HEXION

**Technical Data Sheet**

Issued: August 2006

# EPIKOTE™ Resin MGS™ RIMR 135 and EPIKURE™ Curing Agent MGS™ RIMH 134–RIMH 137

## CHARACTERISTICS

| | |
|---|---|
| **Approval** | German Lloyd |
| **Application** | Specially designed for infusion processes (RMT, SCRIMP/VARI); rotor blades for wind turbines, boat and shipbuilding, sports equipment |
| **Operational Temperature** | -60 °C up to +50 °C (-76 °F up to 122 °F) without heat treatment<br>-60 °C bis +80 °C (-76 °F up to 176 °F) after heat treatment |
| **Processing** | At temperatures between 10 °C and 50 °C (50-122 °F) due to the very low mixing viscosity especially suited for infusion, injection and pultrusion |
| **Features** | Very low viscosity, excellent initial curing properties at room temperature, pot life from approx. 0,5 hours to approx. 4 hours, short curing times at high temperatures |
| **Storage** | Shelf life of 24 months in originally sealed containers |

## APPLICATION

Very low viscosity laminating resin system with different pot lives for processing of glass, carbon and aramide fibers. Due to its good mechanical properties, this system is suitable for the production of components featuring high static and dynamic loadability.

The range of pot lives is between approx. 0,5 hour and 3-4 hours. The parts can be worked and demoulded after curing at room temperature. Curing at higher temperatures (up to approx. 80-100 °C, 176-212 °F) is possible, depending on layer thickness and geometry of the parts to be manufactured. The curing times can be reduced to a few minutes by this.

Adding internal parting agents, such as zinc stearate, etc., has proven useful for pultrusion processes. Profiles with good surface qualities are obtained. Depending on profile geometry, mould temperatures in the range of 180-230 °C (356-446 °F) are possible, thus permitting high drawing speeds.

The mixing viscosity is very low, which is especially advantageous for infusion and injection processes. It may be lowered to approx. 150 mPas by heating the resin mass (see diagram). This means that even complicated molded parts with long flow paths can be easily infused. The temperature rise with hardener RIMH 137 remains very low up to a mold temperature of approx. 30 °C, so that even parts of greater thickness can be produced at elevated temperatures.

The infusion resin system does not contain any unreactive components. The raw materials used feature a

very low vapor pressure. This permits processing of the material under vacuum even at elevated temperatures (VARIM process). Compatibility problems are not to be expected in combination with UP gelcoats, various paints (e.g. PUR-based), etc. However, comprehensive tests are indispensable.

The relevant industrial safety regulations for the handling of epoxy resins and hardeners and our instructions for safe processing are to be observed.

The resin and hardeners can be stored for at least 24 months in their carefully sealed original containers. The resin and hardeners may crystallise at temperatures below +15 °C (59 °F). The crystallisation is visible as a clouding or solidification of the contents of the container. Before processing, the crystallisation must be removed by warming up. Slow warming up to approx. 50-60 °C (122-140 °F) in a water bath or oven and stirring or shaking will clarify the contents of the container without any loss of quality. Use only completely transparent products. Before warming up, open containers slightly to permit equalization of pressure. Caution during warm-up! Do not warm up over an open flame! While stirring up, use safety equipment (gloves, eyeglasses, respirator).

## SPECIFICATIONS

| | | Infusion Resin RIM 135 |
|---|---|---|
| Density | [g/cm³] | 1,13 - 1,17 |
| Viscosity | [mPas] | 700 - 1.100 |
| Epoxy equivalent | [g/equivalent] | 166 - 185 |
| Epoxy value | [equivalent/100g] | 0,54 - 0,60 |
| Refractory index | | 1,548- 1,552 |

| | | Hardener RIMH 134 | Hardener RIMH 137 |
|---|---|---|---|
| Density | [g/cm³] | 0,93 - 1,00 | 0,93 - 0,98 |
| Viscosity | [mPas] | 10 - 80 | 10 - 50 |
| Amine Value | [mg KOH/g] | 550 - 700 | 400 - 600 |
| Refractory index | | 1,4900 - 1,5000 | 1,460 - 1,463 |

