



# CTD-101G Epoxy Resin System

***High Performance Insulation with Filler for Superconducting and Normal Magnets and Motors. Excellent for Moderate Radiation Environments***

CTD-101G is specially formulated with a filler for use with normal and superconducting magnet systems and motors, requiring moderate thermal conductivity and excellent crack resistance. It has excellent performance at cryogenic temperatures and in moderate radiation environments. CTD resins have been used for nearly 30 years to successfully insulate many of the world's largest, most complex, and highest performance magnet coils built around the world. CTD-101G offers long pot life, and features flexible handling characteristics and cure cycles to accommodate many magnet designs and insulation processes. The system is non-carcinogenic with very low toxicity and will not release volatiles during cure.



## ***Process Compatibilities***

- Vacuum Pressure Impregnation (VPI)
- Resin Transfer Molding (RTM)
- Casting with or without filler
- Filament winding (FW)

## ***Cure Cycles***

CTD has developed several cure schedules to accommodate our worldwide customers' needs. All cure schedules result in equivalent thermal and mechanical performance.

- Moderate temperature cure (100 to 110°C for 5 hours) with post cure (125°C for 16 hours)
- Accelerated cure (110°C for 5 hours with post cure at 135°C for 1.5 hours)

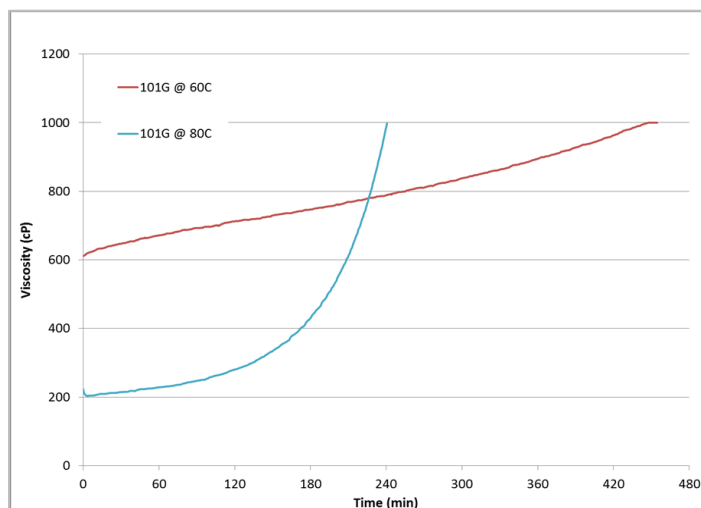
Please contact CTD with any questions regarding other potential cure schedules

## ***Material Advantages***

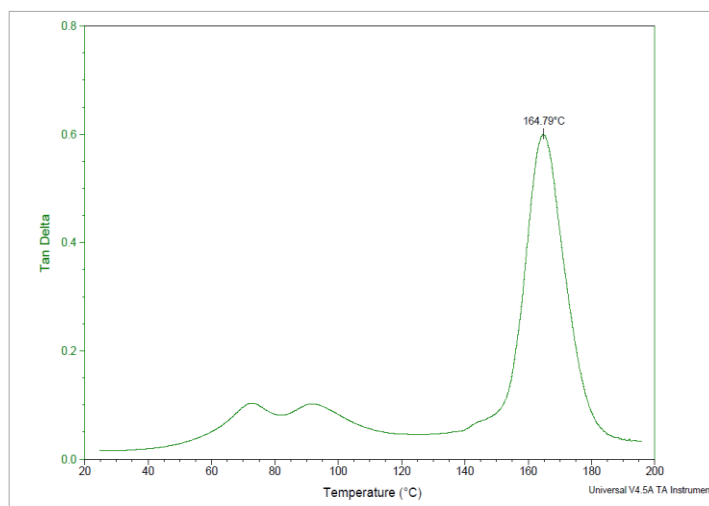
- Non-Carcinogenic, Low Toxicity
- Long Pot-Life, >8 hours at 60°C
- Viscosity: 660 cP at 60°C, 250 cP at 80°C
- Good thermal conductivity
- Excellent adhesion to fibers and fillers
- Processing Temperature 80-110°C

## ***Thermal Properties***

***"Enabling Your Solutions..."***



**CTD-101G Viscosity Profile at 60°C and at 80°C**



**Resin glass transition temperature  
( $T_g$ ) as a function of cure cycle  
(Expressed as DMA tan  $\delta$ )**

### ***General Material Properties***

Viscosity at 80°C (cP) ASTM D6267	Glass Transition Temperature (°C) ASTM D7028	Linear Shrinkage† (%) ASTM D2566	Dielectric Strength, 3.7 mm thick, at 76 K (KV/mm)‡ ASTM D3755
250	130-170°C*	0.55%	47

