

Advanced Materials**Araldite® LY 1556 / Aradur® 906 / Accelerator DY 070****HOT CURING EPOXY MATRIX SYSTEM**

Araldite® LY 1556 is an epoxy resin

Aradur® 906 is an anhydride hardener

Accelerator DY 070 is an imidazol accelerator

| | | | |
|---------------------|--|---------------------------|----------------------|
| APPLICATIONS | High performance composite parts | | |
| PROPERTIES | Reactive diluent free matrix system with a very long pot life. The reactivity can be adjusted by varying the accelerator content. The system has very good high temperature performance after post cure and exhibits good mechanical and dynamic properties. | | |
| PROCESSING | Filament Winding Pressure Moulding Pultrusion | | |
| KEY DATA | Araldite® LY 1556 | | |
| | Aspect (visual) | clear, pale yellow liquid | |
| | Colour (Gardner, ISO 4630) | ≤ 2 | |
| | Epoxy content | 5.30 - 5.45 | [eq/kg] |
| | Viscosity at 25 °C (ISO 12058-1) | 10000 - 12000 | [cps] |
| | Density at 25 °C (ISO 1675) | 1.15 - 1.20 | [g/cm ³] |
| | Flash point (ISO 2719) | > 200 | [°C] |
| | Aradur® 906 | | |
| | Aspect (visual) | clear, pale yellow liquid | |
| | Colour (Gardner, ISO 4630) | ≤ 2 | |
| | Viscosity at 25 °C (ISO 12058-1) | 175 - 350 | [cps] |
| | Density at 25 °C (ISO 1675) | 1.20 - 1.25 | [g/cm ³] |
| | Flash point (ISO 2719) | > 135 | [°C] |
| | Accelerator DY 070 | | |
| | Aspect (visual) | clear liquid | |
| | Colour (Gardner, ISO 4630) | ≤ 9 | |
| | Viscosity at 25 °C (ISO 12058-1) | ≤ 50 | [cps] |
| | Density at 25 °C (ISO 1675) | 0.95 - 1.05 | [g/cm ³] |
| | Flash point (ISO 2719) | > 92 | [°C] |

PROCESSING DATA

| MIX RATIO | <i>Components</i> | <i>Parts by weight</i> | <i>Parts by volume</i> |
|---|---|---|---|
| | Araldite® LY 1556 | 100 | 100 |
| | Aradur® 906 | 95 | 92 |
| | Accelerator DY 070 | 0.5 - 2 | 0.6 - 2.4 |
| <p>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.</p> | | | |
| PROCESSING RECOMMENDATIONS | <p>To simplify the mixing process the resin can be preheated to about 30 °C to 50 °C before adding the cold hardener.</p> <p>Hardener and accelerator can be premixed, thus allowing the use of two component mixing/metering equipment. The mix of hardener and accelerator has a shelf life of at least 1 day.</p> <p>The impregnation bath should be heated to 35 - 45 °C in order to ensure optimum wetting of fibres. The mandrel should be heated to 60 - 110 °C during the filament winding process.</p> <p>The gelation temperature should not be higher than absolutely necessary. A high gelation temperature induces high shrinkage and generates internal stresses.</p> | | |
| INITIAL MIX VISCOSITY (HOEPLER, ISO 12058-1B) | <i>Mixture with 1 pbw of Accelerator DY 070</i> | <i>[°F]</i> at 78 at 104 | <i>[cps]</i> 1900 - 2100 400 - 500 |
| POT LIFE (TECAM, 100 ML, 65 % RH) | | <i>[°F]</i> at 78 at 104 | <i>[h]</i> 50 - 55 37 - 42 |
| GEL TIME (HOT PLATE) | | <i>[°F]</i> at 248 at 284 at 320 | <i>[min]</i> 14 - 16 4 - 6 1 - 2 |
| <p>The values shown are for small amounts of pure resin/hardener mix. In composite structures the gel time can differ significantly from the given values depending on the fibre content and the laminate thickness.</p> | | | |
| TYPICAL CURE CYCLES | <p>2 h 248 °F + 8 h 320 °F or 2 h 248 °C + 8 h 356 °F</p> <p>The optimum cure cycle has to be determined case by case depending on the processing and the economic requirements.</p> | | |

