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NCAMP Material Specification

350°F Autoclave Cure, Toughened Epoxy Prepregs
Type 35, Class 1, Form 1, Grade 120
Toray Advanced Composites TC380 T1100GC 24K, 120 gsm, 35% RC Unidirectional Tape

This specification is generated and maintained in accordance with NCAMP Standard Operating Procedures, NSP 100

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Reviewed by: Russell Kirkman (Toray TAC), Daniel Erigero (Toray TAC), Joe Feskanin (Toray TAC), Royal Lovingfoss (NCAMP)

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REVISIONS:

Rev	By	Date	Description
-	Vinsensius Tanoto	5/2/2024	Initial Release
A	Vinsensius Tanoto	9/8/2025	Cover Page: • Added “Daniel Erigero (Toray TAC)” to reviewer list. Section 3 Table 1: • Specification limits were added. Section 3.4.3: • Standard widths was revised from “24 and 36 inches” to “24 inches” only. Section 3.5.2 Table 3: • Specification limits were revised or added. • Note 3 was revised. • Note 4 was revised from “± 18 ºF” to “± 18 ºC”. Section 3.5.3 Table 4: • Specification limits were revised or added.

1. SCOPE:

1.1 Form:

This detail specification along with the base specification NMS 380 establishes the requirements for continuous unidirectional carbon fiber impregnated with a modified B-staged epoxy resin (“unidirectional tape prepreg”). The prepreg is produced using a hot-melt process.

This detail specification follows the section and table numbering scheme of the base specification. It contains additional or superseding requirements. The base specification shall govern where no additional requirement is specified; in such cases, the applicable sections are omitted from this detail specification.

1.3 Classification: All products qualified to this detail specification have the following classification: Type 35, Class 1, Form 1, Grade 120

3. TECHNICAL REQUIREMENTS:

Table 1 – Prepreg Physical and Chemical Properties

Property	Product Form	Test Method (1)	Number of Replicates	Requirements
Resin Content	Prepreg	ASTM D3529	Every roll (2)(5)	35 ± 4% ind. 35 ± 3% avg.
Fiber Areal Weight	Prepreg	ASTM D3529	Every roll (2)(5)	120 ± 5 gsm ind. 120 ± 5 gsm avg.
Volatile Content	Prepreg	ASTM D3530	First and last rolls of every batch (2)	2% max ind. 2% max avg.
Flow	Prepreg	ASTM D3531	First and last rolls of every batch (2)	13 to 23%
Gel Time (4)	Prepreg	ASTM D3532	First and last rolls of every batch (2)	13 to 23 mins
Tack	Prepreg	NMS 380 4.6.1	First and last rolls of every batch	Level IV
Drape	Prepreg	NMS 380 4.6.2	First and last rolls of every batch	Pass
HPLC (3)	Prepreg	SACMA SRM 20R-94	First and last rolls of a batch	P1/P3: 1.80-2.80 P2/P3: 1.60-3.00 P4/P3: 0.65-1.35 P5/P3: 1.15-2.10
FTIR (3)(4)	Resin (extracted from prepreg)	ASTM E168 ASTM E1252	One roll per batch	>95% Correlation (PCD)
Differential Scanning Calorimetry (DSC)	Resin (3)(4)	ASTM D3418	First and last rolls of every batch	240 ± 20 °C 350 ± 70 J/g
Exotherm peak temperature Total heat of reaction	Prepreg (4)	ASTM D3418	First and last rolls of every batch	240 ± 20 °C 140 ± 40 J/g

(1) Specific procedures should be identical to those used in the original material qualification program.
(2) Three specimens should be taken across the width of the prepreg; left, center, right.
(3) Not required for receiving inspection test.
(4) Optional for batch release test.
(5) A minimum of one roll per batch is acceptable for receiving inspection.

3.2 Constituent Material Requirements:

3.2.2 Reinforcement: Efforts to qualify the carbon fiber to NCAMP carbon fiber material specification, NMS 818, are ongoing. In the meantime, Toray Advanced Composites will continue to provide aerospace-grade carbon fiber for this prepreg per the prepregger's carbon fiber procurement specification and Toray Advanced Composites s internal aerospace-grade PCD. In addition, the following change control is implemented on the carbon fiber:

The carbon fiber tow product manufacturer shall establish control factors which will yield product meeting the technical requirements of this specification. The factors which are used in the production of fiber tow used in the prepreg material qualification shall constitute the approved factors; they shall be used for manufacturing production carbon fiber tow product. Control factors are Controlled Process Equipment and Controlled Process Parameters for producing the product. Control factors include, but are not limited to, the following:

a) PAN Precursor formulation (raw ingredients and ratios),
b) PAN Precursor manufacturing process, equipment, line, or site,
c) PAN Precursor acceptance requirements,
d) Carbon fiber tow processing parameters (e.g. temperature and speed),
e) Carbon fiber tow manufacturing equipment, line, or site,
f) Carbon fiber tow acceptance requirements,
g) Carbon fiber tow acceptance test methods,
h) Carbon fiber tow acceptance sampling plan,
i) Carbon fiber tow surface treatment methods and levels,
j) Carbon fiber tow sizing formulation and sizing level, and
k) Carbon fiber tow sizing application and drying methods, including equipment.

