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1. SCOPE:

1.1 Form:

This specification and its associated detail specifications establish the requirements for continuous fiber unidirectional and fabric impregnated with a modified B-staged epoxy resin (“unidirectional tape and fabric prepreg”).

1.2 Application:

These composite prepreg material systems are intended for use in the fabrication of aerospace structures and components. The materials are designed specifically for vacuum-bag oven cure in accordance with NPS 4708 baseline cure cycle “C” for applications that require a relatively high glass transition temperature, hot/wet performance, toughness, and mechanical properties for a moderate cure temperature thermoset resin system.

Material property data including statistically based material allowables are available publicly for the materials covered by this specification. Part fabricators that wish to utilize the material property data, allowables, and specifications may be able to do so by demonstrating the capability to reproduce the original material properties; a process known as equivalency. More information about this equivalency process including the

1.8 Change Control Approval :

Prepreg product shall be produced in accordance with an NCAMP approved Process

2. APPLICABLE DOCUMENTS

2.1 NCAMP Publications :

2.2 ASTM Publications (available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, <http://www.astm.org>)

MIL-PRF-131	Dehumidification Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable
CMH-17	Composite Materials Handbook (formerly MIL-HDBK-17) (Rev. 10/1993)

- 3.4.2.1 The prepreg material shall be free from foreign material, cut or broken fibers, cured resin, unwetted fibers, wrinkles, resin-rich areas, dry or boardy areas, and indications of moisture visible to the unaided eye.
- 3.4.2.2 Fuzz balls shall be acceptable provided:
 - a. The fuzz balls cause no apparent fiber distortion. This shall be determined without removing the fuzz balls.
 - b. Any fuzz ball shall not exceed 1.5 inches in any direction.
 - c. The accumulated number of fuzz balls shall not exceed 6 in any 10 square feet of one side of prepreg material.
 - d. The overall thickness change due to fuzz ball is no more than 50 percent of the prepreg material nominal thickness.
- 3.4.2.3 The edge of the prepreg tape shall not deviate from a straight line by more than 0.025 inch per foot of length and shall be flush with the separator paper.
- 3.4.2.4 All fiber tows shall be collimated and parallel, within 0.025 inch per foot of length, to the centerline of the material.
- 3.4.2.5 The length of fiber gap, parallel to the 0° direction, shall not exceed 10 inches. The width of fiber gap, perpendicular to the 0° direction, shall not exceed 0.030 inch. One gap 0.010 to 0.030 inch wide and not exceeding 10 inches long is acceptable in each 10 square feet of prepreg. Gaps less than 0.010 inch wide and not exceeding 10 inches long are acceptable.
- 3.4.2.6 The prepreg shall be free from crimped fibers and fiber tow crossovers visible to the unaided eye.
- 3.4.2.7 The following specifies the acceptance/reject criteria for puckers and/or pimples in the unrolled condition.

TABLE 2 – Acceptance/Rejection Criteria for Puckers and/or Pimples

Largest Dimension	Frequency	Criteria
Greater than 0.50 inch	Any	Rejectable
0.25 to 0.50 inch	3 or less per 1 sq. ft	Acceptable
Less than 0.25 inch	All	Acceptable

3.4.3 Visual Requirements (Class 2):

- 3.4.3.1 The prepreg material shall be free from foreign material, cut or broken fibers, folded selvages that overlap nonselvage areas, cured resin, unwetted fibers, wrinkles, resin-rich areas, dry or boardy areas, and indications of moisture visible to the unaided eye.

- 3.4.3.2 The warp yarns shall be parallel to the warp direction within 1.0 inch over any 21.0 inches.
- 3.4.3.3 The fill yarns shall be perpendicular to the warp direction within 1.0 inch over any 21.0 inches.
- 3.4.4 Roll characteristics:

The total weight or length of material shall be specified by the purchaser. Unless otherwise specified by the purchaser, individual roll weight shall not exceed 70 pounds and 115 lbs for Class 1 and Class 2 materials, respectively. Width shall be as specified by the purchaser. Unless otherwise specified by the purchaser, tolerances on the width of the prepreg shall be:

- a. For unidirectional tape widths greater than 12.0 inches: ± 0.060 inch
- b. For unidirectional tape widths of 12.0 inches: ± 0.030 inch
- c. For unidirectional tape widths less than 12.0 inches: ± 0.020 inch
- d. For woven fabric (excluding the selvages): ± 1.000 inch

- 3.4.5 Material not conforming to the visible defect limitations and dimensional requirements:
 - 3.4.5.1 In cases where foreign material or resin rich areas can be removed without causing any apparent deformation of the prepreg surface, they may be removed by spatula or adhesive tape. The spatula or adhesive tape shall not transfer any contaminants to the prepreg product.
 - 3.4.5.2 Areas not conforming to Section 3.4.1, 3.4.2, or 3.4.3 shall be identified along the edge of the prepreg roll by markers. Markers shall be distinguishable from the prepreg and carrier release paper and removable without damaging the prepreg material.
 - 3.4.5.3 For single-point defects, use a single marker.
 - 3.4.5.4 Successive single-point defects 3 feet or less apart shall be considered as one continuous defect. For continuous defective areas, markers shall be placed at the beginning, at each 2-foot maximum interval, and at the end of the continuous defect.
 - 3.4.5.5 Prepreg tape material (Class 1

50 feet. The remaining 10 percent shall not contain two successive splices or defects closer than 15 feet.