\* Dependent upon cure cycle

† Neat resin linear cure shrinkage, sample cured 5 hr at 110°C with a 1.5 hr postcure at 135°C

### ***Mechanical Properties‡***

Temperature (K)	Short Beam Shear(ksi)	Torsional Shear (ksi)	Compression (ksi)
4	34.0		
76		24.4	81.2

‡CTD-101G, with 67% filler by weight

Values represent minimum performance under tested conditions; actual values may be higher

### ***Thermal Conductivity‡***

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Test Temperature	Thickness @ 25°C (mm)	Specific Heat (J/g-K)	Thermal Conductivity (W/m-K)
25°C	1.81	0.91*	0.9

\*Properties tested per ASTM E1461; CTD-101G, 67% filler by weight

### *Material Properties after Irradiation (tested at 76K) ‡*

Irradiation Temp (K)	Dose (Gy)	Torsional Strain (radians)	Modulus (GPa)	Shear Strength (MPa) ASTM D2344
4	-	.028	8.1	168.0
4	$2.9 \times 10^7$	.024	7.9	147.0
4	$1.6 \times 10^8$	.006	4.6	25.0
60	-	.028	8.2	168.0
60	$9.7 \times 10^6$	.022	7.6	131.0
60	$9.7 \times 10^7$	.019	7.6	50

‡CTD-101G, 67% filler by weight

### *Dimensional Stability with Radiation Exposure‡*

Irradiation Temp (K)	Dose (Gy)	Change in Diameter (%)	Change in Length (%)	Change in Mass (%)
4	-	0	0	0
4	$2.9 \times 10^7$	-0.10	-1.08	-0.26
4	$1.6 \times 10^8$	-0.12	-0.98	-2.27
330	-	0	0	0
330	$9.7 \times 10^6$	0.24	-0.20	-0.26
330	$9.7 \times 10^7$	-0.83	-0.95	-0.78

‡CTD-101G, 67% filler by weight

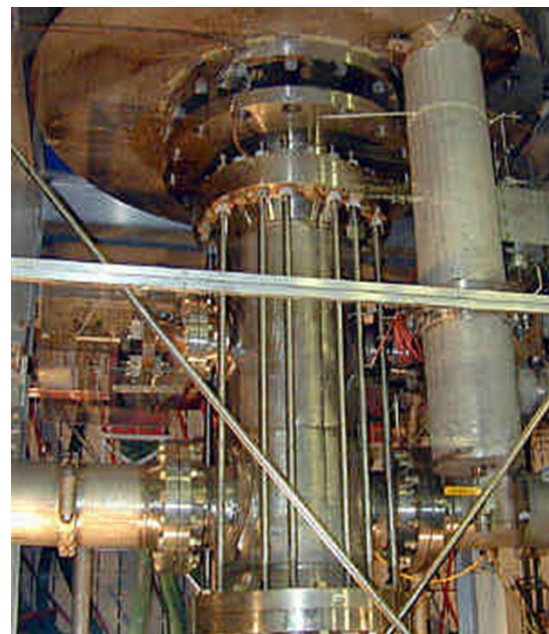


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## ***CTD's History in Magnet Insulation***

CTD has developed and supplied high-performance electrical insulations to the Fusion, High Energy Physics (HEP), and magnetic imaging communities for nearly 30 years. CTD currently markets and sells over 20 electrical insulation products to an international list of clients and customers. In some cases these materials have become “standard” products for our customers for numerous applications, including conventional and superconducting magnets, and other devices such as magnetic imaging, motors, generators, transformers, magnetic separation and power storage.

Our products include epoxy and cyanate ester-based impregnation systems, wrappable preregs, and ceramic/polymer hybrid insulations. In each instance, CTD has worked with the customer to provide a best-in-class solution for the various programs in which the company has been involved.



**NHMFL 45T Coil Insulated with  
CTD-101K**

## ***CTD- Magnet Insulation Customers***

CTD resins are used by over 30 magnet fabricators worldwide including United States, Europe, and Asia. Applications range from superconducting magnets for fusion and accelerator applications to medical imaging.



**100T coil with CTD-101K  
(photo courtesy of Everson Tesla)**

For further information, please contact

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