

EPIKOTE™ Resin MGS® RIM 235

EPIKURE™ Curing Agent RIM H 235-238

**suter-kunststoffe ag**  
**swiss-composite.ch**

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<b>Approval</b>	Germanischer Lloyd
<b>Application</b>	rotor blades for wind turbines, boat and shipbuilding, sports equipment, model construction, tooling and moulding
<b>Operational temperature</b>	-60 °C up to +50 °C (-76°F up to 122 °F) without heat treatment -60 °C bis +80 °C (-76 °F up to 176 °F) after heat treatment
<b>Processing</b>	at temperatures between 15 °C and 50 °C ( 59 - 122 °F)
<b>Features</b>	very low viscosity pot life from approx. 10 minutes to approx. >10h economically priced, physiologically compatible
<b>Storage</b>	shelf life of 24 months in originally sealed containers

**Characteristics**

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**EPIKOTE™ Resin MGS® RIM 235**

RIM 235 is an infusion resin for manufacturing composite parts such as rotorblades for wind turbines or boatbuilding. This epoxy resin system is specially suited to process all state of the art fabrics, such as glass, carbon or aramide using common infusion techniques such as VARIM, SCRIMP or RIM.

The Infusion resin system RIM 235 remains practically free of crystallisation, even if it is stored at low temperatures (<15 °C/ <59 °F). As the formulation contains only a very low percentage of reactive diluent, this system shows a particularly good physiological compatibility, even if it is being worked in open moulded processes.

Although the initial cure at room temperature is good, the full mechanical properties will only be obtained after a suitable post cure cycle. Especially for operations at elevated temperatures (maximum 80 °C/176 °F), such a post cure cycle is required to obtain the required thermal stability. For optimum mechanical properties a heat treatment of minimum 50°C is required.

Optimum processing temperatures are in the range of 15-40°C (59-104 °F). Potlife depends on the choice of hardeners and can be varied between 10 min. and more than 10 h. The shortest working life is established using RIMH 235. Pot life increases with the increasing number of the dedicated hardener and can be as high as >10 h with hardener RIMH 238. As the initial cure at room temperature is very slow as for the low reactive hardeners, some heat treatment should be performed at minimum 40-50 °C (104-122 °F) before demoulding the produced parts to ensure short cycle times.

RIM 235 features an extraordinary low mixed viscosity, resulting in fast and complete fiber wetting at a high transportation rate in infusion processes. However, if parts should be produced using hand lay-up techniques, it is recommended to add some thixotropic agent, such as Aerosil, to prevent drain out from vertical laminates, especially if non-crimp fabrics are being processed.

Although RIM 235 is very unlikely to crystallize at low temperatures, storage conditions of 15-30 °C (59-86 °F) and low humidity are recommended. After dispensing material, the containers must again be closed carefully, to avoid contamination or absorption of water.

All amine hardeners show a chemical reaction when exposed to air, known as „blushing“. This reaction is visible as white carbamide crystals, which could make the materials unusable.

The materials have a shelf life of minimum 2 years, when stored in their originally sealed containers.

## Application

## EPIKOTE™ Resin MGS® RIM 235

## Specifications

		Infusion resin RIM 235
<b>Density</b>	[g/cm³]	1,14 - 1,18
<b>Viscosity</b>	[mPas]	1000 - 1300
<b>Epoxy equivalent</b>	[g/equivalent]	161 - 181
<b>Epoxy value</b>	[equivalent/ 100 g]	0,55 - 0,62
<b>Refractory index</b>		1,55-1,56

### Measuring condition:

measured at 25 °C / 77 °F

		Hardener RIMH 235	Hardener RIMH 236
<b>Density</b>	[g/cm³]	0,92 - 0,96	0,98 - 1,02
<b>Viscosity</b>	[mPas]	20 - 40	10 - 20
<b>Amine value</b>	[mg KOH/g]	500 - 600	450 - 550
<b>Refractory index</b>		1,465 - 1,469	1,460 - 1,469

		Hardener RIMH 237	Hardener RIMH 238
<b>Density</b>	[g/cm³]	0,92 - 0,96	0,93 - 0,97
<b>Viscosity</b>	[mPas]	10 - 30	10 - 30
<b>Amine value</b>	[mg KOH/g]	420 - 520	450 - 550
<b>Refractory index</b>		1,4550-1,4750	1,455 - 1,468

### Measuring condition:

measured at 25 °C / 77 °F

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## EPIKOTE™ Resin MGS® RIM 235

