

# Laminating resin MGS<sup>®</sup> L 285

Hardeners MGS<sup>®</sup> 285, 286, 287

|                               | page | <b>Content</b> |
|-------------------------------|------|----------------|
| Characteristics               | 11   |                |
| Application                   | 12   |                |
| Processing details            | 13   |                |
| Specification                 | 13   |                |
| Temperature development       | 14   |                |
| Gel time                      | 14   |                |
| Mixing ratios                 | 14   |                |
| DMA                           | 15   |                |
| T <sub>g</sub> conditioned    | 15   |                |
| Development of T <sub>g</sub> | 16   |                |
| Mechanical data               | 17   |                |

|                                |  |
|--------------------------------|--|
| <b>Approval</b>                | German Federal Aviation Authority  |
| <b>Application</b>             | production of gliders, motor gliders and motor planes, boat and shipbuilding, sports equipment, model airplanes, moulds and tools  |
| <b>Operational temperature</b> | -60 °C up to +50 °C (-76 °F up to 122 °F) without heat treatment<br>-60 °C up to +80 °C (-76 °F up to 176 °F) after heat treatment |
| <b>Processing</b>              | at temperatures between 10 °C and 50 °C (50-122 °F)<br>all usual processing methods  |
| <b>Features</b>                | extremely good physiological compatibility, good mechanic and thermic properties, pot life of approx. 45 min. to approx. 4 hours   |
| <b>Special modifications</b>   | L 285 T:           thixotropic<br>L 285 W:           white   |
| <b>Storage</b>                 | shelf life of 24 month in originally sealed containers   |

## Characteristics

In the process of international testing system harmonization, the national standards previously used are being increasingly replaced by ISO (DIN EN ISO) standards. All information, recommendations and suggestions offered by Hexion Specialty Chemicals GmbH, whether orally, in written form or in a database, are provided to the best of our knowledge and belief. However, they may not be construed as legally binding statements and do not represent either express or implicit assurances, or a guarantee of specific properties. The data parameters stated for products are specific values that may also be found in our technical information leaflets, and like these do not represent the basis of either a guarantee or specification. The same applies analogously to the data parameters stated for examples of cured binder systems; these represent analytical results and are only intended to simplify advance selection of the individual components of a binder. This information, these recommendations and suggestions describe our products and possible applications in general or exemplary terms, but do not refer to specific cases. Changes in the data parameters, texts and illustrations can result from the constant process of technical development and improvement of our products; possible changes are not specially mentioned in the text. Our support does not free the customer from the obligation to conduct its own review of our current informational literature, in particular our product data sheets, safety data sheets and our technical information leaflets. The customer must carry out tests of our products on his own responsibility to determine their suitability for the intended process and uses, as well as to establish whether their processing characteristics are appropriate in a specific case, since the technical uses of our products are numerous and can vary widely in a specific instance. Therefore, such factors do not fall within our control, and are the exclusive responsibility of the customer. If a specific assurance of data parameters should be required, an appropriate agreement must be reached to this effect. Any applicable patents, existing laws and regulations must be observed by the customer or user of our products on its own responsibility. This publication does not represent a license, nor does it intend to infringe or encourage infringement of any type of patent. Note: this edition voids and replaces all previous publications on the pertinent subject.

Am Ostkai 21/22  
70327 Stuttgart  
Germany  
Phone: +49 (0) 711 - 3 89 80 00  
Fax: +49 (0) 711 - 3 89 80 011  
www.hexionchem.com

**Laminating resin MGS® L 285**

Laminating resin system approved by the **GERMAN FEDERAL AVIATION AUTHORITY** with different pot lives for processing of glass, carbon and aramide fibres, featuring high static and dynamic loadability.

After heat treatment at 50 - 55 °C (122-131 °F), the system meets the standards for gliders and motor gliders (operational temperatures -60°C (-76°F) to +54°C (129 °F). In order to meet the standards for motor planes (operational temperatures -60°C (-76 °F) to +72 °C (161 °F), heat treatment at 80 °C (176 °F) is necessary.

The range of pot lives is between approx. 45 min and 4 h. The hardeners have the same mixing ratio and can be mixed among themselves in any ratio. This permits a selection of the optimum system for all processing methods. After initial curing at room temperature, the components manufactured are workable and demouldable. You will receive high-gloss and non-tacky surfaces, even with unfavourable precuring conditions, e. g. lower temperatures or high humidities.

