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NCAMP Material Specification

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

350°F Autoclave Cure, High Toughness Epoxy Prepregs
Type 35, Class 1, Form 1, Grade 145

Syensqo EP2190 IMS65 Tape

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REVISIONS:

Rev	By	Date	Pages Revised or Added
N/C	Evelyn Lian and Royal Lovingfoss	11/4/2021	Document Initial Release
A	Vinsensius Tanoto and Royal Lovingfoss	8/26/2025	<p>All Section:</p> <ul style="list-style-type: none"> Replaced "Solvay" with "Syensqo". <p>Cover Page:</p> <ul style="list-style-type: none"> Added "Form 1". Updated reviewer names. Added Matt Aldridge (Syensqo). <p>Section 1.3:</p> <ul style="list-style-type: none"> Added "Form 1". <p>Section 3:</p> <ul style="list-style-type: none"> Table 1, Note 2 was added to Gel and DSC (prepreg for receiving inspection). Table 1, FTIR, Drape, Tack and Resin DSC were removed. <p>Section 3.5.3:</p> <ul style="list-style-type: none"> Compression RT was replaced with ET. Specification limits were added. Modulus ranges were added. <p>QPL:</p> <ul style="list-style-type: none"> Added "Form 1".

1. SCOPE:

1.1 Form:

This detail specification along with the base specification NMS 219 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 145

3. TECHNICAL REQUIREMENTS:

Table 1 – Prepreg Physical and Chemical Properties

Property	Test Method ⁽¹⁾	Number of Replicates	Requirements ⁽⁵⁾
Resin Content	ASTM D3529	Every roll ⁽²⁾	35±3% ind. 35±2% avg.
Fiber Areal Weight	ASTM D3529	Every roll ⁽²⁾	145±7 gsm ind. 145±5 gsm avg.
Volatile Content	ASTM D3530	First and last rolls of every batch ⁽²⁾	3% max ind. 2.5% max avg.
Flow	ASTM D3531	First and last rolls of every batch ⁽²⁾	5 to 18%
Gel Time (Optional) ⁽⁴⁾	ASTM D3532	First and last rolls of every batch ⁽²⁾	0.5 to 25 mins
HPLC ⁽³⁾	SACMA SRM 20R-94	First and last rolls of a batch	P1/P4: 0.34 - 0.39 P2/P4: 0.34 - 0.44 P3/P4: 0.005 - 0.025
Differential Scanning Calorimetry (DSC) ⁽⁶⁾			
Exotherm peak temperature	ASTM D3418	First and last rolls of every batch ⁽²⁾	228 to 253°C
Total heat of reaction			90 to 167 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) "ind." refers to individual measurements. "avg." refers to the average measurements per roll.
- (6) Product Form is Prepreg.

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, Syensqo will continue to provide aerospace-grade carbon fiber for this prepreg per the prepregger's carbon fiber procurement specification PRS 161437 and Syensqo'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:

3.4.4 Roll characteristics - The standard width for this product is 24 inches. 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	0.0053 to 0.0061 inch, avg.
Dry Glass Transition Temperature Dry, T _g by DMA ⁽⁴⁾	by flexural loading per ASTM D7028	376 to 412 °F, 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 $\alpha=0.01$ and modified CV, and theoretical Cured Ply Thickness as the nominal.

(4) Limits computed using Syensqo historical average production data $\pm 18^\circ\text{F}$. Drying at $250^\circ\text{F} \pm 5^\circ\text{F}$ for 1 day 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 Method ⁽¹⁾	Requirements ⁽³⁾
0° Tension Strength and Modulus Room Temperature, Ambient Layup: [0] ₈	ASTM D3039	Strength ⁽²⁾ : Min. Ind. ≥ 346.3 ksi Strength ⁽²⁾ : Average ≥ 399.2 ksi Modulus ⁽²⁾⁽⁴⁾ : 20.9 to 24.7 msi, avg
0° Compression Strength and Modulus 250°F, Ambient Layup: [0] ₈	SACMA SRM 1R-94	Strength ⁽²⁾ : Min. Ind. ≥ 93.3 ksi Strength ⁽²⁾ : Average ≥ 124.7 ksi Modulus ⁽²⁾⁽⁵⁾ : 18.9 to 22.4 msi, avg
0° Short Beam Strength, Room Temperature, Ambient Layup: [0] ₄₄	ASTM D2344	Strength: Min. Ind. ≥ 10.3 ksi Strength: Average ≥ 11.8 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 0.0056 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 $\alpha=0.01$ and modified CV.

(4) Modulus range must be linear and calculated using 1000 to 3000 microstrain.

(5) Modulus range must be linear and calculated using ~500-1000 to ~2500-3000 microstrain. Specimens might fail before reaching 3000 microstrain.

QUALIFIED PRODUCTS LIST

Supplier Product Designation	Supplier Name and Production Location	Date Qualified	Specification Callout ⁽¹⁾
Syensqo EP2190 IMS65 Tape	Supplier Name: Syensqo Composite Materials Production Location: Abenbury Way Wrexham Industrial Estate Wrexham Clwyd – LL13 9UZ United Kingdom	9/18/2025	NMS 219/1 Classification callout is optional because Type 35, Class 1, Form 1, Grade 145 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 219/1.” 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.