	Infusion resin RIM 235	Hardeners RIMH 235 - RIMH 238
<b>Average EP - Value</b>	0,57	-
<b>Average amine equivalent</b>	-	60

### Processing details

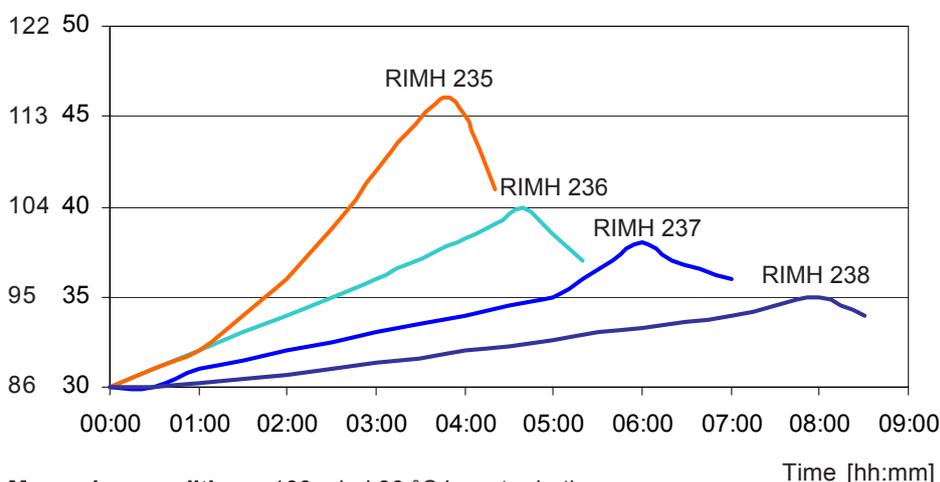
	Infusion resin RIM 235 : Hardener RIMH 235 - RIMH 238
<b>Parts by weight</b>	100 : 34 ± 2
<b>Parts by volume</b>	100 : 41 ± 2

### Mixing ratios

The mixing ratio stated must be observed carefully. Adding more or less hardener will not result in a faster or slower cure, only incomplete curing with limited performance, that can not be corrected in any way.

Resin and hardener must be mixed carefully. Mix until no clouding is visible in the mixing container. Special attention must be paid to the walls and bottom of the mixing container.

[°F] [°C] Temperature



### Temperature development

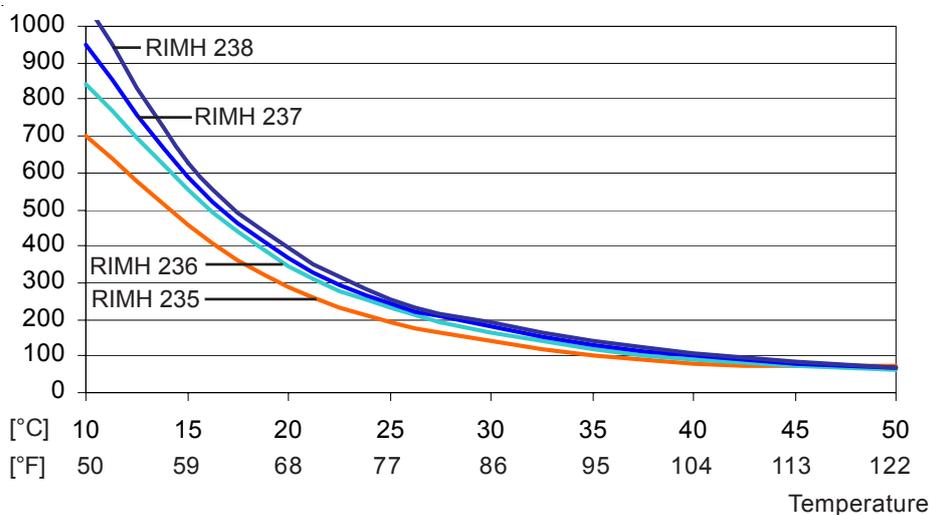
**Measuring conditions:** 100 g bei 30 °C in water bath

The optimum processing temperature is in the range between 20 and 40 °C. Higher processing temperatures are possible, but will shorten pot life. An increase in temperature of 10 °C will halve the pot life. Water (for example very high humidity or contained in fabrics or fillers) causes an acceleration of the resin / hardener reaction. Different temperatures and humidities during processing have no significant impact on the mechanical properties of the cured product.