The mixing viscosity guarantees fast and complete impregnation of the reinforcement fibres; however, the resin will not spill out of the fabrics on vertical surfaces. In order to obtain special properties, it is also possible to add fillers to the mixture of resin/hardener, such as Aerosil, microballoons, cotton flakes, metal powder, etc.

If high heat resistance or aircraft approval are not necessary, hardener 285 can also be used without heat treatment afterwards. However, the indicated properties will only be obtained after heat treatment at temperatures over 50 °C (122 °F).

As a matter of experience L 285 can be combined with suitable gelcoats on UP, PU and EP basis.

Although our resin systems are 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.

Crystallization is visible as a clouding or solidification of the contents of the container. If crystallisation of either component should be observed, it can 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, gas mask).

Since the approval of laminating resin L 285 in 1985, it has been used by nearly all manufacturers of planes and gliders and - especially because of the extremely good physiological compatibility - it is the most commonly used system in the aircraft industry today. It often happens that workers who have experienced problems with some epoxy resins concerning allergies or skin irritation are able to process laminating resin L 285.

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

**Application**

In the process of international testing system harmonization, the national standards previously used are being increasingly replaced by ISO (DIN EN ISO) standards. All information, recommendations and suggestions offered by Hexion Specialty Chemicals GmbH, whether orally, in written form or in a database, are provided to the best of our knowledge and belief. However, they may not be construed as legally binding statements and do not represent either express or implicit assurances, or a guarantee of specific properties. The data parameters stated for products are specific values that may also be found in our technical information leaflets, and like these do not represent the basis of either a guarantee or specification. The same applies analogously to the data parameters stated for examples of cured binder systems; these represent analytical results and are only intended to simplify advance selection of the individual components of a binder. This information, these recommendations and suggestions describe our products and possible applications in general or exemplary terms, but do not refer to specific cases. Changes in the data parameters, texts and illustrations can result from the constant process of technical development and improvement of our products; possible changes are not specially mentioned in the text. Our support does not free the customer from the obligation to conduct its own review of our current informational literature, in particular our product data sheets, safety data sheets and our technical information leaflets. The customer must carry out tests of our products on his own responsibility to determine their suitability for the intended process and uses, as well as to establish whether their processing characteristics are appropriate in a specific case, since the technical uses of our products are numerous and can vary widely in a specific instance. Therefore, such factors do not fall within our control, and are the exclusive responsibility of the customer. If a specific assurance of data parameters should be required, an appropriate agreement must be reached to this effect. Any applicable patents, existing laws and regulations must be observed by the customer or user of our products on its own responsibility. This publication does not represent a license, nor does it intend to infringe or encourage infringement of any type of patent. Note: this edition voids and replaces all previous publications on the pertinent subject.

Am Ostkai 21/22

70327 Stuttgart

Germany

Phone: +49 (0) 711 - 3 89 80 00

Fax: +49 (0) 711 - 3 89 80 011

www.hexionchem.com

## Laminating resin MGS® L 285

|                         |                    | Laminating resin L 285 |
|-------------------------|--------------------|------------------------|
| <b>Density</b>          | [g/cm³]            | 1,18 - 1,23            |
| <b>Viscosity</b>        | [mPas]             | 600 - 900              |
| <b>Epoxy equivalent</b> | [g/ equivalent]    | 155 - 170              |
| <b>Epoxy value</b>      | [equivalent /100g] | 0,59 - 0,65            |
| <b>Refractory index</b> |                    | 1,525 - 1,5300         |

## Specification

### Measuring conditions:

measured at 25 °C / 77 °F

|                         |            | Hardener 285    | Hardener 286    | Hardener 287    |
|-------------------------|------------|-----------------|-----------------|-----------------|
| <b>Density</b>          | [g/cm³]    | 0,94 - 0,97     | 0,94 - 0,97     | 0,93 - 0,96     |
| <b>Viscosity</b>        | [mPas]     | 50 - 100        | 60 - 100        | 80 - 120        |
| <b>Amine value</b>      | [mg KOH/g] | 480 - 550       | 450 - 500       | 450 - 500       |
| <b>Refractory index</b> |            | 1,5020 - 1,5500 | 1,4995 - 1,5100 | 1,4950 - 1,4990 |

