Advanced Materials

HUNTSMAN

Enriching lives through innovation

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	ca. 150 °C
DSC Tg mid-point	75 - 85 °C
Typical preforming cycle	20 ± 10 s at 180 ± 20 °C + cold stamping

(1) Typical preforming conditions: cold pressing after infra-red heating

(2) Data generated with 1-2phr internal release agent

(3) 5°C/min

(4) Torsion mode, 2°C/min

(5) 50K UD, TVf 50%

Building on BMW «i» experience

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

Very fast curing solutions designed for highly structural applications

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)

NEW 30" cure

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	8 - 10 %
DSC Tg midpoint (3) ISO 11357-2 on CFRP	120-130°C
DMA Tg onset (4) ISO 6721 on CFRP	105 - 115 °C
ILSS (5) ASTM D2344 on CFRP	56-60 MPa

Aradur® 3475 hardener platform

The ideal reactivity for each part

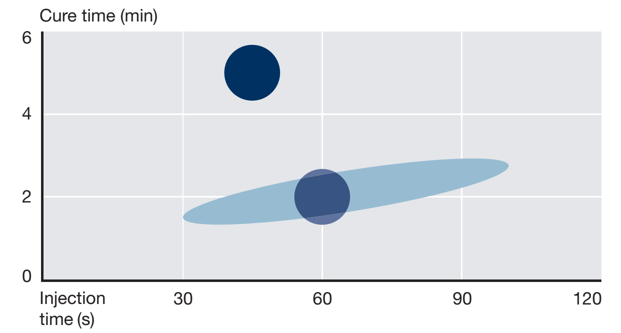
The hardener reactivity can be adjusted to optimize part production time without influencing mechanical performance:

> HP-RTM: injection time optimization to different part size

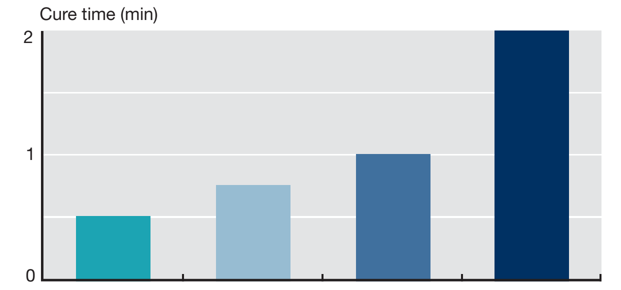
> WCM: very fast cure (no injection latency required)

> Prototyping: using low temperature molding (standard RTM)

HP-RTM - Cure time versus injection time at 115°C (Reference at 100°C)



Wet compression molding - Cure time at 140°C



Optimizing productivity and qualification

The ideal strategy for each program

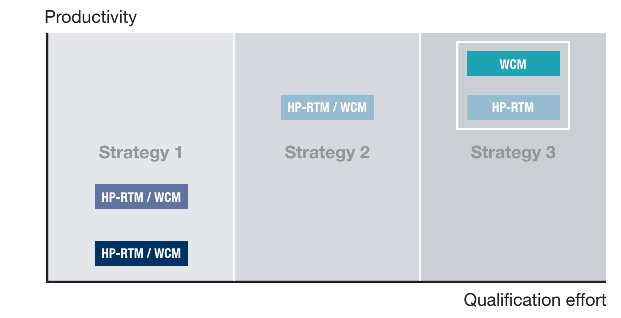
Depending on HP-RTM part size and the number of HP-RTM / WCM parts to produce, different strategies can be followed to optimize productivity and qualification cost:

> **Strategy 1** One system for all (single product)

> **Strategy 2** One platform for all (Aradur® 3475 hardener platform)

> **Strategy 3** Two or more products

Strategies for composites production



Araldite® LY 3031 / Aradur® 3032 NEW 30" cure

For Wet Compression Molding

Araldite® LY 3585 / Aradur® 3475

For RTM / Wet Compression Molding

Araldite® LY 3585 / Aradur® 3475 hardener platform

The ideal reactivity for each part

Reference: Araldite® LY 3585 / XB 3458

First generation fast cure system built for BMW «i»

Insert > Close > Cure > Demold

New Dynamic Fluid Compression Molding (DFCM) process

Autoclave quality in 1minute

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.