**Measuring conditions: measured at 25 °C / 77 °F**

**PROCESSING DETAILS**

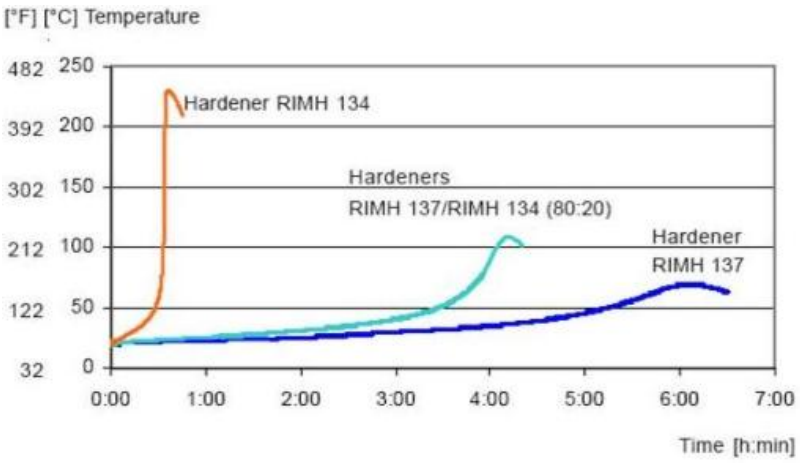
| | Infusion Resin RIMR 135 | Hardeners RIMH 134-137 |
|---|---|---|
| Average EP - Value | 0,56 | - |
| Average amine equivalent | - | 52 |

## MIXING RATIOS

| | Infusion Resin RIMR 135 : Hardener RIMH 134 – RIMH 137 |
|---|---|
| Parts by weight | 100 : 30 ± 2 |
| Parts by volume | 100 : 36 ± 2 |

The specified mixing ratios must be observed as exactly as possible. Adding more or less hardener will not effect a faster or slower reaction - but in incomplete curing which cannot be corrected in any way. Resin and hardener must be mixed very thoroughly. Mix until no clouding is visible in the mixing container. Pay special attention to the walls and the bottom of the mixing container.

## TEMPERATURE DEVELOPMENT




Quantity: 100 g / 20 °C (77 °F)

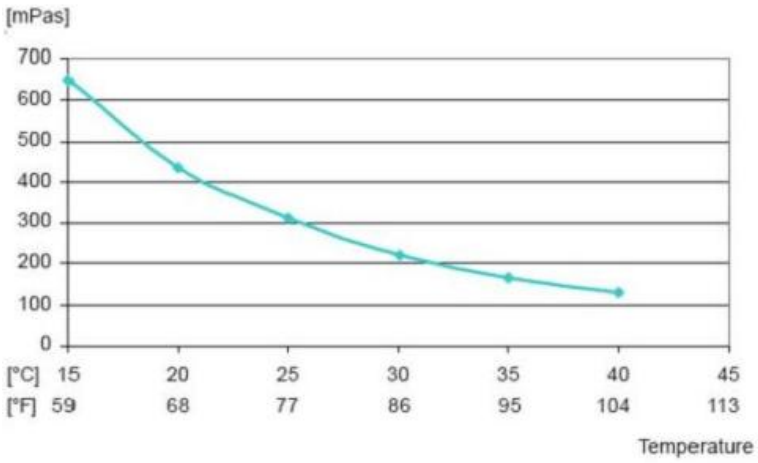
The optimum processing temperature is in the range between 20 °C and 25 °C (68-77 °F). Higher processing temperatures are possible, but will shorten pot life. A rise in temperature of 10 °C (50 °F) will halve the pot life. Water (for example very high humidity or contained in fillers) causes an acceleration of the resin/hardener reaction. Different temperatures and humidities during processing have no significant effect on the strength of the hardened product.