- 3.4.5.8 The type, location, and length (for continuous defect) of each marked defect, and the location of the splices shall be indicated on a defect log accompanying each roll of prepreg material. Defect and splice locations shall be identified by markers on the prepreg roll edge.
- 3.4.5.9 Defective areas, considered as the length of the defect multiplied by the width of the roll, shall not be counted toward the amount of material purchased.

3.5

3.6.1.1 Release Paper/poly Film:

A non-transferring separator paper with differential release may be used on the inside of the roll. Paper or release film shall be used to permit easy removal of the preimpregnated material from the roll without loss of resin, tearing, shredding, fiber realignment, or other damage. The material shall be capable of being cut cleanly without other visible damage. The release paper shall not contaminate the prepreg.

3.6.1.2 Material Handling:

All rolled material greater than 12 inches wide shall be supported at all times by the ends of the internal fiberboard tube and kept horizontal. Unless otherwise specified by the purchaser, the fiberboard tube shall extend a minimum of 2 inches past the separator film for this purpose. The material shall not be allowed to rest against any surface, and except for rolls of 12.0 inches or less in width, shall not be allowed to rest in a vertical position. Wider width rolled material may be momentarily rested against a surface or in a vertical position only while being transferred to or from storage. Core size shall be defined in detail specifications.

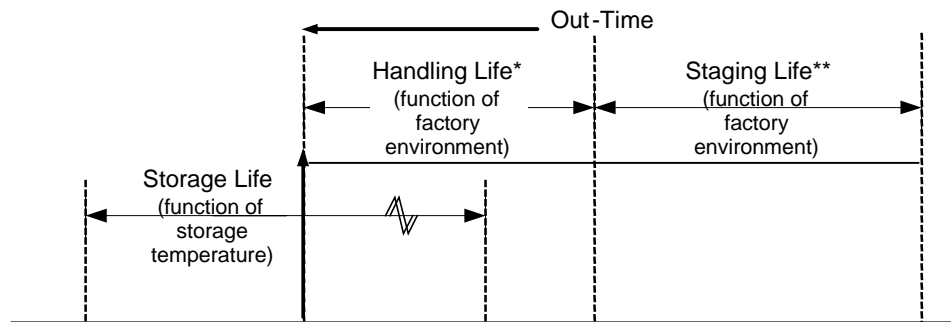
3.6.1.3 Thawing Rolled Materials:

Preimpregnated materials shall be allowed to warm at ambient temperature until moisture does not condense on the packaging (i.e. prepreg temperature is above dew point). The material out-time shall be recorded by the distributor and purchaser. The material out-time between manufacture and shipment at supplier location shall be in accordance with 5.2.3.

NOTE - No form of applied or direct heat shall be used to accelerate the thawing process.

3.6.

- 3.6.2.1.2 For purposes of tracking the storage life, the time shall be measured from the date of manufacture, unless otherwise specified in the purchase order. Material that has been stored for a time period longer than the maximum storage life shall not be used until tests have been performed to extend the storage life as defined by 3.6.2.1.3 or the user's process specifications.
- 3.6.2.1.3 Storage Life Extension: There is currently no data to support storage life of more than 12 months beyond the date of manufacture. Storage life extension must be supported by test data and approved by Material Review Board (MRB). It is recommended that the storage life extension, if approved by MRB, is for no more than 6 months only.
- 3.6.2.2 Handling Life: The handling life of the material at 72+/-5°F and 0-65% relative humidity is 30 days. Handling life begins when the prepreg is removed from the freezer and ends when prepreg is laid onto the tool. The handling life may be extended by 15 days provided that the material passes the gel-time, flow, volatile content, and short beam strength requirements.
- 3.6.2.3 Staging Life: . Staging life begins at placement of the ply on the tool at 72+/-5°F and 0-65% relative humidity (relative humidity requirement does not apply if kept under vacuum bag) and ends when the cure cycle begins.
- 3.6.2.4 Out-time: Out-time begins when the prepreg is removed from freezer storage and ends when the cure cycle begins. Total out-time is the summation of handling life and staging life. The total permissible out-time is 45 days. Extension of out-time requires Material Review Board (MRB) action, which should consider the intended application, handling characteristics (tack and drape), and mechanical properties of the material.



A material distributor shall perform the same documentation of storage life and handling life as the material supplier and purchaser. If the original packaging is to be opened to allow for re-spooling into smaller units, the prepreg shall be allowed to warm at ambient temperature in the unopened package until moisture does not condense on the packaging (i.e. prepreg temperature is above dew point). All out-time accumulated during warming, re-spooling, and repackaging shall be subtracted from the total handling life and documented for the purchaser(s). Distributors are not allowed to extend the storage life unless explicitly allowed by the purchaser.