### Measuring conditions:

measured at 25 °C / 77 °F

|                                 | Resin L285 | Hardener 285 | Hardener 286 | Hardener 287 |
|---------------------------------|------------|--------------|--------------|--------------|
| <b>Average EP - Value</b>       | 0,62       | -            | -            | -            |
| <b>Average amine equivalent</b> |            | 64           | 64           | 64           |

## Processing details

In the process of international testing system harmonization, the national standards previously used are being increasingly replaced by ISO (DIN EN ISO) standards. All information, recommendations and suggestions offered by Hexion Specialty Chemicals GmbH, whether orally, in written form or in a database, are provided to the best of our knowledge and belief. However, they may not be construed as legally binding statements and do not represent either express or implicit assurances, or a guarantee of specific properties. The data parameters stated for products are specific values that may also be found in our technical information leaflets, and like these do not represent the basis of either a guarantee or specification. The same applies analogously to the data parameters stated for examples of cured binder systems; these represent analytical results and are only intended to simplify advance selection of the individual components of a binder. This information, these recommendations and suggestions describe our products and possible applications in general or exemplary terms, but do not refer to specific cases. Changes in the data parameters, texts and illustrations can result from the constant process of technical development and improvement of our products; possible changes are not specially mentioned in the text. Our support does not free the customer from the obligation to conduct its own review of our current informational literature, in particular our product data sheets, safety data sheets and our technical information leaflets. The customer must carry out tests of our products on his own responsibility to determine their suitability for the intended process and uses, as well as to establish whether their processing characteristics are appropriate in a specific case, since the technical uses of our products are numerous and can vary widely in a specific instance. Therefore, such factors do not fall within our control, and are the exclusive responsibility of the customer. If a specific assurance of data parameters should be required, an appropriate agreement must be reached to this effect. Any applicable patents, existing laws and regulations must be observed by the customer or user of our products on its own responsibility. This publication does not represent a license, nor does it intend to infringe or encourage infringement of any type of patent. Note: this edition voids and replaces all previous publications on the pertinent subject.

Am Ostkai 21/22  
70327 Stuttgart  
Germany  
Phone: +49 (0) 711 - 3 89 80 00  
Fax: +49 (0) 711 - 3 89 80 011  
www.hexionchem.com

## Laminating resin MGS® L 285

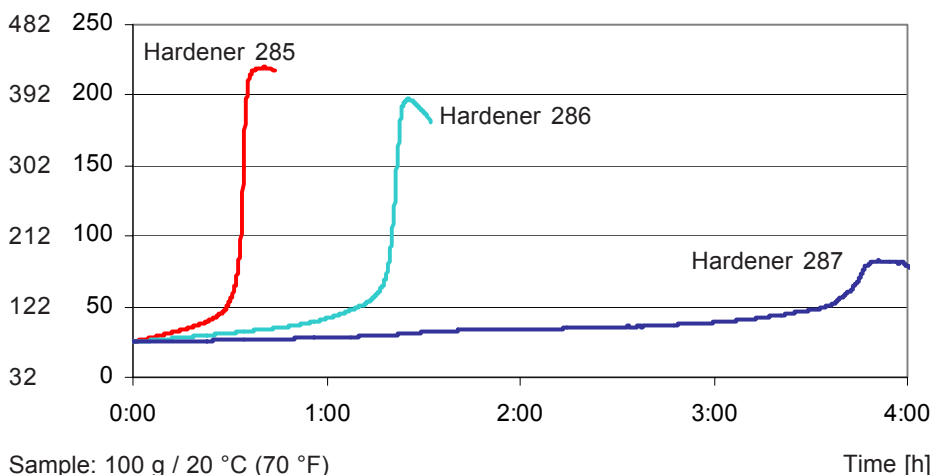
|                        | Laminating resin L 285: Hardeners 285, 286, 287 |
|------------------------|---|
| <b>Parts by weight</b> | 100 : 40 ± 2                                    |
| <b>Parts by volume</b> | 100 : 50 ± 2                                    |

### Mixing ratios

The mixing ratio stated must be observed carefully. Adding more or less hardener will not result in a faster or slower cure, but in 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

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 effect on the mechanical properties of the cured product.

|  | Resin L 285<br>Hardener 285 | Resin L 285<br>Hardener 286 | Resin L 285<br>Hardener 287 |
|--|-----------------------------|-----------------------------|-----------------------------|
| <b>68 - 77 °F</b><br><b>20 - 25 °C</b>   | app. 2-3 hours              | app. 3-4 hours              | app. 5-6 hours              |
| <b>104 - 113 °F</b><br><b>40 - 45 °C</b> | app. 45-60 min              | app. 60-90 min              | app. 80-120 min             |