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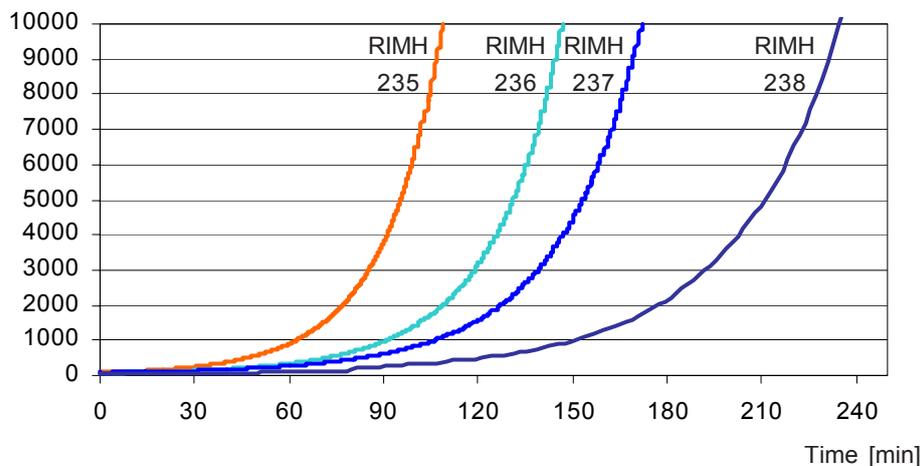
## EPIKOTE™ Resin MGS® RIM 235

[mPas] Viscosity



**Viscosity  
of mixture**

[mPas] Viscosity



**Viscosity  
development**

**Measuring conditions:**

Investigation in rotation viscosimeter, plate-plate configuration

measuring gap: 0,2mm

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	Infusion resin RIM 235	
	Hardener RIMH 235	Hardener RIMH 236
<b>20 - 25 °C</b> <b>68 - 77 °F</b>	app. 8-9 h	app. 12-14 h
<b>40 - 45 °C</b> <b>104 - 113 °F</b>	app. 3-4 h	app. 4-6 h

**Gel time**

Film thickness 1 mm at different temperatures

	Hardener RIMH 237	Hardener RIMH 238
<b>20 - 25 °C</b> <b>68 - 77 °F</b>	app. 15-20 h	app. 24-28 h
<b>40 - 45 °C</b> <b>104 - 113 °F</b>	app. 7-8 h	app. 10-14 h

Film thickness 1 mm at different temperatures

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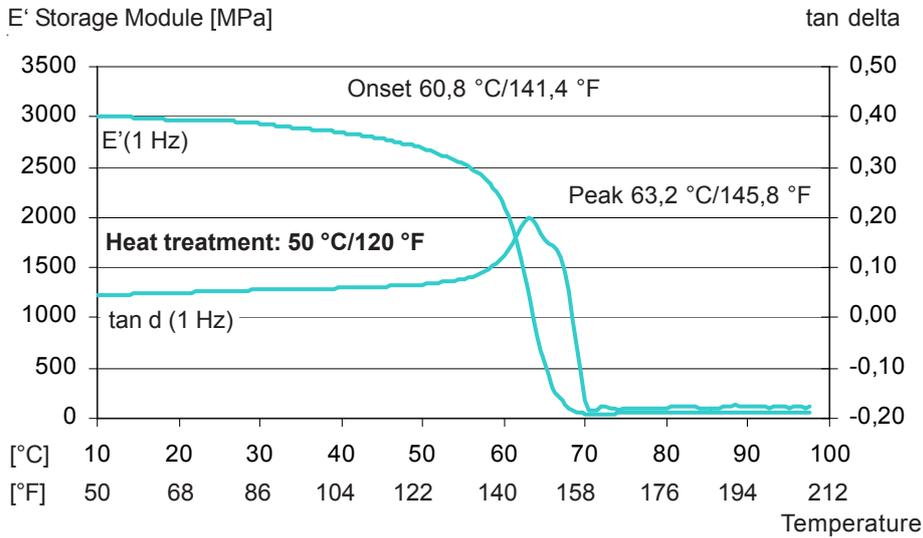
**EPIKOTE™ Resin MGS® RIM 235**