3.7 Environmental, Health, and Safety :

3.7.1 Equipment, materials, solutions, and emissions (if applicable) shall be controlled, handled, used, and disposed of in accordance with all local, State, and Federal Government Safety, Health, and Environmental Affairs (SHEA).

3.7.2 The delivered prepreg system shall fulfill the local requirements of the health and safety laws of the country of the purchaser. When processing the prepreg in the composite shop, there shall be no health hazards or emissions that require special measures to be taken to protect the environment.

3.7.3 The manufacturer shall inform the purchaser about the safe handling procedures of the material. The Material Safety Data Sheet (MSDS) shall be made available to the purchaser.

3.8 Defects During Usage:

3.8.1 Defects, as defined by this specification, which are not marked by the supplier but found in the prepreg material after acceptance shall be cause for rejection and the defective material may be returned to the supplier. Defects caused by user mishandling, improper storage, or expiration of storage or out-life are not the responsibility of the supplier and shall not be cause for rejection back to the supplier.

3.9 Qualification Requirements :

Materials shall be qualified in accordance with an NCAMP test plan.

3.10 Material Re- Qualification and Equivalency :

3.10.1 If any change occurs relevant to this specification or the PCD, NCAMP reserves the right to require a re-qualification by the prepreg manufacturer to validate that the changed material is equivalent to the material in the initial qualification. The extent of the re-qualification program will depend on the nature of the change of the material or the material processing. DOT/FAA/AR-06/10 and DOT/FAA/AR-07/3 provide guidance in this area.

3.10.2 Equivalency is limited to the evaluation of minor changes in a material's constituents, manufacturing process, or fabrication (e.g. curing) process used with a material.

Significant changes to the prepreg material will require a full qualification program and a separate specification.

3.10.3 It is the responsibility of the material supplier to conduct testing to demonstrate that the current material, when processed to the baseline process specification, will generate composite properties statistically equivalent to the properties of the original materials.

3.11 Process Control Document :

3.11.1 The supplier shall prepare and control a Process Control Document (PCD) in accordance with NRP 101. The PCD shall be considered proprietary and shall be protected in accordance with disclosure agreements signed by the supplier and NCAMP. The established Process Control Document (PCD) shall be presented to NCAMP upon request. NCAMP shall treat any information contained in the PCD as proprietary.

3.11.2 Changes to the PCD of a qualified material (as defined by DOT/FAA/AR-06/10, DOT/FAA/AR-07/3 and NRP 101) are subject to the written approval of NCAMP. Such changes may require substantial testing.

3.12 Traceability :

Each individual material and its constituents as defined by the PCD shall be identifiable at all stages of manufacture and delivery. The material manufacturer shall present evidence of the material traceability upon request.

3.13 Manufacturer's Responsibility :

3.13.1 The manufacturer is responsible for the development and manufacture of any material submitted in accordance with this specification. Quality control by the manufacturer (u)10 (eh(al))T
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3.1: 3.11.2 T : h e : m a n u f a c t

- a. Cut sufficient material to obtain three specimens that are a minimum of 2-inches long by a minimum of 3-inches wide, and remove any release paper or film.
- b. Complete wrapping each specimen separately over a 0.25 inch diameter mandrel within 15 seconds of initiation, with fiber direction transverse to mandrel centerline.
- c. Remove each specimen from the mandrel and inspect for evidence of cracks, wrinkles, folds, or tears on the surface of the material. Evidence of these defects in cut edges extending less than 0.13 inch inward maximum from the edge shall not be considered rejectable.

If no evidence of filament breakage can be visually observed, the specimen has met the requirements for drape. Report as pass or fail.

5. PREPARATION FOR DELIVERY :

5.1 Packaging :

- 5.1.1 The prepreg shall be rolled onto a core suitable for use at the purchaser. Suppliers uncertain as to core suitability shall direct their inquiries through the purchaser prior to fabrication of material.
- 5.1.2 Each spool/roll of material shall be wrapped and sealed with a non-adherent, non-contaminating moisture-proof bag to prevent penetration of moisture. The bag material shall conform to MIL-PRF-131, Class 1 or 3, or equivalent.
- 5.1.3 Place a minimum of four units of MIL-D-3464, Type II desiccant in each bag prior to sealing.
- 5.1.4 The individual spool or roll shall be packed in a shipping container that will be acceptable for safe transportation by common carriers and shall include a packing list. The core shall be supported on ends to avoid damage to the prepreg. The container shall be of such design as to prevent damage or degradation to the prepreg during shipment.
- 5.1.5 The outside of each container and the inside of the roll core shall be clearly marked with the following information:
 - a. Title, number and revision letter of this specification
 - b. Date of manufacture (or date of shipment if specified by the detail specification)
 - c. D