### Gel time

#### Film thickness 1 mm at different temperatures

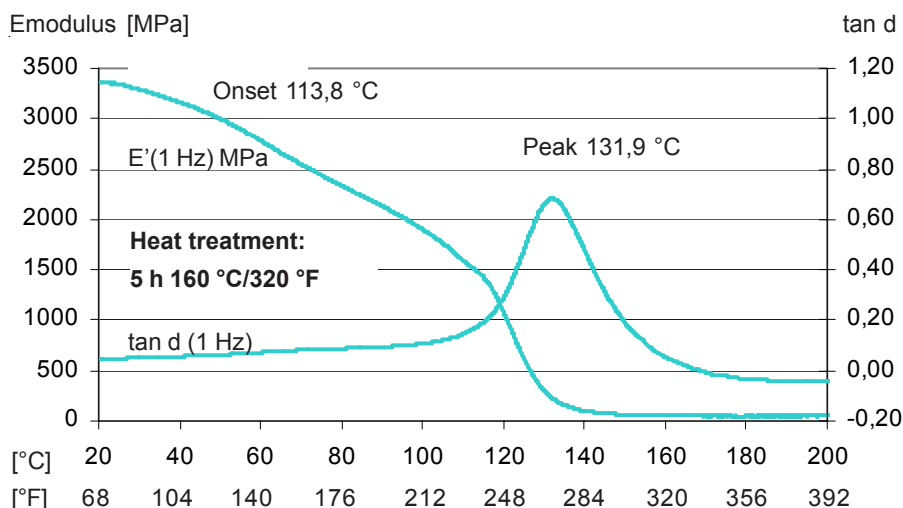
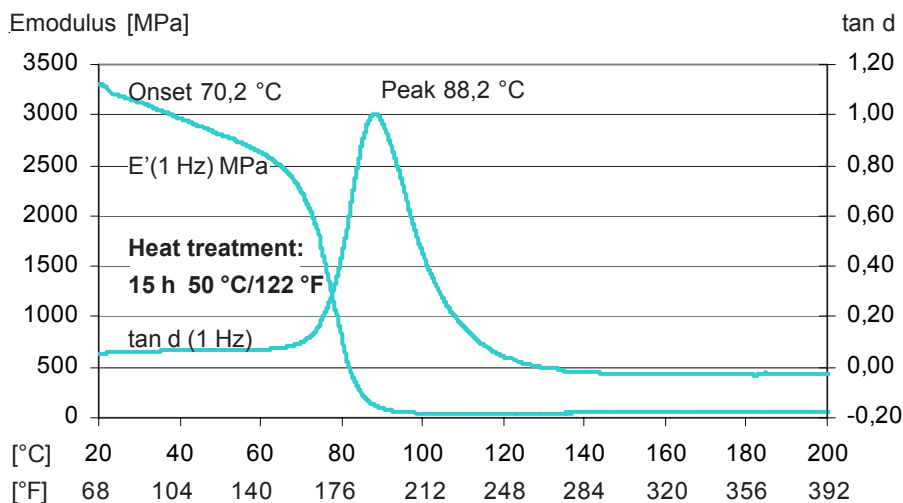
In the process of international testing system harmonization, the national standards previously used are being increasingly replaced by ISO (DIN EN ISO) standards. All information, recommendations and suggestions offered by Hexion Specialty Chemicals GmbH, whether orally, in written form or in a database, are provided to the best of our knowledge and belief. However, they may not be construed as legally binding statements and do not represent either express or implicit assurances, or a guarantee of specific properties. The data parameters stated for products are specific values that may also be found in our technical information leaflets, and like these do not represent the basis of either a guarantee or specification. The same applies analogously to the data parameters stated for examples of cured binder systems; these represent analytical results and are only intended to simplify advance selection of the individual components of a binder. This information, these recommendations and suggestions describe our products and possible applications in general or exemplary terms, but do not refer to specific cases. Changes in the data parameters, texts and illustrations can result from the constant process of technical development and improvement of our products; possible changes are not specially mentioned in the text. Our support does not free the customer from the obligation to conduct its own review of our current informational literature, in particular our product data sheets, safety data sheets and our technical information leaflets. The customer must carry out tests of our products on his own responsibility to determine their suitability for the intended process and uses, as well as to establish whether their processing characteristics are appropriate in a specific case, since the technical uses of our products are numerous and can vary widely in a specific instance. Therefore, such factors do not fall within our control, and are the exclusive responsibility of the customer. If a specific assurance of data parameters should be required, an appropriate agreement must be reached to this effect. Any applicable patents, existing laws and regulations must be observed by the customer or user of our products on its own responsibility. This publication does not represent a license, nor does it intend to infringe or encourage infringement of any type of patent. Note: This edition voids and replaces all previous publications on the pertinent subject.

