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Advanced Materials

RenLam® 5052 Resin
Ren® 5052 Hardener

APPLICATIONS:

Aerospace and industrial composites, tooling, aircraft repair.

PROPERTIES:

Due to its outstanding features, the cold-curing epoxy laminating system RenLam® 5052 Resin / Ren® 5052 Hardener meets the requirements of a large range of applications.

Depending on the required properties and cycle times, the cure conditions for the system can be adapted between room temperature and temperature above 100°C. The system exhibits excellent properties after room temperature cure with potential for even higher mechanical and dynamical properties after postcure at elevated temperatures.

The resulting laminates are renowned for their outstanding mechanical and dynamic performance. The system is qualified by the Luftahrt Bundesamt (German Aircraft Authority).

PROCESSING:

- Wet lay-up
- Resin Transfer Molding (RTM)
- Pressure Molding
- Filament Winding

KEY DATA:

RenLam® 5052 Resin

Aspect (visual)	Clear liquid	
Color (Gardner, ISO 4630)	≤ 2	
Viscosity at 25°C (ISO 12058-1)	1000 – 1500	[mPa s]
Density at 25°C (ISO 1675)	1.17	[g/cm^3]
Flash point (ISO 2719)	≥ 140	[°C)
Storage temperature (see expiration date on original container)	2 - 40	[°C]

Ren® 5052 Hardener

Aspect (visual)	Clear liquid	
Color (Gardner, ISO 4630)	≤ 4	
Viscosity at 25°C (ISO 12058-1)	40 – 60	[mPa s]
Density at 25°C (ISO 1675)	0.94	[g/cm^3]
Flash point (ISO 2719)	≥ 110	[°C)
Storage temperature (see expiration date on original container)	2 - 40	[°C]

MIX RATIO:

Component	Parts by weight	Parts by volume
RenLam® 5052 Resin	100	100
Ren® 5052 Hardener	38	47

We recommend that the components are weighed with an accurate balance to prevent mixing inaccuracies which can affect the properties of the matrix system. The components should be mixed thoroughly to ensure homogeneity. It is important that the side and the bottom of the vessel are incorporated into the mixing process.

When processing large quantities of mixture, the pot life will decrease due to exothermic reaction. It is advantageous to divide large mixes into several smaller containers.

INITIAL MIX VISCOSITY:
(ISO 12058-1)

[°C]	**[mPa s]**
At 18	1150 – 1350
At 25	500 – 700
At 40	200 - 250

VISCOSITY BUILD-UP:
(ISO 12058-1)

[°C]	**[mPa s]**	**[min]**
At 25	To 1500	50 – 60
At 25	To 3000	90 – 110
At 40	To 1500	40 – 45
At 40	To 3000	50 – 60
At 60	To 1500	15 – 18
At 60	To 3000	18 - 22

POT LIFE:
(Tecam, 100ml, 65% RH)

[°C]	**[min]**
At 18	280 – 320
At 25	110 – 160
At 40	45 – 55

GEL TIME:
(Hot plate)

[°C]	[mPa s]
At 25	420 – 500
At 40	150 – 170
At 60	40 – 55
At 80	14 – 17
At 100	4 – 6
At 120	2 – 3

The values shown are for small amounts of pure resin/hardener mix. In practice, fiber content and laminate thickness may modify the gel time to a very significant extent. In composite structures the gel time can differ significantly from the given values depending on the fiber content and the laminate thickness.

GELATION AT 23°C:
(in thin layers: 0.4 – 0.7mm)

	[h]
Start	5 – 6.5
End	7 - 8

TYPICAL CURE CYCLES:

1 day 23°C + 15 h 50°C
or 1 day 23°C + 4 h 100°C

The optimum cure cycle has to be determined case by depending on the processing and the economic requirements.

GLASS TRANSITION TEMPERATURE:
(IEC 1006, DSC, 10 K/min)

Cure	T_G onset [°C]	T_G [°C]
2 days 25°C	50 – 52	52 – 55
8 days 25°C	60 – 64	62 – 66
4 months 23°C	64 – 68	67 – 71
1 day 23°C + 10 h 40°C	68 – 72	70 – 76
1 day 23°C + 20 h 40°C	72 – 76	74 – 80
1 day 23°C + 10 h 50°C	78 – 82	80 – 85
1 day 23°C + 15 h 50°C	81 – 85	82 – 88
1 day 23°C + 10 h 60°C	92 – 96	94 – 104
1 day 23°C + 15 h 60°C	94 – 98	96 – 106
1 day 23°C + 2 h 80°C	106 – 110	108 – 114
1 day 23°C + 8 h 80°C	112 – 116	114 – 122
1 day 23°C + 1 h 90°C	104 – 108	108 – 118
1 day 23°C + 4 h 90°C	112 – 116	116 – 126
1 day 23°C + 1 h 100°C	116 – 120	118 – 130
1 day 23°C + 4 h 100°C	118 – 124	120 – 134
4 months 23°C + 4 h 130°C	106 – 112	120 - 132

