

## KDT Ceraset Polyureasilazane

*Heat Curable Ceramic Precursor (Product Code: C-2000)*

KDT Ceraset Polyureasilazane is a liquid polysilazane that is readily thermoset to a solid by heating to 180-200°C. Cure can be effected at lower temperatures through the addition of a small quantity of a free radical generator. The resulting solid can then be pyrolyzed to either silicon carbide or silicon nitride by heating to 1,000°C. KDT Ceraset Polyureasilazane finds utility as a ceramic precursor to SiCN MEMS devices. KDT Ceraset Polyureasilazane may be used as a low viscosity alternative to KDT Ceraset Polysilazane 20 in CMC applications.



### Major Applications:

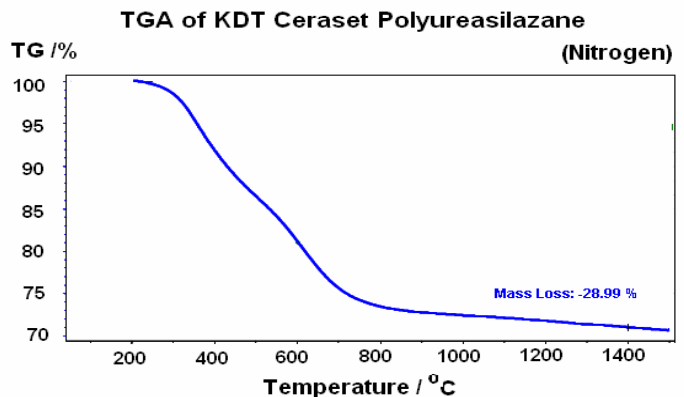
Ceramic MEMS, Ceramic Matrix Composites (CMCs), Metal Matrix Composites (MMCs), Ceramic Joining, SiC/Si<sub>3</sub>N<sub>4</sub> coatings for C/C composites and ceramic nanocomposites.

### Cure Conditions:

Depending on the free radical initiator employed, cure from liquid to solid can be accomplished in times ranging from 1 to 90 minutes over a temperature range of 90°C to 190°C. The peroxides are typically dissolved in solvent free polymer at the 0.5 to 1.0wt% level based on the weight of polymer employed. Cure without the use of peroxide can be effected by heating to 180-200°C.

### Physical Properties of Resin

Color	Clear to pale yellow liquid
Refractive Index	1.490 @ 23 °C [73 °F]
% Resin	100 % solids as a liquid
Flash Point	75 °C [167 °F]
Density of Liquid	0.960 g/cm <sup>3</sup>
Density of Cured Material	1.120 g/cm <sup>3</sup>
Density of Ceramic	2.400 g/cm <sup>3</sup>
Viscosity	50 cps @ 25 °C [77 °F]



### Pyrolysis and Ceramic Conversion:

Pyrolysis of cured KDT Ceraset Polyureasilazane results in progressive conversion of the polymer to an amorphous and ultimately crystalline ceramic phase. Pyrolysis up to 1400°C results in amorphous ceramic; crystallization begins above 1400°C. The final phase is dependent upon the pyrolysis atmosphere and the presence of any fillers which may seed particular ceramic phases. Inert gas pyrolysis results in a silicon carbide ceramic, while pyrolysis in an ammonia-containing atmosphere results in a silicon nitride ceramic.

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### Pyrolysis Composition of KDT Ceraset Polyureasilazane

Pyrolysis Atmosphere	Composition	Crystalline Phases
Argon	SiC	$\beta$ -SiC
Nitrogen	SiC/Si <sub>3</sub> N <sub>4</sub>	$\beta$ -SiC, $\alpha$ -Si <sub>3</sub> N <sub>4</sub> , $\beta$ -Si <sub>3</sub> N <sub>4</sub>
Ammonia/Nitrogen*	Si <sub>3</sub> N <sub>4</sub>	$\alpha$ -Si <sub>3</sub> N <sub>4</sub> , $\beta$ -Si <sub>3</sub> N <sub>4</sub>
Air**	SiC <sub>x</sub> N <sub>y</sub> O <sub>z</sub>	$\alpha$ -SiO <sub>2</sub> , $\alpha$ -Si <sub>3</sub> N <sub>4</sub>

\*Ammonia to 800 °C, then nitrogen to 1600 °C

\*\*Pyrolysis composition very dependent upon process conditions

Nicalon Fiber Reinforced Nanocomposites fabricated with KDT Polyureasilazane and Nanoparticles:

Nanoparticle	Flexural Strength (MPa)	Modulus	% Change in Strength
No Nanoparticle	31.9	95.1	-
TiO <sub>2</sub>	35.2	69.6	+10.4
ZnO	38.2	76.1	+19.9
Y <sub>2</sub> O <sub>3</sub>	33.3	88.2	+4.6
C	35.8	89.3	+12.5
SiC	33.6	74.2	+5.3

#### Clean Up:

Clean tools immediately after use with acetone or mineral spirits. Solvent cleaning can be followed by a wash with soapy water. Cured material cannot be removed with solvent. Proper clean-up of equipment is essential.

#### Handling:

**Storage Life:** Minimum of 2 years for unopened containers.

**Pot Life:** Usable life will be determined by the precautions taken to keep containers tightly sealed and protected from moisture.

#### Solvents:

KDT Ceraset Polyureasilazane is miscible with dry aprotic solvents such as alkanes, aromatic hydrocarbons, ethers, ketones, and esters. KDT Ceraset Polyureasilazane is hydrolytically sensitive and will slowly generate ammonia upon contact with moisture. The polymer will also react with other protic substances such as acids, bases, and alcohols.

#### Safety:

Use safety glasses and adequate ventilation. Protect skin from exposure using gloves and appropriate clothing. Seek medical attention if ingestion or overexposure is suspected. Keep uncured product from flame, all ignition sources, and moisture. This product is intended for professional use by persons familiar with this product data sheet, the Material Safety Data Sheet (MSDS) that accompanies product shipments, and applicable health, safety, and environmental practices and regulations. Contact KDT for advice concerning this product's suitability for specific applications.

#### Disclaimer:

Information on this product sheet is subject to change without notice as a result of experience and ongoing product development. It is the user's responsibility to verify that this sheet is current prior to use. The user accepts all risk associated with any use of this product for any purpose other than as recommended herein.

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