HUNTSMAN

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Advanced Materials

XU 35610 Benzoxazine Resin

Bisphenol A-based Benzoxazine

PRELIMINARY DATA SHEET

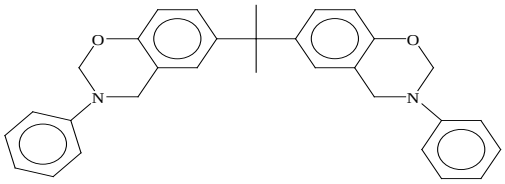
Key Properties

- **Exhibits minimal volatile release during cure**
- **High temperature resistance**
- **Low water absorption**
- **Dimensional stability**
- **High modulus properties**
- **Good electrical properties**

Description:

XU 35610 is a bisphenol-A based benzoxazine thermoset resin which can be homopolymerized or co-react with an epoxy or phenolic resin resulting in polymers with extremely good thermal and mechanical properties. This product is volatile-release free during curing and has good solubility in ketone or other common solvents.

Chemical Structure



Processing

Pultrusion, Pressure Molding, Pre-preg, Resin Transfer Molding (RTM)

Applications

Advanced composites, Structural adhesives, Laminates for printed wiring boards, Encapsualtes, High performance coating, Molding compounds.

Product data

	XU 35610
Visual Appearance	Yellow solid
Viscosity at 125 ^{o}C, cp	200-600
Gel time at 200 ^{o}C, sec.	160-450
Melting points, ^{o}C (^{o}F)	58 - 70 (136 - 158)
Solubility in Methyl ethyl ketone (MEK)	Up to 75% total solid content

* Product data are based on Huntsman testing methods, copies area available upon request

Typical cured Properties

Unless otherwise stated, the data were determined with typical production batches using standard testing method. They are provided solely as technical information and do not constitute a product specification

Cure schedule: 2h at 180 °C + 4h at 200 °C

Mechanical Properties

Flexural test[1]	
Flexural Modulus, MPa	5,342
Flexural Strength, MPa	138
Ultimate Elongation, %	2.3
Tensile test[2]	
Tensile Modulus, MPa	5,143
Tensile Strength, MPa	57
Ultimate Elongation, %	1.15
Toughness Test[3]	
K1c, MPa√m	0.74
G1c, J/m^2	114

Thermal and Water Absorption Properties

Glass transition (Tg)	
DSC, °C[4]	161
DMA, °C[5]	158
DMA after 48 h in boiling water, °C[5]	143
Water absorption 48 h in boiling water, %	0.7
Weight loss[6]	
On-set temperature, °C	324
@ 1%, °C	264
@ 5%, °C	313

1. ISO 178/01
2. ISO 527T2/93
3. Bend Notch test ISO 13586/03
4. DSC: TA Q2000 / ramp @ 10°C / 30°C - 350°C / nitrogen
5. DMA: TA Q800 / ramp @ 5°C / 30°C - 350°C / nitrogen, Tg is determined by onset of E'
6. TGA: TA 5000 / ramp @ 10°C / 30°C - 800°C / nitrogen

Casting Procedure

XU 35610 generates almost no voids during curing. Therefore, minimum pre-degassing is needed. In case degassing is preferred, use procedure below as a guidance:

Weigh benzoxazine material in an appropriate kettle equipped with heating capability, mechanical stirrer and temperature recording device. Heat to 120-140°C until a clear homogeneous solution is obtained. Additional heating dictates the pot life of the resultant prepolymer. Degas the resultant mixture at 120 °C - 140 °C with 26+ inches of vacuum for 15 minutes. Hot degassed melt can be poured into preheated molds; and cured at the desired conditions.

Formulations

XU 35610 can be homopolymerized or formulate with epoxy resins to improve performance. While formulating the benzoxazine must be melted below their onset temperature of reaction by 30°C. Degassing time of the components in a vacuum oven should not exceed 50% of the gel time at temperature at least 30°C below the onset temperature of reaction. Once degassed cured as recommended cure schedule.

Formulation No		**1**	**2**	**3**
XU 35610		75	75	75
CY179[7]		25		
GY6010[8]			25	
MY0500[9]				25
Gelling time at 200 °C, sec		403	430	461
Cure cycle: 2h at 180 °C + 2h at 200 °C + 2h at 220 °C				
Mechanical Properties				
Flexural test[1]				
Flexural Modulus, MPa		4,753	4,774	4,855
Flexural Strength, MPa		107	123	116
Ultimate Elongation, %		2.1	2.5	2.3
Tensile test[2]				
Tensile Modulus, MPa		4,527	4,096	4,478
Tensile Strength, MPa		36	40	38
Ultimate Elongation, %		0.76	0.85	0.82
Toughness Test[3]				
K1c, MPa√m		0.58	0.59	0.45
G1c, J/m^2		91	104	65
Thermal Properties				
Glass transition (Tg)				
By DSC, °C[4]		218	152	190
DMA, °C[5]	E'	209	144	181
	E''	226	165	197
	Tan Delta	240	181	212
Weight loss[6]				
On-set temperature, °C		351	344	341
@ 1%, °C		310	258	288
@ 5%, °C		345	333	336

7. Liquid cycloaliphatic epoxy resin (epoxy equivalent weight: 131-143)

8. Standard bisphenol-A liquid epoxy resin (epoxy equivalent weight: 182 - 192)

9. Low viscosity trifunctional liquid epoxy resin (epoxy equivalent weight: 105 -115)

Storage

XU 35610 benzoxazine resin may be stored for up to 1 year from date of manufacture at temperature around 77^{o}F provided the product is stored in sealed container.

Handling precautions

Caution

Do not use this product until the MSDSs have been read and understood. To protect against any potential health risks presented by our products, the use of proper personal protective equipment (PPE) is recommended. Eye and skin protection is normally advised. Respiratory protection may be needed if mechanical ventilation is not available or is insufficient to remove vapors. For detailed PPE recommendations and exposure control options consult the product MSDS or a Huntsman EHS representative.

Huntsman Advanced Materials
10003 Woodloch Forest Drive
The Woodlands, Texas 77380

Tel: 888-564-9318
Fax: 281-719-4047
www.huntsman.com/advanced_materials