### MAKING THE WORLD LIGHTER

ROHACELL<sup>®</sup> high-performance foam cores for sandwich structures



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# LIGHTWEIGHT AND STRONG

ROHACELL<sup>®</sup> structural foam is at the core of lightweight sandwich component designs that display high shear and pressure resistance, even at elevated temperatures.

Increasing the rigidity and strength of a composite structure using sandwich construction is a design concept championed by innovation and efficiency driven industries around the world. ROHACELL® polymethacrylimide (PMI)-based structural foam cores have been used to increase structure stiffness in fiber-reinforced composite technology for almost 50 years. A versatile solution offering extensive design freedom, the foam can be CNC milled, thermoformed or thermoshaped into complex geometries. It is compatible with all common thermoset and thermoplastic polymers. When combined with common resin systems, the foam cores are suitable for auto-clave, press, vacuum infusion, resin transfer molding (RTM) and vacuum assisted resin transfer molding (VARTM). So it is no coincidence that ROHACELL<sup>®</sup> remains a proven leader in high performance lightweight sandwich construction. ROHACELL® products for success in your industry

Product grade	Application industry
ROHACELL <sup>®</sup> A	Aircraft
ROHACELL <sup>®</sup> HERO	Aircraft
ROHACELL <sup>®</sup> RIST-HT	Aircraft
ROHACELL <sup>®</sup> RIMA	Aircraft • Sport
ROHACELL <sup>®</sup> XT	Aircraft
ROHACELL <sup>®</sup> WF	Aircraft • Radomes
ROHACELL <sup>®</sup> S	Aircraft • Railway • Shipbuilding
ROHACELL <sup>®</sup> EC	Aircraft • Electronics
ROHACELL <sup>®</sup> HF	Radomes • Medical
ROHACELL <sup>®</sup> SL	Sport • Automotive
ROHACELL <sup>®</sup> IG-F	Automotive • Medical • Sport • Electronics
ROHACELL <sup>®</sup> WIND-F	Wind



#### **ROHACELL**<sup>®</sup> PRODUCT OVERVIEW

Cell size	Curing temperature	Special properties
Coarse	≤ 130°C / 266°F	Low temperature curing • standard aircraft grade
Medium	≤ 180°C / 356°F	Highest elongation at break • excellent damage tolerance
Medium	≤ 180°C / 356°F	Designed for resin infusion • small cells
Fine	≤ 180°C / 356°F*	Designed for resin infusion • smallest cells
Coarse	≤ 190°C / 374°F*	Highest temperature resistance • usable with BMI resins
Coarse	≤ 180°C / 356°F*	Most frequently qualified aircraft grade
Coarse	≤ 130°C / 266°F	Good fire behavior for railcars, ships and small aircraft (no OSU)
Medium	≤ 180°C / 356°F*	Electrically conductive • designed for UAVs and other stealth applications
Fine	≤ 130°C / 266°F	High frequency transparency $ullet$ designed for radome and medical x-ray table applications
Medium	≤ 180°C / 356°F*	Increased elongation at break
Medium	≤ 130°C / 266°F	Standard grade for non-qualified applications
Medium	≤ 130°C / 266°F	Reduce blade mass and turbine loads

\* only with HT version

ROHACELL<sup>®</sup> closed-cell foam features a unique combination of advantages

- → Excellent compressive creep behavior up to 180 °C (356 °F) and 1.0 MPa (145 psi)
- → Excellent dynamic strength and fatigue behavior
- → Multiple cell size options for process method optimization
- → Excellent mechanical properties over a wide temperature and density range
- → High temperature resistance up to 210 °C (428 °F) in pressure-free post-cure processes



MAKING THE WORLD LIGHTER WITH ROHACELL®



# ADDED VALUE

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#### Аегозрасе

- → Stable, uniform and reliable core during fabrication
- → Reduced fabrication time
- → Co-curing, no core stabilization required
- $\rightarrow$  High specific strength
- → Outstanding creep compression resistance

