CEM101

Cyanate Ester Component Prepreg

Introduction

CEM101 is a cyanate ester prepreg designed to cure at medium temperatures. It is closely related to CEM100 used for high temperature motorsport applications, however CEM101 is more focused on dielectric properties for applications requiring minimal dielectric constant and loss tangent. In such applications, materials are needed with combined characteristics of good dielectric properties coupled with structural strength. It can be supplied on a variety of fabrics to meet your cost and manufacturing requirements, however typical reinforcements include E-glass Style 7781, S2-glass Style 6781 and Quartz Style 4581.

Typical applications: *High service temperature – Radome/Motorsport*

Key Features & Benefits

- Cure temperature from **135°C (275°F)** to **140°C (285°F)**
- Service temperature up to **320°C (610°F)** after post cure
- Low CTE and shrinkage
- Work life at 21°C (70°F): **30 days**
- Storage life at -18°C (0°F): **12 months**
- Very low VOC content – no added solvents during manufacture
- Inherently flame-retardant resin chemistry
- **High service temperature**
- **Low Relative Permittivity (Dk)**

Storage & Out Life

This material should be kept frozen at 0°F (-18°C). It must be kept sealed in a polythene bag which must not be opened until fully thawed to room temperature. If the material is not fully used, then the material must be resealed in the polythene bag to prevent moisture absorption.

Important Note:

If bags are opened before fully cured, condensation may form on the material. Cyanate ester prepregs may react with moisture, which can affect the curing reaction and cause voidage. Great care must be taken to avoid contact with water. Thoroughly dry all tooling and fixtures before commencing lay-up.

Cure Cycles & performances

- Recommended Initial cure:
  - **135°C (275°F)** for **2h**, at a ramp rate of **1°C/min (2°F/min)**, under **6 bar (90 psi)** pressure.
  - Apply full vacuum at the beginning of the cure then pressurise
  - Vent vacuum at 1 bar (15 psi) pressure.
- Minimum Post cure for service:
  - **160°C (320°F)** for **2h**, at a ramp rate of **1°C/min (2°F/min)** *(on suitable matched CTE tool)*
- Recommended Post cure for 250°C (482F) service:
  - **250°C (480°F)** for **2h**, at a ramp rate of **0.3°C/min (0.5°F/min)** *(free-standing)*

  Note: other post cure options are available according to service needs

Important Note:
It is recommended that post curing is carried out immediately after initial cure. This will remove the risk of performance degradation due to moisture absorbance.

- Curing Schedule is meant to be a guide only and is subject to local conditions.
- To avoid exotherm particular care must be taken with thick laminates.
  Ramp rates must not exceed **1°C (2°F)** per minute during **initial cure**.
  Ramp rates must not exceed **0.3°C (0.5°F)** per minute during **post cure** (free standing).

- Typical Tg by DMA:

Temperature		Duration	Tg, E' onset	Tg, tan δ peak
135°C (275°F)	Cure	2 hours	160°C (320°F)	200°C (390°F)
160°C (320°F)	Post Cure	2 hours	175°C (345°F)	225°C (435°F)
180°C (355°F)	Post Cure	2 hours	200°C (390°F)	240°C (465°F)
250°C (480°F)	Post Cure	2 hours	400°C (750°F)	420°C (790°F)
300°C (570°F)	Post Cure	2 hours	400°C (750°F)	420°C (790°F)

*Tests performed on **CEM101-AQ2-4581** quartz laminates*

Cured Material Properties

Mechanical properties

*Tests performed on **CEM101-C205T-3K-HS-42%RW** laminates (205gsm 2x2 twill, T300 3k carbon fabric)*

Test	Results			StDev.	Standard
Vf	Fibre volume fraction	**49.45**	**%**	-	*BS EN ISO 14127 Method B*
CPT	Cured ply thickness	**0.233**	**mm**	*0.002*	*BS EN ISO 14127 Method B*
Tensile 0°	Tensile strength	**601**	**MPa**	*29.4*	*BS EN ISO 527-4*
	Tensile modulus	**57.4**	**GPa**	*0.4*	
	Poisson's ratio	**0.05**	**-**	*0.00*	
Tensile 90°	Tensile strength	**549**	**MPa**	*16.8*	
	Tensile modulus	**56.9**	**GPa**	*0.7*	
	Poisson's ratio	**0.06**	**-**	*0.00*	
Compressive 0°	Compressive strength	**742**	**MPa**	*12.1*	*prEN 2850 Type B*
	Compressive modulus	**52.9**	**GPa**	*0.6*	
Compressive 90°	Compressive strength	**780**	**MPa**	*23.8*	
	Compressive modulus	**52.4**	**GPa**	*0.9*	
In-Plane Shear ±45°	In-Plane shear strength (ultimate)	**78.3**	**MPa**	*1.0*	*BS EN ISO 14129*
	In-Plane shear modulus	**4.17**	**GPa**	*0.03*	
Interlaminar Shear 0°	Interlaminar shear strength	**38.5**	**MPa**	*1.1*	*BS EN ISO 14130*
Interlaminar Shear 90°	Interlaminar shear strength	**42.1**	**MPa**	*2.2*	
Flexural 0°	Flexural strength	**798**	**MPa**	*27.5*	*BS EN ISO 14125*
	Flexural modulus	**53.2**	**GPa**	*0.4*	
Flexural 90°	Flexural strength	**809**	**MPa**	*35.1*	
	Flexural modulus	**52.7**	**GPa**	*0.4*	
DMA – Dry Tg	Tg E' Onset	**382**	**°C**		*Modified ASTM D7028 (Single Cantilever)*
	Tg Peak Tan δ	**412**	**°C**		
DMA – Wet Tg	Tg E' Onset	**TBC**	**°C**		
14 days in water at 70°C	Tg Peak Tan δ	**TBC**	**°C**		