Am Ostkai 21/22  
70327 Stuttgart  
Germany  
Phone: +49 (0) 711 - 3 89 80 00  
Fax: +49 (0) 711 - 3 89 80 011  
www.hexionchem.com

## Laminating resin MGS® L 285

### DMA - T<sub>g</sub> (peak) tan delta laminating resin L 285 with hardener 286 measuring after heat treatment

### DMA



#### Measurement conditions

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

|                      | Hardener 285           | Hardener 286           | Hardener 287           |
|----------------------|------------------------|------------------------|------------------------|
| <b>unconditioned</b> | 176-185 °F<br>80-85 °C | 185-194 °F<br>85-90 °C | 194-203 °F<br>90-95 °C |
| <b>conditioned</b>   | 149-158 °F<br>65-70 °C | 172-179 °F<br>78-82 °C | 181-190 °C<br>83-88 °C |

### T<sub>g</sub> conditioned

#### Sample preparation:

Conditioned at 40 °C (104°F) 90 % rel. humidity

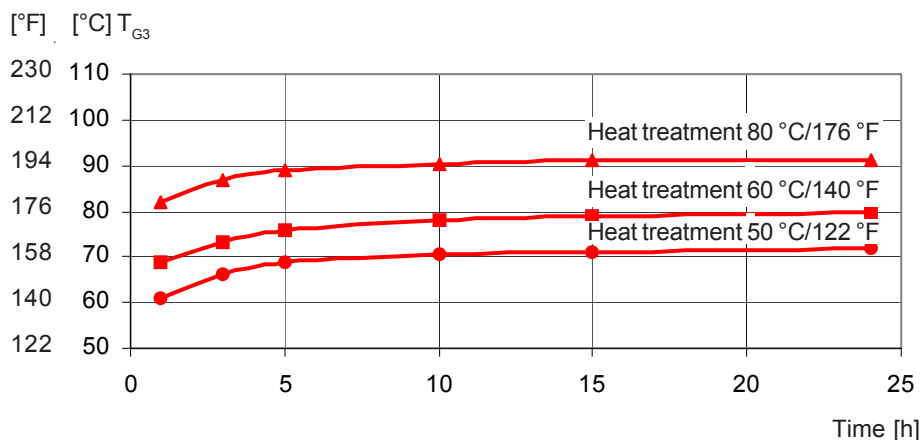
In the process of international testing system harmonization, the national standards previously used are being increasingly replaced by ISO (DIN EN ISO) standards. All information, recommendations and suggestions offered by Hexion Specialty Chemicals GmbH, whether orally, in written form or in a database, are provided to the best of our knowledge and belief. However, they may not be construed as legally binding statements and do not represent either express or implicit assurances, or a guarantee of specific properties. The data parameters stated for products are specific values that may also be found in our technical information leaflets, and like these do not represent the basis of either a guarantee or specification. The same applies analogously to the data parameters stated for examples of cured binder systems; these represent analytical results and are only intended to simplify advance selection of the individual components of a binder. This information, these recommendations and suggestions describe our products and possible applications in general or exemplary terms, but do not refer to specific cases. Changes in the data parameters, texts and illustrations can result from the constant process of technical development and improvement of our products; possible changes are not specially mentioned in the text. Our support does not free the customer from the obligation to conduct its own review of our current informational literature, in particular our product data sheets, safety data sheets and our technical information leaflets. The customer must carry out tests of our products on his own responsibility to determine their suitability for the intended process and uses, as well as to establish whether their processing characteristics are appropriate in a specific case, since the technical uses of our products are numerous and can vary widely in a specific instance. Therefore, such factors do not fall within our control, and are the exclusive responsibility of the customer. If a specific assurance of data parameters should be required, an appropriate agreement must be reached to this effect. Any applicable patents, existing laws and regulations must be observed by the customer or user of our products on its own responsibility. This publication does not represent a license, nor does it intend to infringe or encourage infringement of any type of patent. Note: this edition voids and replaces all previous publications on the pertinent subject.