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#### Antennas, Radomes and Electronics

- → Dielectric properties closely match those of air
- → High specific properties while maintaining transparency
- → Tight dimensional tolerances for optimum performance

#### Automotive

- → Reduction of fuel consumption and CO<sub>2</sub> emission
- → Short cycle times when using RTM or thermoplastic layers
- → Extended range and thermal insulation for electric vehicles

#### **ROHACELL®** APPLICATIONS



#### Medical

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- ightarrow No inclusion due to homogeneous cell structure
- → Lightweight and durable imaging beds
- $\rightarrow$  Superior quality of X-ray and CT images
- → Minimal patient radiation exposure due to low AI-equivalent

#### Railway

- → Low energy consumption and high acceleration capability
- → Good FST properties (generates no smoke, no toxic gasses)

→ Optimize interior dimensions for optimal passenger space

#### Sports and Lifestyle

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 $\rightarrow\,$  Lightweight design for top performance and rugged endurance

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- ightarrow High specific mechanical properties
- ightarrow Design freedom to create complex geometric shapes

Supporting customers is the number one priority at the ROHACELL® solution center. This team of sandwich technology experts works directly with customers to review application requirements, recommend products and provide information on the latest state-of-the-art efficient processing solutions – helping you explore all the options to use ROHACELL® successfully in composite designs.



We support your use of ROHACELL® in all composite manufacturing processes.

# SUPPORT

#### Sandwich Technology Expertise

Our technical team supports prototype fabrication and small production runs, plus we can conduct sandwich structure testing and experiments. With experience in thermoforming, thermoshaping, liquid composite molding, autoclaving and other processes, our experts can demonstrate the use of ROHACELL<sup>®</sup> with traditional and non-traditional techniques. Customer product training is also available.



Take advantage of our know-how to help you:

- → Reduce cycle time in production
- → Select the best shaping method for an application (thermoforming, thermoshaping, CNC machining or in-mold foaming)
- ightarrow Identify a stable and reliable curing process
- ightarrow Evaluate cost saving concepts
- ightarrow Shorten development cycles

#### Increase your efficiency

Apply the advantages of ROHACELL® to your lightweight construction designs and optimize your processes.

- → ROHACELL® can reduce the curing process to a single step. With its high thermal stability and creep compression strength, the structural foam sets new standards in processing.
- → Shortened lay-up time can achieve cost savings of up to 50%, in comparison to a honeycomb core structure.
- → Design and produce composite components with the greatest of ease by optimizing integral construction. Whether by thermoforming, thermoshaping, high-speed CNC machining or even in-mold foaming, ROHACELL® eliminates geometric challenges by combining creativity with mechanical effectiveness.

ROHACELL® SHAPES department can produce precisely shaped foam cores in any geometry and ship them directly to you. Choose from CNC machining, thermoforming or thermoshaping.





# SMART CHOICE

#### **OUR COMPETENCES IN SHAPES**

#### Engineering service

- → ITAR certified facility at ROHACELL<sup>®</sup> production site (Mobile, AL, USA only)
- → Ftp site data transfer
- $\rightarrow$  CAD data transfer to CNC data 2D/3D
- → CNC data generation
- $\rightarrow$  Prototype and serial production

#### Pre-process management

- → Moisture and environmental management
- → Drying
- → Heat treatment

### **3** Thermoforming and thermoshaping

- $\rightarrow$  Cold and hot forming
- ightarrow Thermoforming tool concept





### A smart and convenient choice

- $\rightarrow$  Focus on your primary business
- $\rightarrow$  No bound capital, no scrap parts
- $\rightarrow\,$  Reduce finished part cost by up to 30%
- → Decrease lead time by not using a third-party shaper

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### **4** CNC machining

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 $\rightarrow$  4 axis and 5 axis