TENSILE TEST:
(ISO 527)

	Cure	7 days RT	15 h 50°C	8 h 80°C
Tensile strength	[MPa]	49 – 71	82 – 86	84 – 86
Elongation at tensile strength	[%]	1.5 – 2.5	3.1 – 3.7	5.7 – 5.9
Ultimate strength	[MPa]	49 – 71	80 – 83	80 – 84
Ultimate elongation	[%]	1.5 – 2.5	35 – 5.5	7.0 – 8.5
Tensile modulus	[MPa]	3350 – 3550	3450 – 3650	3000 - 3200

FLEXURAL TEST:
(ISO 178)

	Cure	15 h 50°C	8 h 80°C
Flexural strength	[MPa]	130 – 140	116 – 122
Elongation at flexural strength	[%]	5.8 – 6.3	6.5 – 7.2
Ultimate strength	[MPa]	90 – 115	87 – 113
Ultimate elongation	[%]	8.0 – 9.5	8.5 – 13.4
Flexural modulus	[MPa]	3000 – 3300	2700 - 3000

FRACTURE PROPERTIES:
Bend notch test
(PM 258-0/90)

	Cure	8 h 80°C
Fracture toughness K_{1C}	[MPa√m]	0.77 – 0.83
Fracture energy G_{1C}	[J/m^2]	192 - 212

WATER ABSORPTION:
(ISO 62)

	Cure	7 days RT	8 h 80°C
4 days H_2O 23°C	[%]	0.45 – 0.50	0.40 – 0.45
10 days H_2O 23°C	[%]	0.70 – 0.80	0.65 – 0.70
30 min H_2O 100°C	[%]	0.55 – 0.60	0.45 – 0.50
60 min H_2O 100°C	[%]	0.70 – 0.80	0.60 – 0.70

COEFFICIENT OF LINEAR:
Thermal expansion
(DIN 53 752)

Mean value	Cure	7 days RT	15 h 50°C	8 h 80°C
α from 20 – 50°C	[10^{-6}/K]	97	-	-
α from 20 – 90°C	[10^{-6}/K]	-	71	-
α from 20 – 120°C	[10^{-6}/K]	-	-	71

POISON'S RATIO:

Poison's ration	0.35

FLEXURAL TEST:
(ISO 178)

Samples: 16 layers (4mm) E-glass fabric 1:1, 280 – 300g/m^2
Fibre volume content: 45 – 46%
Cure: 10 h 80°C

		Unconditioned
Flexural strength	[MPa]	440 – 490
Elongation at flexural strength	[%]	2.7 – 3.0
Ultimate strength	[MPa]	420 – 460
Ultimate elongation	[%]	2.9 – 3.2
Flexural modulus	[MPa]	20000 - 22000

		After 30 days in H_2O 23°C
Flexural strength	[MPa]	380 – 400
Elongation at flexural strength	[%]	2.7 – 3.0
Ultimate strength	[MPa]	340 – 370
Ultimate elongation	[%]	1.9 – 3.4
Flexural modulus	[MPa]	19000 - 21000

TENSILE TEST:
(ISO 527)

Samples : 16 layers (4mm) E-glass fabric 1 :1, 280 - 300g/m^2
Fibre volume content: 45 – 46%
Cure: 10 h 80°C

Tensile strength	[MPa]	360 – 390
Ultimate elongation	[%]	1.6 – 1.9
Tensile modulus	[MPa]	33100 - 39100

INTERLAMINAR SHEAR:
(ASTM D 2344)

Short beam : E-glass unidirectional specimen, thickness t = 3.2mm
Fibre volume content: 60%

	Cure	**7 days RT**	**8 h 80°C**
Unconditioned	[MPa]	57 – 61	60 – 65
After 1 h in H_2O 100°C	[MPa]	55 – 60	58 - 62

STORAGE :

RenLam® 5052 Resin should be stored in a dry place, in the sealed original container, at temperatures between +2°C and +40°C (+35.6°F and 104°F). Under these storage conditions, the shelf life is 3 years. The product should not be exposed to direct sunlight.

Ren® 5052 Hardener should be stored in a dry place, in the sealed original container, at temperatures between +2°C and +40°C (+35.6°F and 104°F). Under these storage conditions, the shelf life is 3 years. The product should not be exposed to direct sunlight.

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First Aid!
Refer to MSDS as mentioned above.

KEEP OUT OF REACH OF CHILDREN

FOR PROFESSIONAL AND INDUSTRIAL USE ONLY

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