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### NCAMP Material Specification

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

Medium Toughness Polyaryletherketone (PAEK) Thermoplastic  
Toray (Formerly TenCate) Cetex<sup>®</sup> TC1225 Low Melt (LM) Polyaryletherketone  
Type 34, Class 1, Form 3 (0.25-inch Width), Grade 145

Cetex<sup>®</sup> TC1225 LM PAEK, T700 (Unsize fiber), 145 gsm, 34% 0.25-inch Slit  
Tape

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**Distribution Statement A.** Approved for public release; distribution is unlimited.

**REVISIONS:**

<b>Rev</b>	<b>By</b>	<b>Date</b>	<b>Pages Revised or Added</b>
-	Shakya Liyanage (NIAR), Waruna Seneviratne (NIAR), and John Tomblin (NIAR)	11/20/2024	Document Initial Release
A	Vincent Tanoto	12/17/2025	<p>All Sections:</p> <ul style="list-style-type: none"> <li>• Updated material code.</li> </ul> <p>Cover Page:</p> <ul style="list-style-type: none"> <li>• Updated reviewers list.</li> </ul> <p>Section 4:</p> <ul style="list-style-type: none"> <li>• Table 1 title, "Target" was removed.</li> <li>• Note 6 was removed.</li> </ul> <p>Section 4.5.2:</p> <ul style="list-style-type: none"> <li>• Table 2 title, "Target" was removed.</li> <li>• Note 7 and 8 were revised.</li> <li>• Updated specification limits to physical, chemical and mechanical test requirements</li> </ul>
B	Vincent Tanoto	2/24/2026	<ul style="list-style-type: none"> <li>• Cover Page – Distribution statement changed to public release.</li> </ul>

## 1. SCOPE:

### 2.1 Form:

This detailed specification along with the base specification NMS 122 establishes the requirements for continuous unidirectional carbon fiber impregnated with a low melt (LM) Polyaryletherketone (PAEK) thermoplastic resin (“unidirectional tape prepreg”).

This detailed 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.

### 2.3 Classification:

All products qualified to this detail specification have the following classification: Type 34, Class 1, Form 3, Grade 145

### 2.4 Toray Documents:

PCD 080 Toray Advanced Composites Process Control Document, Cetex® TC1225 LM PAEK, T700 145 gsm, 34%

## 4. TECHNICAL REQUIREMENTS:

Table 1 – Prepreg Physical and Chemical Properties (Class 1, Form 3) <sup>(4)(5)</sup>

Property	Test Method <sup>(1)</sup>	Number of Replicates	Requirements
Resin Content	ASTM D3529	Each Batch <sup>(2)</sup>	34 ± 4% ind. 34 ± 3% avg.
Fiber Areal Weight	ASTM D3776/SACMA SRM 23R-94	Each Batch <sup>(2)</sup>	145 ± 7gsm ind. 145 ± 5gsm avg.
Differential Scanning Calorimetry (DSC)			
Melt Temp. (Peak)	ASTM D3418	Each Batch <sup>(2)</sup>	578 to 596°F, ind. <sup>(3)</sup>
Hot Crystallization Temp. (Peak)			484 to 504°F, ind. <sup>(3)</sup>

<sup>(1)</sup> Specific procedures should be identical to those used in the original material qualification program.

<sup>(2)</sup> Three specimens minimum should be taken for each prepreg batch.

<sup>(3)</sup> “ind.” refers to individual measurements.

<sup>(4)</sup> Batch release testing - performed using master roll prepreg tape form (prior to slitting), specification limits are listed in this NMS, Toray PCD and CoC. Material

supplier is not conducting batch release testing in slit tape form.

- (5) Receiving inspection - DSC is performed using NMS 122/2 slit tape. Resin Content and Fiber Areal Weight shall be tested on Test Kit (master roll).

## 4.2 Constituent Material Requirements:

### 4.2.2 Reinforcement:

Efforts to qualify the carbon fiber to NCAMP carbon fiber material specification, NMS 818, are ongoing. In the meantime, Toray will continue to provide aerospace-grade carbon fiber for this prepreg per the prepregger's carbon fiber procurement specification and Toray'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).

## 4.4 Visual and Dimensional Requirements:

- 4.4.3 Roll characteristics - The standard width of the master roll prepreg tape is 12 inches. Other widths may be supplied only if it is specifically requested by the purchaser. The final product width after slitting is 0.25 inches  $\pm$  0.005 inches for AFP use.

## 4.5 Consolidated Laminate Requirements:

### 4.5.2 Consolidated Laminate Physical Properties:

Table 2 – Consolidated Laminate Physical Properties (Class 1, Form 3) <sup>(7)(8)</sup>

Property	Test Method <sup>(1)</sup>	Requirements <sup>(2)</sup>
Consolidated Ply Thickness <sup>(3)</sup>	ASTM D3171	0.0051 to 0.0057 in, avg.
Laminate Density <sup>(4)</sup>	ASTM D792	1.56 to 1.59 g/cc, avg.
Fiber Volume, by Volume <sup>(4)(6)</sup>	ASTM D3171	56 to 62 %, avg.
Resin Content, by Weight <sup>(4)(6)</sup>	ASTM D3171	30 to 36 %, avg.
Void Content, by Volume <sup>(6)</sup>	ASTM D3171	≤ 3 %, avg.
Differential Scanning Calorimetry (DSC)		
Melt Temp. (Peak)	ASTM D3418	578 to 596 °F, avg.
Cold Crystallization Temp. (Peak)		none <sup>(5)</sup>
Hot Crystallization Temp. (Peak)		484 to 504 °F, avg.