PROPERTIES OF THE CURED, NEAT FORMULATION

| GLASS TRANSITION TEMPERATURE (T_G) (IEC 1006, 10 K/MIN) | <i>Cure:</i> | <i>T_G TMA [°F]</i> | <i>T_G DSC [°F]</i> |
|---|--------------------------------------|-------------------------------|-------------------------------|
| | 8 h 248 °F | 266 - 277 | 284 - 295 |
| | 2 h 248 °F + 8 h 284 °F | 320 - 329 | 329 - 338 |
| | 2 h 248 °F + 2 h 320 °F | 320 - 329 | 329 - 338 |
| | 2 h 248 °F + 8 h 320 °F | 320 - 329 | 329 - 347 |
| | 2 h 248 °F + 2 h 356 °F | 320 - 329 | 329 - 347 |
| | 2 h 248 °F + 8 h 356 °F | 165 - 338 | 329 - 356 |
| | 2 h 248 °F + 2 h 320 °F + 2 h 356 °F | 165 - 338 | 347 - 356 |

Cure temperatures above 266 °F may lead to a brownish colouration of the epoxy system. This colouration does not influence the properties of the system.

| TENSILE TEST (ISO 527) | <i>Cure:</i> | | <i>2 h 248 °F + 8 h 320 °F</i> |
|----------------------------------|--------------|--|------------------------------------|
| Tensile strength | [Kpsi] | | 6.5 – 8.7 |
| Ultimate elongation | [%] | | 1.5 - 2.5 |
| Tensile modulus | [Kpsi] | | 392 - 435 |

| FLEXURAL TEST (ISO 178) | <i>Cure:</i> | | <i>2 h 248 °F + 8 h 320 °F</i> |
|-----------------------------------|--------------|--|------------------------------------|
| Flexural strength | [Kpsi] | | 14.5 – 20.3 |
| Ultimate elongation | [%] | | 4 - 7 |
| Flexural modulus | [Kpsi] | | 421 - 450 |

| FRACTURE PROPERTIES BEND NOTCH TEST (PM 258-0/90) | <i>Cure:</i> | | <i>2 h 120 °C + 8 h 160 °C</i> |
|---|---|--|------------------------------------|
| Fracture toughness K _{1C} | [$\text{vin}^*\text{lb}/\text{in}^2$] | | 659 - 824 |
| Fracture energy G _{1C} | [$\text{In}^*\text{lb}/\text{in}^2$] | | 0.57 - 0.71 |

| WATER ABSORPTION (ISO 62) | <i>Immersion:</i> | <i>Cure:</i> | <i>2 h 248 °F + 8 h 320 °F</i> |
|-------------------------------------|--------------------------------|--------------|------------------------------------|
| | 1 day H ₂ O 73 °F | [%] | 0.15 - 0.17 |
| | 10 days H ₂ O 73 °F | [%] | 0.48 - 0.52 |

PROPERTIES OF THE CURED, REINFORCED FORMULATION

| INTERLAMINAR SHEAR STRENGTH (ASTM D 2344) | Short beam: E-glass unidirectional specimen Laminate thickness t = 3.2 mm Fibre volume content: 59 - 62 % | <i>Cure:</i> | <i>2 h 248 °F + 8 h 320 °F</i> |
|---|---|--------------|------------------------------------|
| | | | |
| | Shear strength | [Kpsi] | 10.0 – 10.9 |

| TENSILE TEST, TRANSVERSE STRESS | Test specimens: unidirectionally wound tubes |
|--|--|
|--|--|

| E-glass | Roving | E-glass roving, 1200 tex, silane finish | | | | | |
|------------------|----------------------|---|---|----------------|---------------|------------|-------------|
| | Fibre volume content | 66 % | | | | | |
| | Gelation temperature | 212 °F | | | | | |
| | Cure | 2 h 248 °F + 8 h 320 °F | | | | | |
| Carbon | Roving | Torayca T 300 B | | | | | |
| | Fibre volume content | 58 % | | | | | |
| | Gelation temperature | 212°F | | | | | |
| | Cure | 2 h 248 °F + 8 h 320°F | | | | | |
| Tensile strength | | [Kpsi] | <table border="0"> <thead> <tr> <th><i>E-glass</i></th> <th><i>Carbon</i></th> </tr> </thead> <tbody> <tr> <td>9.1 – 10.6</td> <td>11.3 – 12.3</td> </tr> </tbody> </table> | <i>E-glass</i> | <i>Carbon</i> | 9.1 – 10.6 | 11.3 – 12.3 |
| <i>E-glass</i> | <i>Carbon</i> | | | | | | |
| 9.1 – 10.6 | 11.3 – 12.3 | | | | | | |

STORAGE

Araldite® LY 1556 should be stored in a dry place, in the sealed original container, away from heat and humidity, at temperatures between +2°C and +40°C (+35.6°F and +104°F). Under these storage conditions, the shelf life is 6 years. The product should not be exposed to direct sunlight. Araldite® LY 1556 which has crystallized and looks cloudy can be restored to its original state by heating to 60 - 80 °C.