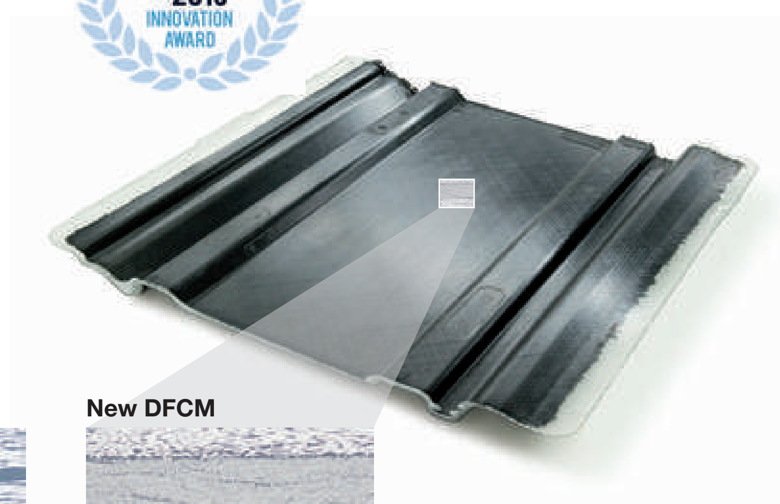
Exceptional benefits versus standard wet compression molding: outstanding mechanical performance thanks to fiber volume content up to 65% in a low wastage process, simple processing, even with heavy-tow industrial reinforcements, void-free parts produced consistently straight from the mold.

NEW exclusive DFCM process

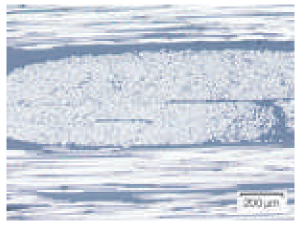
> Fiber volume content up to 65%
> Void-free parts
> Faster process vs. RTM
> Simple processing of heavy-tow industrial fabrics
> Pressure only 30 bar
> Fiber wash eliminated
> Low equipment investment
> Reduced waste
> Fiber preform not mandatory
> Complex parts possible (medium draw or 2.5+D)
> Consistent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

JEC GROUP WINNER OF 2016 INNOVATION AWARD

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

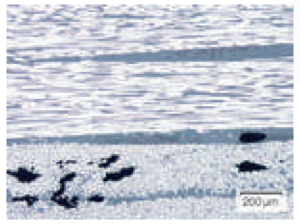


HP-RTM



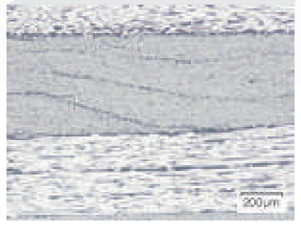
Low porosity, medium FVC (50%)

Standard WCM



High porosity, high FVC (60%)

New DFCM



Low porosity, high FVC (60%)

Consistent quality straight from the mold

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

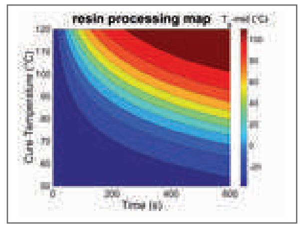


Fig. 1 Material model

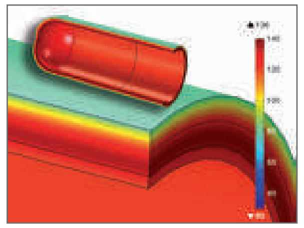


Fig. 2 Exotherm prediction

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)	

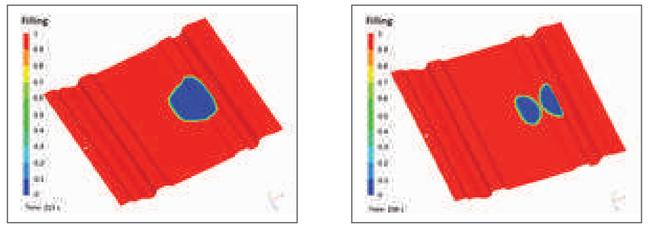


Fig. 3 Effect of process induced variation

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

Mobile App from Huntsman Advanced Materials

Download our mobile App and easily find the product to fulfill your need.