- (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. Required only on one of the panels listed in Table 3. Specification limits are derived from Slit tape form with AFP+VBO consolidation.
- (3) Consolidated Ply Thickness of the Laminates in Table 3. Computed from actual qualification panel thicknesses using  $\alpha=0.01$  and modified CV, and theoretical Consolidated Ply Thickness is set as the nominal.
- (4) Limits computed at  $\alpha=0.01$ .
- (5) Cold Crystallization should not be observed.
- (6) Fiber Density Nominal: 1.790 g/cc and Resin Density Nominal: 1.300 g/cc.
- (7) Batch release testing - performed using master roll prepreg tape form (prior to slitting) using static press.
- (8) Receiving inspection - the laminates may be fabricated with AFP machine using slit tape or with static press using Test Kit. However, NCAMP recommends for the purchasers to perform receiving inspection with AFP machine using slit tape. Table 2 specification limits apply to all laminates in Table 3.

## 4.5.3 Consolidated Laminate Mechanical Properties

Table 3 – AFP+VBO Consolidated Laminate Mechanical Properties (Class 1, Form 3) <sup>(4)(5)</sup>

Property	Test Method <sup>(1)</sup>	Requirements <sup>(3)</sup>
0° Tension Strength and Modulus Room Temperature, Ambient Layup: [0] <sub>8</sub>	ASTM D3039	Strength <sup>(2)(6)</sup> : Min. Ind. ≥ 304.3 ksi Strength <sup>(2)(7)</sup> : Average ≥ 345 ksi Modulus <sup>(2)(7)</sup> : 17.4 to 21.0 Msi, avg.
90/0° Compression Strength and Modulus Room Temperature, Ambient Layup: [90/0] <sub>4s</sub>	ASTM D6641	Strength <sup>(2)(7)</sup> : Min. Ind. ≥ 90.8 ksi Strength <sup>(2)(7)</sup> : Average ≥ 102.5 ksi Modulus <sup>(2)(7)</sup> : 8.5 to 10.5 Msi, avg.
90° Flex Room Temperature, Ambient Layup: [90] <sub>22</sub>	ASTM D790	Strength <sup>(6)</sup> : Min. Ind. ≥ 12.6 ksi Strength <sup>(6)</sup> : Average ≥ 18.5 ksi

<sup>(1)</sup> Specific procedures should be identical to those used in the original material qualification program.

<sup>(2)</sup> Normalize the properties to a consolidated ply thickness value of 0.0054 inch, based on theoretical nominal CPT, using the following equation:

$$\text{D3039 and D6641 Normalized\_Value} = \text{Measured\_Value} \times \text{Measured\_CPT} / \text{Nominal\_CPT}$$

$$\text{D790 Normalized Value} = \text{Measured Value} \times (\text{Measured CPT}^2) / (\text{Nominal CPT}^2)$$

<sup>(3)</sup> “ind.” refers to individual measurements. “avg.” refers to the average of 5 replicates. Specification limits are derived from Slit tape form with AFP+VBO consolidation.

<sup>(4)</sup> Batch release testing - Laminate mechanical testing is not explicitly required for material manufacturer using slit tape. This is performed with static press using master roll prepreg tape form (prior to slitting) in accordance with NPS 81225 Rev F Consolidation Cycle C against material supplier’s recommended specification limits referenced in the CoC and PCD.

<sup>(5)</sup> Receiving inspection - Laminates may be fabricated with AFP machine using slit tape against the specification limits in Table 3 or with static press using Test Kit in accordance with NPS 81225 Rev F Consolidation Cycle C against material supplier’s recommended specification limits referenced in the CoC and PCD. However, NCAMP recommends for the purchasers to perform receiving inspection with AFP machine using slit tape.

<sup>(6)</sup> Limits computed at  $\alpha=0.01$  and modified CV.

<sup>(7)</sup> Limits were negotiated with material supplier based on historical data.

QUALIFIED PRODUCTS LIST

Supplier Product Designation	Supplier Name and Production Location	Date Qualified	Specification Callout <sup>(1)</sup>
Cetex® TC1225 Low Melt (LM) Polyaryletherketone (PAEK) T700, 145gsm, 34% RC, 0.25 inch slit-tape (Unsize)	Supplier Name: Toray Advanced Composites (Formerly TenCate)  Production Location: 18410 Butterfield Blvd Morgan Hill, CA 95037  Line: TP5	1/16/2026	NMS 122/2  Classification callout is optional because Type 34, Class 1, Grade 145, Form 3 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.

(1) The proper specification callout for material procurement purpose is “NMS 122/2.” 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.