**DMA Measuring after heat treatment**

DMA-T<sub>g</sub> (peak) tan delta

Infusion resin RIM 235 with Hardener RIMH 236

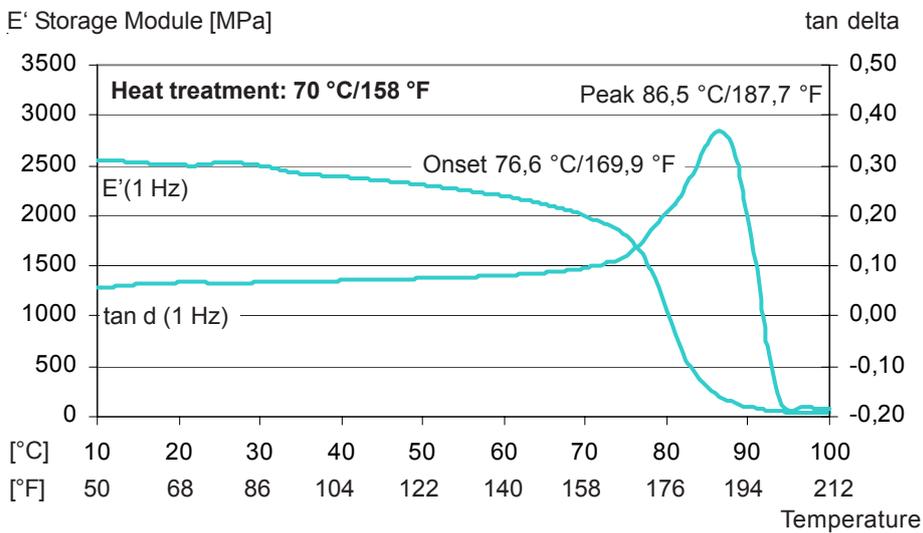
**DMA**



**DMA Measuring after heat treatment**

DMA-T<sub>g</sub> (peak) tan delta

Infusion resin RIM 235 with Hardener RIMH 236



**Measurement conditions**

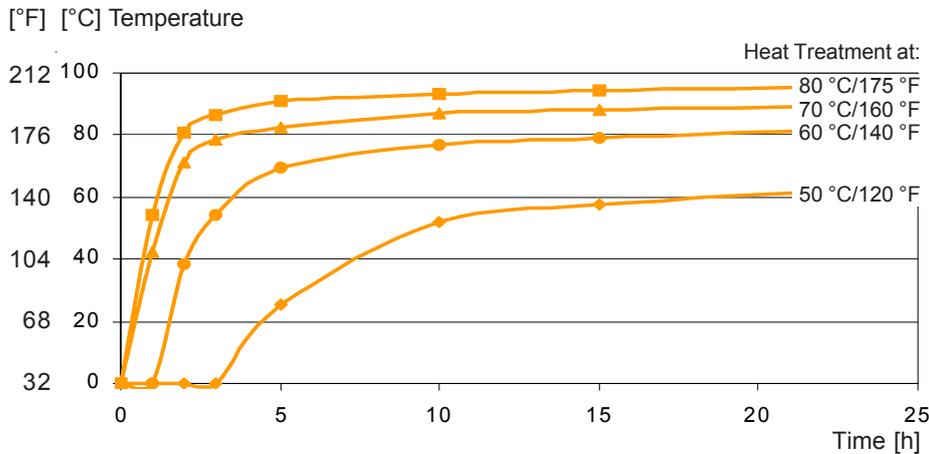
Coupon thickness: 2 mm  
Heating rate: 2 K/min  
Frequency: 1 Hz

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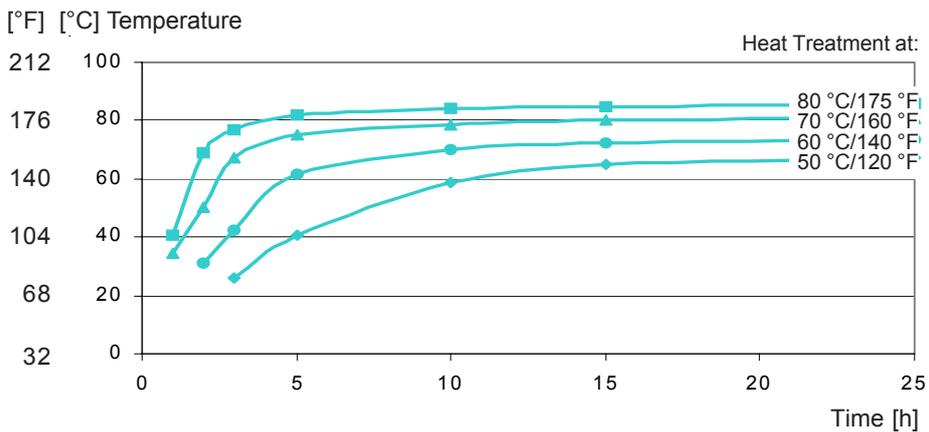
**EPIKOTE™ Resin MGS® RIM 235**