Do not mix large quantities - particularly of highly reactive systems - at elevated processing temperatures. The heat flow from the mixing container is very low, so the contents will heat up fast because of the dissipating reaction heat (exothermic resin-hardener reaction). This can result in temperatures of more than 200 °C (392 °F) in the mixing container, which may cause smoke-intensive burning of the resin mass.

## VISCOSITY

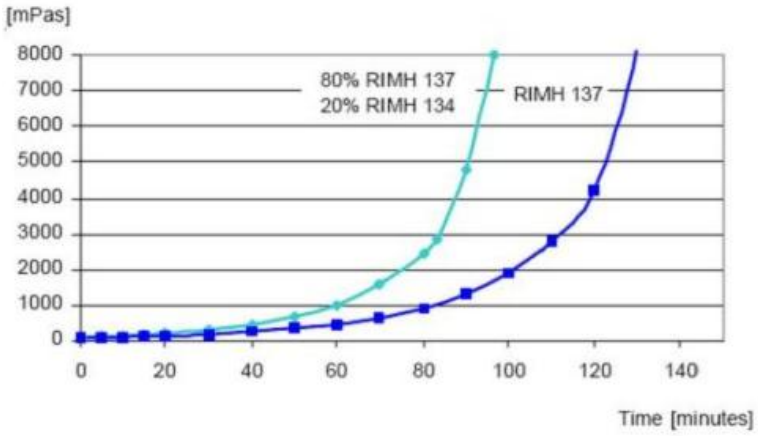
**Viscosity of mixture at different temperatures**

Infusion resin RIM 135 with mixture of Hardeners RIMH 137 (80 %) /RIMH 134 (20 %)




**Viscosity development**

Infusion resin RIM 135 with mixture of Hardeners RIMH 137 (80 %) /RIMH 134 (20 %) and Hardener RIMH 137

