 200 mL 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 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, AMS 3880B, lot 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 a report showing the purchase order number, AMS 3880B, 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 either a statement that the material conforms or 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:

5.1 Packaging and Identification:

5.1.1 Packaging shall be accomplished in such a manner as to ensure that the product, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any other normal hazard.

5.1.2 Each package shall be permanently and legibly marked with not less than the following information:

CRYSTALLIZED GLASS CERAMIC
AMS 3880B
PURCHASE ORDER NUMBER _____
DATE OF MANUFACTURE _____
MANUFACTURER'S IDENTIFICATION _____
LOT NUMBER _____
QUANTITY _____

5.1.3 Ø Containers of the product shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.1 and 5.1.3 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to modifications authorized by purchaser will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.

8.2 Dimensions and properties in inch/pound units and the Celsius temperatures are primary; dimensions and properties in SI units and the Fahrenheit temperatures are shown as the approximate equivalents of the primary units and are presented only for information.