**Infusion resin RIM 235 / Hardener RIMH 235**

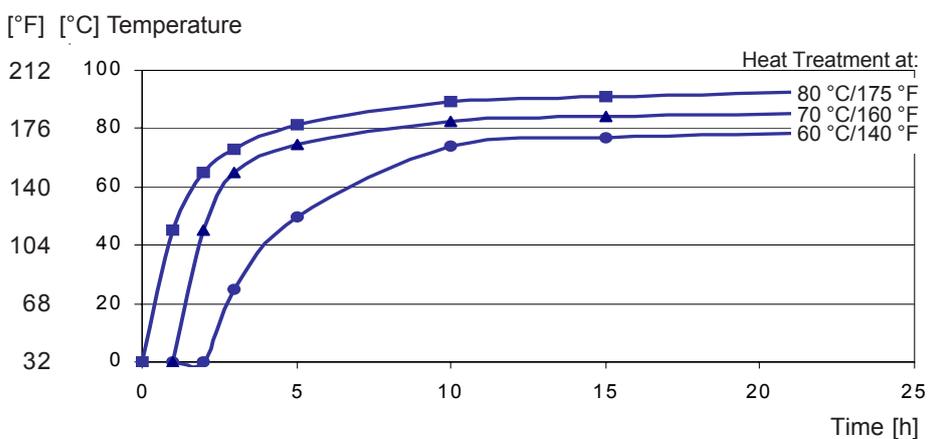
**Development T<sub>G3</sub>**



**Infusion resin RIM 235 / Hardener RIMH 236**



**Infusion resin RIM 235 / Hardener RIMH 238**



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**EPIKOTE™ Resin MGS® RIM 235**
**Mechanical data**

Mechanical data of neat resin		
<b>Density</b>	[g/cm <sup>3</sup> ]	1,10 - 1,20
<b>Flexural strength</b>	[N/mm <sup>2</sup> ]	100 - 120
<b>Modulus of elasticity</b>	[kN/mm <sup>2</sup> ]	3,0 - 3,2
<b>Tensile strength</b>	[N/mm <sup>2</sup> ]	70 - 80
<b>Compressive strength</b>	[N/mm <sup>2</sup> ]	80 - 100
<b>Elongation at break</b>	[%]	8 - 12
<b>Impact strength</b>	[KJ/m <sup>2</sup> ]	60 - 80
<b>Water absorption at 23°C</b>	24 h [%] 7 d [%]	0,10 - 0,50 0,20 - 0,80
<b>Curing:</b> partly cured / full cure		

**Advice:**

Mechanical data are typical for the combination of laminating resin RIM 235 with hardener RIMH 237. Data can differ in other applications.

## EPIKOTE™ Resin MGS® RIM 235

### Data of reinforced resin Static tests in standard climate

### Mechanical data

Reinforced with	GRC Glass fibre	CRC Carbon fibre	SRC Aramide fibre
<b>Flexural strength</b> [N/mm <sup>2</sup> ]	480 - 530	650 - 690	290 - 320
<b>Tensile strength</b> [N/mm <sup>2</sup> ]	440 - 480	450 - 500	380 - 450
<b>Compressive strength</b> [N/mm <sup>2</sup> ]	380 - 400	400 - 450	130 - 150
<b>Interlaminar shear strength</b> [N/mm <sup>2</sup> ]	38 - 42	40 - 45	27 - 30
<b>Modulus of elasticity</b> [kN/mm <sup>2</sup> ]	17 - 19	35 - 40	14 - 17
<p><b>GRC samples:</b> 16 layers of glass fabric, 275 g/m<sup>2</sup> 4 mm thick  <b>CRC samples:</b> 8 layers of carbon fabric 200 g/m<sup>2</sup> 2 mm thick  <b>SRC samples:</b> 15 layers of aramide fabric, 170 g/m<sup>2</sup> 4 mm thick</p> <p>Fibre content of samples during processing/testing: 40 - 45 vol%            Data calculated for fibre content of 43 vol%</p> <p>Typical data according to WL 5.3203 Parts 1 and 2            of the GERMAN AVIATION MATERIALS MANUAL</p>			

### Sample preparation

Curing: 24 hours at 23 °C (74 °F)  
+ 15 hours at 80 °C (176 °F)