Araldite®
Composites technology for mass production

A global offer to the automotive industry
A new step forward in composites mass production

Huntsman Advanced Materials brings the next step change in composites technology, allowing part production time in just 1 min. With the release of a new global offer for the automotive industry, Huntsman meets demands for faster processing and reduced composite production cycles.

Preforming solution

Araldite® LT 3366 preforming solution
Epoxy binder qualified for mass production of powdered fabrics and preforms (1)
> High softening point preventing ply-to-ply adhesion during storage and fiber distortion during injection
> Fast preforming cycle

Softening point
c. 150 °C

DSC Tg mid-point
75 - 85 °C

Typical preforming cycle
20 ± 10 s at 180 ± 20 °C
+ cold stamping

In addition to providing the required process latency, the new solutions exhibit very fast demolding stiffness development, enabling drastic reduction in cure time. Their high elongation at break make them ideal solution for impact resistant composite part production.

Araldite® LY 3031 / Aradur® 3032 (2)
For Wet Compression Molding

Tensile modulus
ISO 527-2 on neat resin
2 650 - 2 850 MPa

Tensile strength
ISO 527-2 on neat resin
70 - 80 MPa

Tensile elongation
ISO 527-2 on neat resin
5 - 7 %

DSC Tg midpoint (3)
ISO 11357-2 on CFRP
110-120°C

DMA Tg onset (4)
ISO 6721 on CFRP
95 - 105 °C

ILSS (5)
ASTM D2344 on CFRP
63 - 67 MPa

Araldite® LY 3585 / Aradur® 3475 (2)
For RTM / Wet Compression Molding

Tensile modulus
ISO 527-2 on neat resin
2 700 - 2 900 MPa

Tensile strength
ISO 527-2 on neat resin
75 - 80 MPa

Tensile elongation
ISO 527-2 on neat resin
6 - 10 %

DSC Tg midpoint (3)
ISO 11357-2 on CFRP
120-130°C

DMA Tg onset (4)
ISO 6721 on CFRP
125 - 115 °C

ILSS (5)
ASTM D2344 on CFRP
56-60 MPa

Building on BMW ➞ experience
The new epoxy solutions are built on the first generation Araldite® LY 3585 / Hardenex XB 3458 and Araldite® LT 3366, qualified for the first mass produced automotive carbon composites application (BMW ➞ program).

Very fast curing solutions designed for highly structural applications

Araldite® 3475 hardener platform
The ideal reactivity for each part
The hardener reactivity can be adjusted to optimize part production time without influencing mechanical performance:
> HP-RTM: injection time optimization to different part size
> WCM: very fast cure (no injection latency required)
> Prototyping: using low temperature molding (standard RTM)

Optimizing productivity and qualification
The ideal strategy for each program
Depending on HP-RTM part size and the number of HP-RTM / WCM parts to produce, different strategies can be followed to optimize productivity and qualification cost:
> Strategy 1 One system for all (single product)
> Strategy 2 One platform for all (Araldite® 3475 hardener platform)
> Strategy 3 Two or more products

References
(1) Typical preforming conditions: cold pressing after infra-red heating
(2) Data generated with 1-2phr internal release agent
(3) 2°C/min
(4) Torsion mode, 2°C/min
(5) 50K UD, TVf 50%

[Graph: HP-RTM - Cure time versus injection time at 115°C (Reference at 100°C)]

[Graph: Wet compression molding - Cure time at 140°C]

[Table: Strategies for composites production]

Qualification effort
Productivity
Strategies 1
Strategy 1
Strategy 2
Strategy 3
HP-RTM / WCM
HP-RTM / WCM
HP-RTM / WCM

[Diagram: Araldite® LY 3031 / Aradur® 3032]
For Wet Compression Molding

[Diagram: Araldite® LY 3585 / Aradur® 3475]
For RTM / Wet Compression Molding

Reference: Araldite® LY 3585 / XB 3458
First generation fast cure system built for BMW ➞
Advanced Composites Process Simulation

The shortest possible manufacturing time

In our Composite’s Centre of Excellence in Basel, advanced composites process simulation is used to design a production process tailored to each part. Precise descriptions of the resin are used to generate material models (Figure 1) which are projected onto the CAD data. This enables prediction of the material behavior during the injection and curing process at each point on the composite part.

Resin cure is essential to overall process performance and cure simulation can substantially reduce part development time. Figure 2 shows a pressure vessel: during processing of thick-walled structures, temperature builds up due to the exothermic reaction. Using cure simulation, exotherm peaks can be predicted, simplifying process engineering and enabling selection of the correct resin system and process parameters.

In liquid composite molding, void free parts are key to maximum part performance. By applying flow simulation we support process engineers to evaluate injection strategies and to find optimum processing parameters to ensure complete filling of the part (Figure 3).

Resin selection, flow pattern, injection concepts and cure schedule: virtual process cycles are carried out to refine process design, ensure optimized mold layout and quickly identify ideal processing parameters.

Cure simulation

Predict | Support
--- | ---
- cure cycle time | > process parameter determination
- exotherm temperature | > resin system selection
- evolution of Tg and conversion | > process safety

Flow simulation

Predict | Support
--- | ---
- flow front evolution | > injection strategy
- filling time | > inlet / outlet position
- pressure evolution | > early stage process design
- process induced filling variability (e.g. preferential flow channels, inserts)

New Dynamic Fluid Compression Molding (DFCM) process

NEW exclusive DFCM process
- Fiber volume content up to 65%
- Void-free parts
- Faster process vs. RTM
- Simple processing of heavy-tow industrial fabrics
- Pressure only 30 bar
- Fiber wash eliminated
- Low equipment investment
- Reduced waste
- Fiber preform not mandatory
- Complex parts possible (medium draw or 2.5+D)
- Consistent part quality

Simple and fast, the DFCM process bypasses the injection step and brings composites production cycle to just 1 minute.

Autoclave quality in 1 minute

Combining a novel process and fast-cure Araldite® epoxy solutions, highly structural parts with outstanding properties can be produced in 1 minute. This process is simple, fast and cost effective, requiring low pressure (typically 30 bar) and often removing the need for a fiber preform.

Exceptional benefits versus standard wet compression molding: outstanding mechanical performance thanks to fiber volume content up to 65% in a low wastage process, simple processing, even with heavy-tow industrial reinforcements, void-free parts produced consistently straight from the mold.

Simple and fast, the DFCM process bypasses the injection step and brings composites production cycle to just 1 minute.

HP-RTM
- Low porosity, medium FVC (50%)

Standard WCM
- High porosity, High FVC (80%)

New DFCM
- Low porosity, high FVC (60%)

Consistent quality straight from the mold
Huntsman Advanced Materials

Our Advanced Materials division is a leading global chemical solutions provider with a long heritage of pioneering technologically advanced epoxy, acrylic and polyurethane-based polymer products.

Our capabilities in high-performance adhesives and composites, delivered by more than 1,600 associates, serve over 2,000 global customers with innovative, tailor-made solutions and more than 1,500 products which address global engineering challenges.

Global presence – 13 manufacturing sites

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