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NCAMP Material Specification

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

265°F Cure High Performance Epoxy Prepregs
Type 38, Class 1, Grade 300
(Newport NCT4708 MR60H 300gsm Tape)

NCAMP Project Number: NPN030901

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1. SCOPE:

1.1 Form:

This detail specification along with the base specification NMS 4708 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 NMS 4708. 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 38, Class 1, Grade 300.

3. TECHNICAL REQUIREMENTS:

Table 1 – Prepreg Physical and Chemical Properties

Property	Test Method(1)	Number of Replicates	Requirements(3)
Resin Content	ASTM D 3529	Every roll(2)	38±3% indiv. 38±2% avg.
Fiber Areal Weight	SACMA SRM 23R-94	Every roll(2)	300±12 gsm ind 300±9 gsm avg
Volatile Content	ASTM D 3530	First and last rolls of every batch(2)	1.0% max. ind. 0.8% max. ave.
Flow	ASTM D 3531	First and last rolls of every batch(2)	16±4%
Gel Time	ASTM D 3532	Optional	660±240 seconds ind.
Tack	See 4.6.1	First and last rolls of every batch	Level IV
Drape	See 4.6.2	First and last rolls of every batch	Pass
HPLC	SACMA SRM 20R-94	First and last rolls of a batch	P1/P3=0.3 to 0.5 P1/P5=0.4 to 0.6 P1/P7=1.5 to 2.3
IR	ASTM E 168 ASTM E 1252	Optional	A829/A1237=0.8 to 1.1
Differential Scanning	SACMA SRM	Every resin batch	145-155ºC

Calorimetry (DSC) exotherm peak temperature	25R-94

(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) "ind" refers to individual measurements. "avg" refers to the average measurements per roll.

3.2 Constituent Material Requirements:

3.2.2 Reinforcement: The carbon fiber tow product manufacturer shall establish control factors which will yield product meeting the technical requirements of this prepreg 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).

3.5 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	SACMA SRM 10R-94	Between 0.0119 and 0.0132 inch, avg

Dry Glass Transition Temperature, Tg by DMA	ASTM D7028 Onset of Storage Modulus	Between 280ºF and 316ºF, 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.

3.5.3 Cured Laminate Mechanical Properties:

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

Property	Test Method(1)	Requirements(3)
0° Tension Strength and Modulus, Room Temperature Layup: $[0]_4$	ASTM D3039(4)	Strength(2): Min. Ind. $\geq$ 289 ksi Strength(2): Average $\geq$ 337 ksi Modulus(2): Between 18.9 and 22.4 Msi
0/90° Tension Strength and Modulus, Room Temperature Layup: $[0/90]_{2S}$	ASTM D3039(4)	Strength(2): Min. Ind. $\geq$ 147 ksi Strength(2): Average $\geq$ 174 ksi Modulus(2): Between 9.91 and 11.8 Msi
90/0° Compression Strength, Room Temperature Layup: $[90/0/90]_3$	ASTM D6641	Strength(2): Min. Ind. $\geq$ 50.4 ksi Strength(2): Average $\geq$ 64.5 ksi Modulus(2): Between 6.40 and 7.60 Msi
0° Short Beam Strength, Room Temperature Layup: $[0]_{21}$	ASTM D2344	Strength: Min. Ind. $\geq$ 8.30 ksi Strength: Average $\geq$ 9.48 ksi
0° Flexural Strength and Modulus, Room Temperature Layup: [0]7	ASTM D790	Strength: Min. Ind. $\geq$ 165 ksi Strength: Average $\geq$ 190 ksi Modulus: Between 17.1 and 20.5 Msi

(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 0.0126 inch.
(3) "ind" refers to individual measurements. "avg" refers to the average of 5 replicates.
(4) Optional to perform either 0° Tension or 0/90° Tension tests

QUALIFIED PRODUCTS LIST

Supplier Product Designation	Supplier Name and Production Location	Date Qualified	Specification Callout[1]
NCT4708 MR60H 300gsm Tape	Supplier Name: Newport Adhesives and Composites, Inc. Production Location: 1822 Reynolds Ave. Irvine, CA 92614 USA	1/9/2012	NMS 4708/2 Classification callout is optional because Type 38, Class 1, Grade 300 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 4708/2.” This specification is developed based on the NCAMP-generated 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.