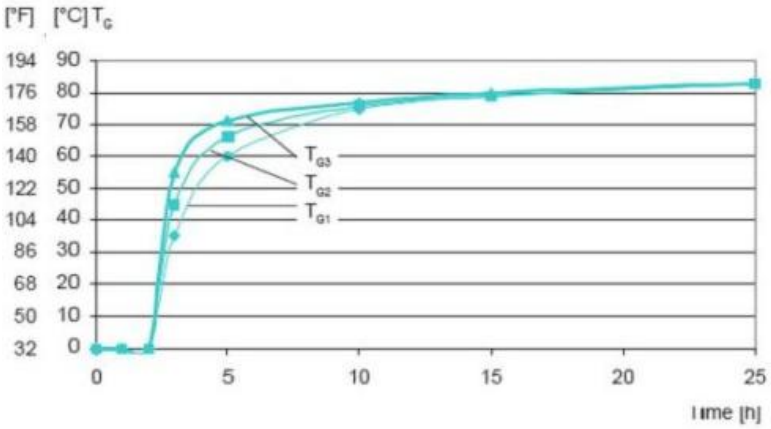



**Measuring conditions:**
Temperature: 40°C (104 °F); measuring gap 0,2 mm

## $T_G$ DEVELOPMENT

**Development of glass transition temperature ( $T_G$ ) at 60 °C**

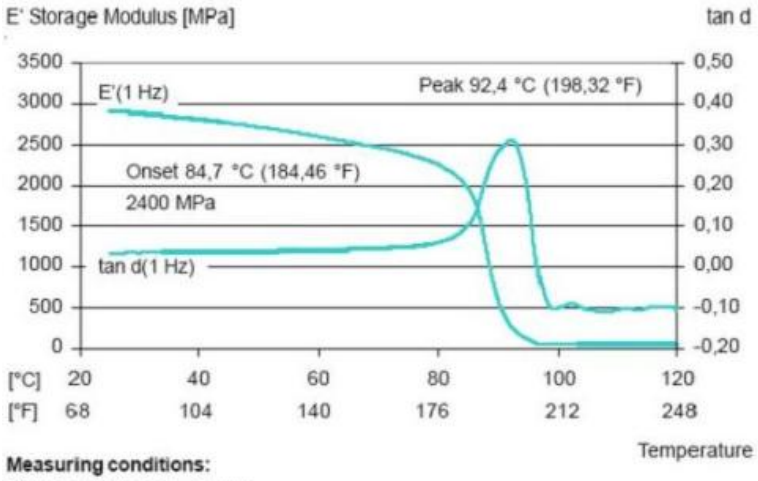
Infusion resin RIM 135 with mixture of Hardeners RIMH 137 (80 %) /RIMH 134 (20 %)




## DMA

**DMA Measuring after heat treatment**

DMA-$T_G$ (peak) tan delta
Infusion resin RIM 135 with mixture of Hardeners RIMH 137 (80 %) /RIMH 134 (20 %)




**Measuring conditions:**
Sample thickness: 2 mm
Heat rate: 2 K/min

**MECHANICAL DATA**

| Mechanical Data of Neat Resin | | |
|---|---|---|
| Density | [g/cm³] | 1,18 - 1,20 |
| Flexural strength | [N/mm²] | 90 - 120 |
| Modulus of elasticity | [kN/mm²] | 2,7 - 3,2 |
| Tensile strength | [N/mm²] | 60 - 75 |
| Compressive strength | [N/mm²] | 80 - 90 |
| Elongation of break | [%] | 8 - 16 |
| Impact strength | [KJ/m²] | 70 - 80 |
| Water absorption at 23 °C | 24 h [%]<br>7 d [%] | 0,10 - 0,20<br>0,20 - 0,50 |
| Fatigue strength under reversed bending stresses acc. to DLR Brunsw. | 10%<br>90% | exp. > 1 x $10^6$<br>exp. > 2 x $10^6$ |
| Curing: 24 h at 23° C (74° F) + 15 h at 60° C (140° F), partly cured/full cure<br>Typical data according to WL 5.3203 Parts 1 and 2 of the GERMAN AVIATION MATERIALS MANUAL | | |

**Advice:** Mechanical data are typical for the combination of laminating resin RIMR 135 with hardener RIMH 137. Data can differ in other applications.

**Data of Reinforced Resin – Static Tests Standard Climate**

| Reinforced with: | | GRC Glass Fibre | CRC Carbon Fibre | SRC Aramide Fibre |
|---|---|---|---|---|
| Flexural strength | [N/mm²] | 510 - 560 | 720 - 770 | 350 - 380 |
| Tensile strength | [N/mm²] | 460 - 500 | 510 - 550 | 400 - 480 |
| Compressive strength | [N/mm²] | 410 - 440 | 460 - 510 | 140 - 160 |
| Interlaminar shear strength | [N/mm²] | 42 - 46 | 47 - 55 | 29 - 34 |
| Modulus of elasticity | [kN/mm²] | 20 - 24 | 40 - 45 | 16 - 19 |

**GRC samples:** 16 layers of glass fabric, 8H satin, 296 g/m² (8.7 oz/sq.yd.), 4 mm (0.16 in) thick
**CRC samples:** 8 layers of carbon fabric, plain, 200 g/m² (5.9 oz/sq.yd.) 2 mm (0.08 in) thick
**SRC samples:** 15 layers of aramide fabric, 4H satin, 170 g/m² (5.0 oz/sq.yd.) , 4 mm (0.16 in) thick

Fibre content of samples during processing/testing: 40-45 vol%
Data calculated for fibre content of 43 vol%

Typical data according to WL 5.3203 Parts 1 and 2 of the GERMAN AVIATION MATERIALS MANUAL

**Sample Preparation:**
Curing: 24 h at 23 °C (74 °F)
+15 h at 80 °C (180 °F)

PDS-8246- (Rev.3/23/2015 3:45:24 AM)