## 5 Quality management

- → First Article Inspection (FAI) reporting
- → Certificate of Conformity for each delivery
- → Digital measurement with "FARO" arm
- $\rightarrow$  Process control documentation

### **6** Logistics

- $\rightarrow$  Just-in-time delivery
- → Ready-to-use shapes
- → Optimized packaging

### ROHACELL<sup>®</sup> FOR THE TECHNOLOGIES OF THE FUTURE



# FUTURE TECHN

#### Automated production of composites

ROHACELL® foam core is highly compatible with both automatization and sandwich design. The foam's mechanical strength and stability enables it to be easily moved and accurately positioned with robotic arms. In a joint study, Evonik and two independent partners confirmed the successful combination of ROHACELL® and automatization, while also developing a quality concept that ensures a reliable process without additional quality NDI in between. With the goal of identifying a new idea for building complex composite parts quickly and efficiently, Evonik Industries (Germany), Composite Technology Center GmbH (CTC) and the Deutsche Zentrum für Luft- und Raumfahrt e. V. (DLR), both based in Stade (Germany), studied the combination of (1) ROHACELL<sup>®</sup> – a rigid core material for sandwich designs driven by high stiffness requirements, with (2) a highly automated part preforming process. Results confirmed the advantages of using ROHACELL<sup>®</sup> foam and automatization to build complex structures in high volumes. Complete study details are available upon request.







# **OLOGIES**

We support you in developing automation concepts with ROHACELL®







PLACEMENT OF CUT-OUTS **OUTER SKIN** 



**CORE INTEGRATION** FOAM CORE



PLACEMENT OF CUT-OUTS **INNER SKIN** 



COMPACTION PREFORMING SETUP ROHACELL® Triple F in-mold foamed cores simplify the production of three-dimensional cores for cost-effective serial production of carbon fiber reinforced composites.



## ROHACELL® TRIPLE F

Composite parts are often geometrically complex and structural cores for these parts must fulfill an increasing number of requirements.





#### **ROHACELL®** FUTURE TECHNOLOGIES





Geometries that are impossible to shape with NC machining can now be foamed directly inside a mold, quickly and easily with ROHACELL<sup>®</sup> Triple F.

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Intricate surface details are accurately reproduced and metal inserts can be positioned and integrated during foaming – remaining permanently fixed in the core after demolding.

- $\rightarrow$  In-mold foamed shapes
- $\rightarrow$  Complex geometries
- → Integrated inserts
- ightarrow High compression strength and high temperature resistance at low density
- $\rightarrow\,$  Compatible with fast curing processes
- → Customizable densities between 70 kg/m<sup>3</sup> and 200 kg/m<sup>3</sup> (4.4 lb/ft<sup>3</sup> and 12.5 lb/ft<sup>3</sup>)
- → Optimized for serial production rates between 1,000 and 40,000 or more parts/year

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ROHACELL® products do not contain heavy metals such as lead, mercury, cadmium, or hexavalent chromium, as specified in Directive 2000/53/EC of the European Parliament and the Council of September 18, 2000.

They do not contain flame retardants polybrominated biphenyls or polybrominated diphenyl ether. There are no hazardous substances that might endanger your staff or require special industrial healthcare. ROHACELL® is IMDS listed.

We have an integrated management system in place to meet global customer requirements and ensure that the highest quality standards are maintained. Our system is ISO 9001, ISO 14001, ISO 50001 and EN 9100-certified and is regularly optimized. The Mobile, Alabama, USA location is certified by the US government to produce ITAR related projects. This information and all technical and other advice are based on Evonik's present knowledge and experience. However, Evonik assumes no liability for such information or advice, including the extent to which such information or advice may relate to third party intellectual property rights. Evonik reserves the right to make any changes to information or advice at any time, without prior or subsequent notice. Evonik disclaims all representations and warranties, whether express or implied, and shall have no liability for, merchantability of the product or its fitness for a particular purpose (even if Evonik is aware of such purpose), or otherwise.

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