HEXION
Responsible Chemistry

Starting Formulation

SF 8017

Epoxy Resin System for Pultrusion or Filament Winding
EPON™ Resin 826 or EPON™ Resin 862 / LS-81K Anhydride Curing Agent (MTHPA)

Introduction

EPON Resin 826 or EPON Resin 862/LS-81K Curing Agent system is based on an epoxy resin cured with an anhydride. LS-81K Curing Agent is a formulated methyltetrahydrophthalic anhydride (MTHPA) containing an internal mold release additive and a cure accelerator, LS-81K is manufactured by Lindau Chemicals Inc.

This resin system's combination of low viscosity, good pot life and fast gelation characteristics during cure make it favorable for wet processing fabrication of composite parts.

• In Pultrusion processes, it processes at high line speeds with low pull loads, and

it yields good surface quality. No internal release agents are needed because they

are already incorporated in the curing agent.

• In Filament Winding processes, good fiber wet-out is achieved because of the resin system's low viscosity. It also has a relatively long pot life.

Neat resin casting data indicate this resin system has a unique balance of Tg, tensile and flexural strength, while providing high toughness properties.

Suggested Uses

- Composite structures
- Civil engineering
- Sporting goods
- Transportation
- Electrical
- Marine

Features

- Non-MDA
- Non-styrene
- Low viscosity
- Long pot life
- Good surface quality
- Retention of properties up to 105 °C (221 °F)
- Good elongation
- High toughness
- Good electrical properties

Chemical Description

- EPON Resin 826 is a bisphenol A epoxy resin
- EPIKOTE Resin 862 is a bisphenol F epoxy resin
- LS-81K is a specially formulated methyltetrahydrophthalic anhydride with an internal mold release agent

Typical Properties

Table 1 / Typical Properties

			EPON Resin 826	EPON Resin 862
	Method	Units		
Epoxide equivalent weight	D-1652	eq/g	178-186	166-177
Viscosity @ 25 °C (77 °F)	D-445	cP	6,500-9,500	2,500-4,500
Color	D-1544	Gardner	1 max.	2 max.
Density @ 25 °C		lbs/gal	9.7	9.9
Specific gravity @ 25 °C, (g/cc)		g/cc	1.16	1.18
	Method	Units	LS-81K Anhydride Curing Agent	
Anhydride equivalent weight		eq/g	185-195	

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Viscosity @ 25 °C (77 °F)	D-2196	cP	200-300
Density @ 25 °C		lbs/gal	9.8-10.0
Specific gravity @ 25 °C		g/cc	1.18-1.20

	Units	826/LS-81K	862/LS-81K
Mix ratio	pbw	100/100	100/100
Viscosity @ 25 °C (77 °F)	cP	1230	897
Density @ 25 °C	lbs/gal	9.8	9.9
Specific gravity @ 25 °C	g/cc	1.18	1.17

Typical Handling Properties

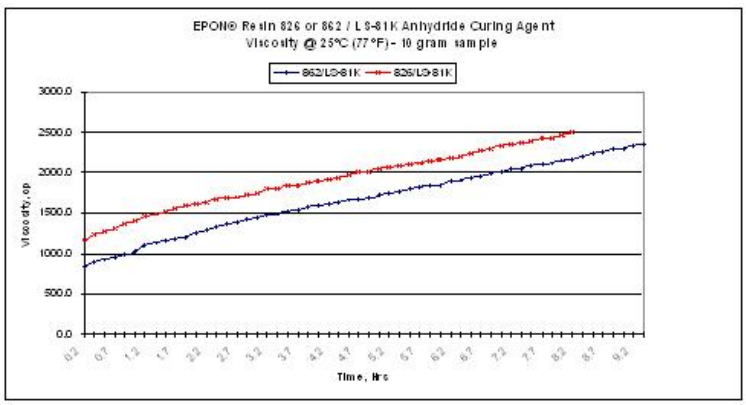
Table 2 / Typical neat resin properties of EPON Resin 826 or EPON 862/LS-81K Anhydride Curing Agent

	Units	826/LS-81K	862/LS-81K
EPON Resin 826	pbw	100	—
EPON Resin 862	pbw	—	100
LS-81K Anhydride Curing Agent	pbw	100	100
Viscosity @ 25 °C [1]	cP	1230	897
Time to double initial viscosity @ 25 °C [1]	hrs	8	5.5
Working life @ 25 °C, time to reach:			
1,000 cP	hrs	N/A	1.0
2,000 cP	hrs	4.6	7.0
3,000 cP	hrs	>8.0	>9.0
Gel time [2]			
@ 150 °C (302 °F)	sec.	80	82
@ 180 °C (356 °F)	sec.	32	28
@ 200 °C (392 °F)	sec.	18	18

[1] ASTM D2196 (Brookfield Viscometer – Small Sample Adapter, about 10 grams).

[2] Hot plate gel time.