Available on the App Store

ANDROID APP ON Google play

HUNTSMAN

Enriching lives through innovation

For more information
www.huntsman.com/advanced_materials
advanced_materials@huntsman.com

Europe, Middle East & Africa
Huntsman Advanced Materials (Switzerland) GmbH
Klybeckstrasse 200
P.O. Box
4002 Basel
Switzerland
Tel. +41 61 299 1111
Fax +41 61 299 1112

Asia Pacific & India
Huntsman Advanced Materials (Guangdong) Co., Ltd.
Room 4903-4906, Maxdo Centre,
8 Xing Yi Road,
Shanghai 200336,
P.R.China
Tel. + 86 21 2325 7888
Fax + 86 21 2325 7808

Americas
Huntsman Advanced Materials Americas Inc.
10003 Woodloch Forest Drive
The Woodlands
Texas 77380
USA
Tel. +1 888 564 9318
Fax +1 281 719 4047

Legal information

All trademarks mentioned are either property of or licensed to Huntsman Corporation or an affiliate thereof in one or more, but not all, countries.
Sales of the product described herein ("Product") are subject to the general terms and conditions of sale of either Huntsman Advanced Materials LLC, or its appropriate affiliate including without limitation Huntsman Advanced Materials (Europe) BVBA, Huntsman Advanced Materials Americas Inc., or Huntsman Advanced Materials (Hong Kong) Ltd. or Huntsman Advanced Materials (Guangdong) Ltd. ("Huntsman"). The following supercedes Buyer's documents. While the information and recommendations included in this publication are, to the best of Huntsman's knowledge, accurate as of the date of publication, NOTHING CONTAINED HEREIN IS TO BE CONSTRUED AS A REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHTS, OR WARRANTIES AS TO QUALITY OR CORRESPONDENCE WITH PRIOR DESCRIPTION OR SAMPLE, AND THE BUYER ASSUMES ALL RISK AND LIABILITY WHATSOEVER RESULTING FROM THE USE OF SUCH PRODUCT, WHETHER USED SINGLY OR IN COMBINATION WITH OTHER SUBSTANCES. No statements or recommendations made herein are to be construed as a representation about the suitability of any Product for the particular application of Buyer or user or as an inducement to infringe any patent or other intellectual property right. Data and results are based on controlled conditions and/or lab work. Buyer is responsible to determine the applicability of such information and recommendations and the suitability of any Product for its own particular purpose, and to ensure that its intended use of the Product does not infringe any intellectual property rights.
The Product may be or become hazardous. Buyer should (i) obtain Material Safety Data Sheets and Technical Data Sheets from Huntsman containing detailed information on Product hazards and toxicity, together with proper shipping, handling and storage procedures for the Product, (ii) take all steps necessary to adequately inform, warn and familiarize its employees, agents, direct and in direct customers and contractors who may handle or be exposed to the Product of all hazards pertaining to and proper procedures for safe handling, use, storage, transportation and disposal of and exposure to the Product and (iii) comply with and ensure that its employees, agents, direct and indirect customers and contractors who may handle or be exposed to the Product comply with all safety information contained in the applicable Material Safety Data Sheets, Technical Data Sheets or other instructions provided by Huntsman and all applicable laws, regulations and standards relating to the handling, use, storage, distribution and disposal of and exposure to the Product. Please note that products may differ from country to country. If you have any queries, kindly contact your local Huntsman representative.

Ref. No. Composite technology for mass production 02.16_EN_EU

Responsible Care®

Registered for REACH

Concept and design by Zygmund SARL