Am Ostkai 21/22  
70327 Stuttgart  
Germany  
Phone: +49 (0) 711 - 3 89 80 00  
Fax: +49 (0) 711 - 3 89 80 011  
www.hexionchem.com

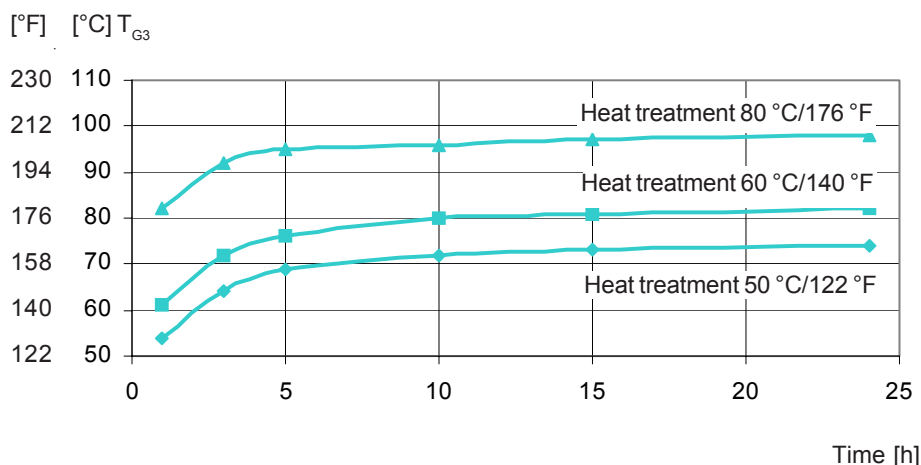
## Laminating resin MGS® L 285

### Laminating resin L 285 Hardeners 285

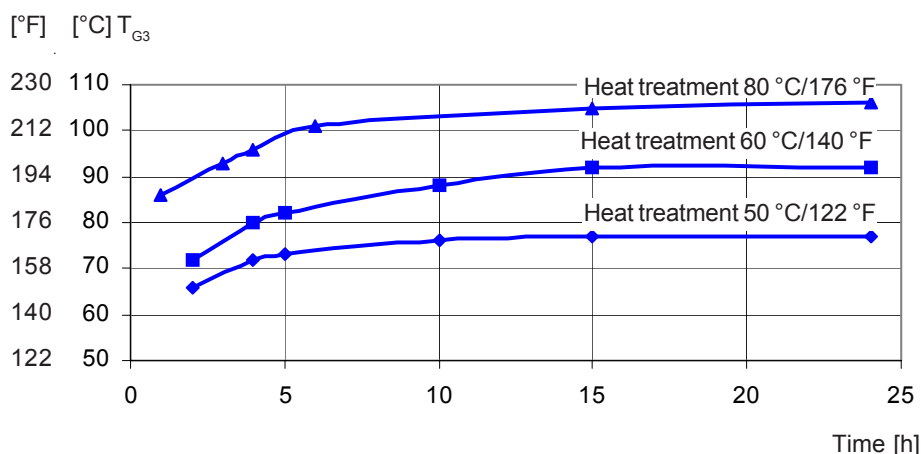
## Development of $T_G$



### Laminating resin L 285 Hardeners 286



### Laminating resin L 285 Hardeners 287



### Sample preparation:

Initial curing before heat treatment 24 h at room temperature

In the process of international testing system harmonization, the national standards previously used are being increasingly replaced by ISO (DIN EN ISO) standards. All information, recommendations and suggestions offered by Hexion Specialty Chemicals GmbH, whether orally, in written form or in a database, are provided to the best of our knowledge and belief. However, they may not be construed as legally binding statements and do not represent either express or implicit assurances, or a guarantee of specific properties. The data parameters stated for products are specific values that may also be found in our technical information leaflets, and like these do not represent the basis of either a guarantee or specification. The same applies analogously to the data parameters stated for examples of cured binder systems; these represent analytical results and are only intended to simplify advance selection of the individual components of a binder. This information, these recommendations and suggestions describe our products and possible applications in general or exemplary terms, but do not refer to specific cases. Changes in the data parameters, texts and illustrations can result from the constant process of technical development and improvement of our products; possible changes are not specially mentioned in the text. Our support does not free the customer from the obligation to conduct its own review of our current informational literature, in particular our product data sheets, safety data sheets and our technical information leaflets. The customer must carry out tests of our products on his own responsibility to determine their suitability for the intended process and uses, as well as to establish whether their processing characteristics are appropriate in a specific case, since the technical uses of our products are numerous and can vary widely in a specific instance. Therefore, such factors do not fall within our control, and are the exclusive responsibility of the customer. If a specific assurance of data parameters should be required, an appropriate agreement must be reached to this effect. Any applicable patents, existing laws and regulations must be observed by the customer or user of our products on its own responsibility. This publication does not represent a license, nor does it intend to infringe or encourage infringement of any type of patent. Note: this edition voids and replaces all previous publications on the pertinent subject.