Graph 1 / EPON Resin 826 or 862/LS-81K Anhydride Curing Agent viscosity @ 25 °C (77 °F) – 10 gram sample



Graph 2 / EPO N Resin 826 or 862/LS-81K Anhydride Curing Agent cure sweep @ 5 ° C per minute

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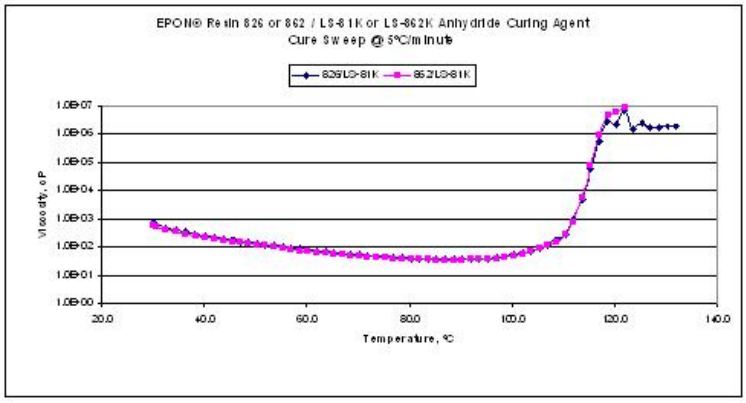

Typical Cured State Properties

Table 2 / Typical cured neat resin system casting properties of EPON Resin 826 or 862/LS-81K Anhydride Curing Agent

	Method	Units	826/LS-81K Value	862/LS-81K Value
Cure Schedule				
Step 1		hrs/°C (°F)	1.5/66 (151)	
Step 2		hrs/°C (°F)	1/85 (185)	
Step 3		hrs/°C (°F)	3/150 (302)	
Tg by rheometrics (max. tan delta)	D-4065	°C (°F)	136 (277)	126 (259)
Tensile Strength, at Break	D-638	psi	10,700	10,700
Tensile Elongation, at Break		%	5	5
Tensile Modulus		ksi	396	413
Flexural Strength	D-790	psi	17,800	17,800
Flexural Modulus		ksi	439	457
Fracture toughness, Kq	E-399	psi-in ^.5	1187	1234
Moisture absorption [1]		% wt.	3.01	2.97
Specific gravity	D-792	g/cc	1.20	1.23
Electrical Properties				
Dielectric constant @ 1 Meg Hz & 23 °C	D-150		3.17	3.24
Dissipation factor @ 1 Meg Hz & 23 °C	D-150		0.018	0.016
Dielectric strength	D-149	Volts/mil	432.3	418.8

[1] Samples immersed in 65 °C (140 °F) water for 30 days (equilibrium), sample size 0.039 in. x 0.5 in. x 2.5 in.

Suggested Formulations

Filament Winding

	Units	Pultrusion	
EPON Resin 826 or EPON Resin 862	pbw	100	100
LS-81K Anhydride Curing Agent	pbw	100	100
ASP-400P [1]	pbw	10-20	N/A

[1] ASP is a registered trademark of Engelhard Corporation.

Composite Fabrication / Pultrusion

The properties of this low viscosity and quick cure system at elevated temperatures provide the pultruder with a processable epoxy resin system. The unique resin system characteristics translate into high line speeds, low pull forces and good surface quality. All features are advantages of fabricators who desire the higher performance properties of epoxy resins.

Mixing – A high shear mixer is recommended to insure complete dispersion of the filler. Mixing time should be kept to a minimum to avoid excess heat build-up of the resin system, as this can reduce the working life of the system.

Resin bath – The resin impregnation bath temperature should be as close to 25 °C (77 °F) as possible to maximize working life.

Process– The EPON Resin 826 or EPIKOTE Resin 862 /LS-81K Curing Agent will cure at die temperatures ranging from 170-180 °C (338-356 °F). The optimum temperatures will depend on parameters such as part thickness, line speed, and preheat temperature. The epoxy part will react to a high degree of cure during the pultrusion process. A post cure, however, may enhance the properties.

Composite Fabrication / Filament Winding

The low viscosity and long working life of the resin system make it desirable for Filament Winding thin wall parts.

Mixing – A high shear mixer is recommended to insure complete mixing. Mixing time should be kept to a minimum to avoid excess heat build-up of the resin system, as this can reduce the working life of the system.

Resin bath – The resin impregnation bath temperature should be as close to 25 °C (77 °F) as possible to maximize working life. However, elevated temperatures may be required to obtain the appropriate viscosity for fiber wet-out.

Process– The 826 or 862/LS-81K system will cure at mandrel/oven temperatures of 80-150 °C within 1-3 hours. The optimum temperatures will depend on parameters such as part thickness.

Storage

Recommendations regarding storage conditions can be obtained by visiting our web site at www.hexion.com

General Information

These are starting formulations and are not proven in the user's particular application but are simply meant to demonstrate the efficacy of the products and to assist in the development of the user's own formulation. It is the user's responsibility to fully-test and qualify the formulation, along with the ingredients, methods, applications or equipment identified herein ("Information"), by the user's knowledgeable formulator or scientist, and to determine the appropriate use conditions and legal restrictions, prior to use of any Information.

Safety, Storage & Handling

Please refer to the MSDS for the most current Safety and Handling information.

Exposure to these materials should be minimized and avoided, if feasible, through the observance of proper precautions, use of appropriate engineering controls and proper personal protective clothing and equipment, and adherence to proper handling procedures. None of these materials should be used, stored, or transported until the handling precautions and recommendations as stated in the Material Safety Data Sheet (MSDS) for these and all other products being used are understood by all persons who will work with them. Questions and requests for information on Hexion Inc. ("Hexion") products should be directed to your Hexion sales representative, or the nearest Hexion sales office. Information and MSDSs on non-Hexion products should be obtained from the respective manufacturer.

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