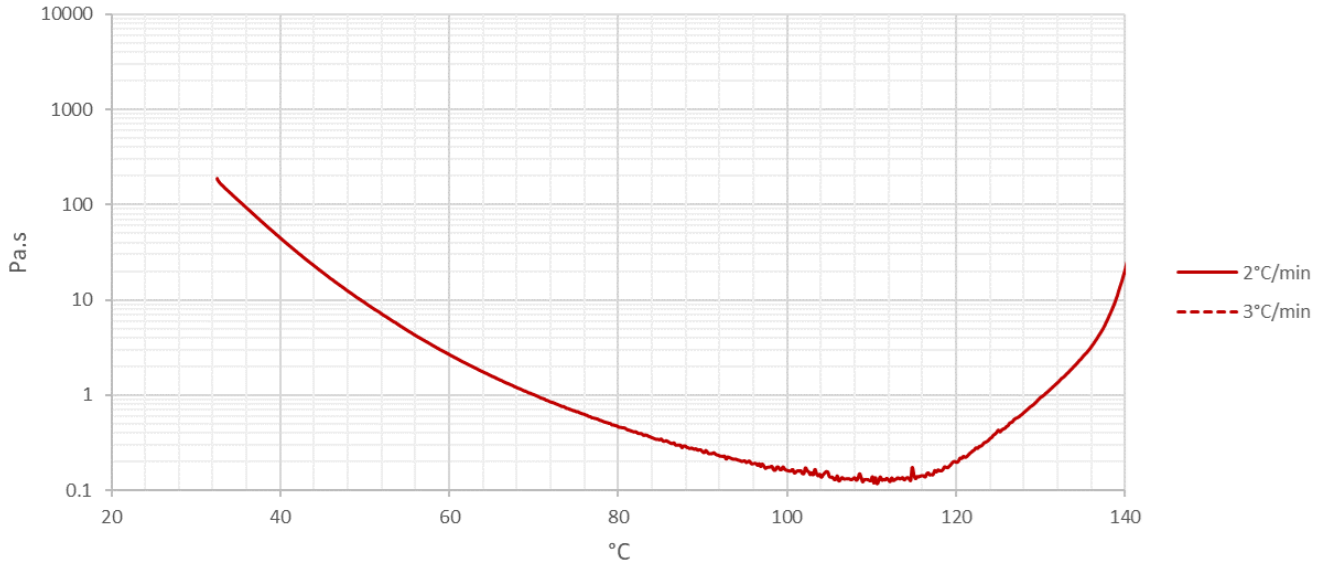
Mechanical testing carried out at 21±2°C (70±4F). "Autoclave" curing schedule: initial cure of 2hrs at 135°C (275F), 6bar pressure. Post cure of 2hrs at 250°C (480F), free-standing. All figures in this report are actual test results and have not been normalised. Testing was either completed by SHD Composites laboratories, or independently by UKAS approved organisations. Complete test reports can be supplied independently upon request.

Consumables and Bagging considerations

Place glass or quartz tows every 150mm (6 inches) to contact the breather. Apply a non-perforated release film, crumpling it up prior to application (cracked ice texture) enhances air removal to edges / tows. Non-perforated film should extend approximately 25mm (1 inch) past the laminate edge and be locally taped with suitable flash breaker tape. Suitable breather is applied to cover the entire layup, and the glass tows should contact the breather.

Viscosity Profile

Testing carried out using a rotational rheometer.



Health and Safety

Please refer to the product Safety Data Sheet before using this material. The following precautions must be taken when using cyanate ester resin prepregs:

- Overalls must be worn.
- Impervious gloves must be worn.
- Curing schedule is meant to be as a guide only and is subject to local conditions.
- To avoid exotherm, particular care must be taken with thick laminates.
- Ramp rates must not exceed 1.0°C (2°F)/min during initial cure and 0.3°C(0.5°F)/min during post cure.