**Laminating resin MGS® L 285**
**Mechanical data**

| Mechanical data of neat resin   |                       |  |
|---|-----------------------|--|
| <b>Density</b>  | [g/cm <sup>3</sup> ]  | 1,18 - 1,20                                    |
| <b>Flexural strength</b>  | [N/mm <sup>2</sup> ]  | 110 - 120                                      |
| <b>Modulus of elasticity</b>  | [kN/mm <sup>2</sup> ] | 3,0 - 3,3                                      |
| <b>Tensile strength</b>   | [N/mm <sup>2</sup> ]  | 70 - 80  |
| <b>Compressive strength</b>   | [N/mm <sup>2</sup> ]  | 120 - 140                                      |
| <b>Elongation of break</b>  | [%]                   | 5,0 - 6,5                                      |
| <b>Impact strength</b>  | [KJ/m <sup>2</sup> ]  | 45 - 55  |
| <b>Water absorption at 23°C</b>   | 24 h [%]<br>7 d [%]   | 0,20 - 0,30<br>0,60 - 0,80                     |
| <b>Fatigue strength under reversed bending stresses acc. to DLR Brunsw.</b>                       | 10 %<br>90 %          | > 2 x 10 <sup>4</sup><br>> 2 x 10 <sup>6</sup> |
| <b>Curing:</b> 24 h at 23 °C (74 °F) + 15 h at 60 °C (140 °F)                                     |                       |  |
| <b>Typical data according to WL 5.3203 Parts 1 and 2 of the German Aviation Materials Manual.</b> |                       |  |

**Advice:**

Mechanical data are typical for the combination of laminating resin L 285 with hardener H 287. Data can differ in other applications.

**Laminating resin MGS® L 285**

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

**Mechanical data**

| Reinforced with   |                       | <b>GRC</b><br>Glass fibre | <b>CRC</b><br>Carbon fibre | <b>SRC</b><br>Aramide fibre |
|---|-----------------------|---------------------------|----------------------------|-----------------------------|
| <b>Flexural strength</b>  | [N/mm <sup>2</sup> ]  | 510 - 560                 | 720 - 770                  | 350 - 380                   |
| <b>Tensile strength</b>   | [N/mm <sup>2</sup> ]  | 460 - 500                 | 510 - 550                  | 400 - 480                   |
| <b>Compressive strength</b>   | [N/mm <sup>2</sup> ]  | 410 - 440                 | 460 - 510                  | 140 - 160                   |
| <b>Interlaminar shear strength</b>  | [N/mm <sup>2</sup> ]  | 42 - 46                   | 47 - 55                    | 29 - 34                     |
| <b>Modulus of elasticity</b>  | [kN/mm <sup>2</sup> ] | 20 - 24                   | 40 - 45                    | 16 - 19                     |
| <p><b>GRC samples:</b><br/>16 layers of glass fabric, 8H satin, 296 g/m<sup>2</sup> (8.5 oz/sq.yd.), 4 mm (0.16 in) thick</p> <p><b>CRC samples:</b><br/>8 layers of carbon fabric, plain, 200 g/m<sup>2</sup> (5.9 oz/sq.yd.) 2 mm (0.08 in) thick</p> <p><b>SRC samples:</b><br/>15 layers of aramide fabric, 4H satin, 170 g/m<sup>2</sup> (5.0 oz/sq.yd.), 4 mm (0.16 in) thick</p> <p>Fibre content of samples during processing/testing: 40 - 45 vol%<br/>Data calculated for fibre content of 43 vol%</p> <p>Typical data according to WL 5.3203 Parts 1 and 2<br/>of the GERMAN AVIATION MATERIALS MANUAL</p> |                       |                           |                            |                             |

**Measuring conditions:**

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