Aradur® 906 should be stored in a dry place, in the sealed original container, away from heat and humidity, at temperatures between +2°C and +40°C (+35.6°F and +104°F). Under these storage conditions, the shelf life is 2 years. The product should not be exposed to direct sunlight. Because Aradur® 906 is sensitive to moisture, storage containers should be ventilated with dry air only.

Accelerator DY 070 should be stored in a dry place, in the sealed original container, away from heat and humidity, 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.

Partly emptied containers should be closed immediately after use.

PRECAUTIONARY STATEMENT

Huntsman Advanced Materials Americas LLC maintains up-to-date Material Safety Data Sheets (MSDS) on all of its products. These sheets contain pertinent information that you may need to protect your employees and customers against any known health or safety hazards associated with our products. Users should review the latest MSDS to determine possible health hazards and appropriate precautions to implement prior to using this material.

First Aid!

Refer to MSDS as mentioned above.

KEEP OUT OF REACH OF CHILDREN**FOR PROFESSIONAL AND INDUSTRIAL USE ONLY**

IMPORTANT LEGAL NOTICE

Huntsman Advanced Materials warrants only that its products meet the specifications agreed with the user. Typical properties, where stated, are to be considered as representative of current production and should not be treated as specifications.

The manufacture of materials is the subject of granted patents and patent applications; freedom to operate patented processes is not implied by this publication.

While all the information and recommendations in this publication are, to the best of Huntsman Advanced Material's knowledge, information and belief, accurate at the date of publication, NOTHING HEREIN IS TO BE CONSTRUED AS A WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING BUT WITHOUT LIMITATION, AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN ALL CASES, IT IS THE RESPONSIBILITY OF THE USER TO DETERMINE THE APPLICABILITY OF SUCH INFORMATION AND RECOMMENDATIONS AND THE SUITABILITY OF ANY PRODUCT FOR ITS OWN PARTICULAR PURPOSE.

The behavior of the products referred to in this publication in manufacturing processes and their suitability in any given end-use environment are dependent upon various conditions such as chemical compatibility, temperature, and other variables, which are not known to Huntsman Advanced Materials. It is the responsibility of the user to evaluate the manufacturing circumstances and the final product under actual end-use requirements and to adequately advise and warn purchasers and users thereof.

Products may be toxic and require special precautions in handling. The user should obtain Safety Data Sheets from Huntsman Advanced Materials containing detailed information on toxicity, together with proper shipping, handling and storage procedures, and should comply with all applicable safety and environmental standards.

Hazards, toxicity and behavior of the products may differ when used with other materials and are dependent on manufacturing circumstances or other processes. Such hazards, toxicity and behaviour should be determined by the user and made known to handlers, processors and end users.

Except where explicitly agreed otherwise, the sale of products referred to in this publication is subject to the general terms and conditions of sale of Huntsman Advanced Materials LLC or of its affiliated companies including without limitation, Huntsman Advanced Materials (Europe) BVBA, Huntsman Advanced Materials Americas Inc., and Huntsman Advanced Materials (Hong Kong) Ltd.

Huntsman Advanced Materials is an international business unit of Huntsman Corporation. Huntsman Advanced Materials trades through Huntsman affiliated companies in different countries including but not limited to Huntsman Advanced Materials LLC in the USA and Huntsman Advanced Materials (Europe) BVBA in Europe.

Araldite and Aradur are registered trademarks of Huntsman Corporation or an affiliate thereof.

Copyright © 2010 Huntsman Corporation or an affiliate thereof. All rights reserved.

Main Offices:

Huntsman Corporation
10003 Woodloch Forest Dr.
The Woodlands, TX 77380
888-564-9318

www.huntsman.com/advanced_materials
advanced_materials@huntsman.com