If it is necessary to make any change in the above control factors, the carbon fiber tow product manufacturer shall submit for re-approval to NCAMP through the prepreg manufacturer in accordance with NRP 101 Prepreg Process Control Document (PCD) Preparation and Maintenance Guide. NRP 102 Polyacrylonitrile-based Carbon Fiber Process Control Document (PCD) Preparation and Maintenance Guide may be used as a reference. The change shall not be incorporated prior to the receipt of re-approval notice, typically in the form of a signed Advanced Change Notice (ACN).

3.4 Visual and Dimensional Requirements:

3.4.3 Roll characteristics - The standard width for this product is 24. Other widths may be supplied only if it is specifically requested by the purchaser.

3.5 Laminate (Cured Prepreg) Requirements:

3.5.2 Cured Laminate Physical Properties:

TABLE 3 - Cured Laminate Physical Properties

Property	Test Method(1)	Requirements(2)
Cured Ply Thickness, CPT(3)	ASTM D3171 Section 14.3.6	0.0045 to 0.0051 inch, avg.
Dry Glass Transition Temperature, Tg by DMA(4)	by flexural loading per ASTM D7028	191 to 227 ºC, ind.

(1) Specific procedures should be identical to those used in the original material qualification program.
(2) “ind.” refers to individual measurements. “avg.” refers to the average measurements per panel.
(3) Cured Ply Thickness of the Laminates in Table 4. Computed from actual qualification panel thicknesses using α=0.01 and modified CV, and theoretical Cured Ply Thickness as the nominal.
(4) Limits computed from average qualification data ± 18 ºC. Drying at 250°F ± 5 °F for 24 hours minimum prior to testing may be required if specimens are likely to have moisture.

3.5.3 Cured Laminate Mechanical Properties:

TABLE 4 - Required Cured Laminate Tests for Mechanical Properties (Class 1)

Property	Test Temperature(4)	Test Method(1)	Requirements(3)
0° Tension (Tabbed) Strength and Modulus Layup: $[0]_{10}$ 0.50 x 10.00 (0°) in.	RT, Ambient	ASTM D3039	Strength(2): Min. Ind. ≥ 385.5 ksi Strength(2): Average ≥ 440.2 ksi Modulus(2): 20.9 to 24.8 msi, avg
90/0° Compression Strength and Modulus Layup: $[90/0/90]_{7}$ 0.50 x 5.50 (0°) in.	RT, Ambient	ASTM D6641	Strength(2): Min. Ind. ≥ 67.4 ksi Strength(2): Average ≥ 77.9 ksi Modulus(2): 7.1 to 8.4 msi, avg
0° Short Beam Strength Strength Layup: $[0]_{32}$ 2T x 6T (0°) in. Span length: 4T	RT, Ambient	ASTM D2344	Strength: Min. Ind. ≥ 11.8 ksi Strength: Average ≥ 13.4 ksi

(1) Specific procedures should be identical to those used in the original material qualification program.
(2) Normalize the properties to a cured ply thickness value of 0.0048 inch, based on theoretical nominal CPT, using the following equation:
Normalized_Value = Measured_Value x Measured_CPT / Nominal_CPT
(3) “ind.” refers to individual measurements. “avg.” refers to the average of 5 replicates. Limits computed at α=0.01 and modified CV.
(4) Drying at 250°F ± 5°F for 24 hours minimum prior to testing may be required if specimens are likely to have moisture.

QUALIFIED PRODUCTS LIST

Supplier Product Designation	Supplier Name and Production Location	Date Qualified	Specification Callout[(1)]
Toray Advanced Composites TC380/T1100GC 24K, 120 gsm, 35% RC HIP	Supplier Name: Toray Advanced Composites Production Location: 18255 Sutter Blvd Morgan Hill, CA 95037 Procurement Contact: 18255 Sutter Blvd Morgan Hill, CA 95037	9/24/2025	NMS 380/1 Classification callout is optional because Type 35, Class 1, Form 1, Grade 120 is the only classification allowed in this QPL.

(1) In accordance with NCAMP Standard Operating Procedures, NSP 100, this QPL shall not contain alternate materials/products. Additional production location may be included in the QPL only after successful equivalency demonstration and approval per NCAMP Prepreg Process Control Document (PCD) Preparation and Maintenance Guide, NRP 101.

The proper specification callout for material procurement purpose is “NMS 380/1.” This specification is developed based on the material properties that are available publicly. The purchaser may specify additional requirements beyond those specified in this specification, especially when the purchaser has generated additional material properties beyond those available publicly or when the application requires additional requirements. The additional requirements are subject to supplier review and approval.