Evonik is one of the world’s leading specialty chemical companies. Our strengths include the balanced spectrum of our business activities, end-markets, and regions. Around 80 percent of sales come from market-leading positions, which we are systematically expanding. Our strong competitive position is based on close collaboration with customers, high innovative capability, and integrated technology platforms.

Evonik manufactures an ever-expanding range of advanced, long service life polymers and composite materials to meet the critical demands of the Aviation and Aerospace Industries. You’ll find our high performance materials on nearly every takeoff and landing, inside and out. Evonik materials provide key OEMs and supply chain partners with the design freedom needed to engineer high quality, unique products with high fatigue performance.

We’re ranked high as an innovation partner because we understand changing technical requirements and strive to offer next generation aviation materials.

Evonik supports ongoing product development efforts focused on weight reduction, impact resistance and fuel savings while lowering production costs and maintaining reliability and safety.

Evonik. Power to create.
EVONIK PRODUCTS IN FLIGHT

ALBIDUR®

The ALBIDUR® core-shell toughening technology for thermosetting resins used in aircraft manufacturing, like epoxy resins or cyanate ester resins, improves significantly the toughness of fiber-reinforced composite parts or structural adhesives. This improvement is provided from -100 °C up to the maximum usage temperature of the thermosetting resins. Furthermore the fatigue performance is increased significantly, thus enhancing service life. Shrink is reduced and the glass transition temperature (T_g) of toughened resins is not affected.

ALBIDUR® products consist of reactive resins, in which fully cured silicone rubber particles with a defined size of 0.1 - 3 µm are finely dispersed. These rubber particles have an organic shell structure comprising reactive groups. The typical addition levels are around 10 wt%, depending on the system to be modified.

ALBIPOX®

ALBIPOX® rubber-modified epoxy resins are used as tougheners for epoxy prepregs for aerospace applications. They increase toughness, reduce microcrack formation in fiber-reinforced composites or structural adhesives. Furthermore they improve fiber wetting and adhesion to aluminum substrates. Some specialty grades are designed as tackifiers to improve the workability of epoxy prepregs and reduce manufacturing costs. They are a vital part of the toolbox of resin formulators.
**COMPIMIDE®**

COMPIMIDE® bismaleimide resin family represents a full range of thermosetting matrix resins and specialties developed for the production of high-performance composites, mostly for aerospace applications. Heat resistant COMPIMIDE® bismaleimide matrix resins are characterized by their high glass transition temperature ($T_g$), thus offering excellent performance in hot and wet conditions, retention of mechanical properties up to 250°C, superior flame and radiation resistance, low smoke and toxicant emissions, and easy processing.

Typical processing techniques include prepregging (from the melt, solution, or suspension), resin transfer molding (RTM), filament winding, compression molding, powder coating, and pultrusion. The COMPIMIDE® bismaleimide product group comprises bismaleimide monomers, toughening modifiers, and formulated bismaleimide resins.

**NANOPOX®**

Evonik is the leading manufacturer of surface-modified silica nanoparticles in epoxy resins. They are used in many fiber-reinforced composites and structural adhesives for aerospace applications. Modulus and strength are significantly improved. Compressive strength is increased and, most important, fatigue performance is significantly higher – thus enhancing service life.

The NANOPOX® products are concentrates of nanosilica in epoxy resins. Due to their small size and the absence of larger aggregates, the nanoparticles can easily penetrate all fiber structures without comprising the impregnation by increased viscosities. All state-of-the-art process technologies like resin infusion, RTM, VARTM etc. can be applied. Nevertheless these products are suitable for prepreg manufacturing as well.

**P84®**

P84® Polyimide (PI) is a high performance polymer combining excellent physical properties with high temperature and chemical resistance. As solution in polar aprotic solvents, it can be used to make anti-friction coatings or insulating layers for aerospace electronics due to its low dielectric constant or high dielectric strength. In fiber form, P84® is typically used for applications ranging from protective clothing for pilots to aerospace insulation and sealing materials.

P84 NT® Polyimide (PI) powder offers high temperature stability to 350°C, chemical resistance, high mechanical strength, low friction coefficient and minimal abrasion. Using sintering technology, it can be cost efficiently manufactured into near-net-shape components on the plane or the engine. Compounds with solid lubricants are used in tribologically demanding applications often found in aerospace environments.
ROHACELL® Polyetheretherketone (PEEK) is a high-performance thermoplastic polymer ideal for manufacturing long-lasting components for use in the toughest conditions. Tight tolerance parts can be produced via traditional molding and extrusion to withstand high temperature, chemical and conductive environments. Thanks to higher ductility and molecular weight, mechanical advantages such as higher elongation at break, higher impact strength and lower notch sensitivity can be achieved across elevated temperature ranges. This is a clear advantage in both fabrication and longevity. Inherent flammability properties and robust performance make it an ideal choice for aerospace applications.

VESTAKEEP® is also used as a resin matrix for thermoplastic composite unidirectional fiber tapes and fabric prepregs. Excellent fatigue, impact, and creep behavior are achievable for continuous use at elevated temperatures to 250°C. Its lower weight combined with high mechanical strength make it a suitable replacement of traditional thermosets and metals.

Additionally, VESTAKEEP® is available as a specially formulated ultra fine powder for use in Additive Manufacturing (Selective Laser Sintering). Selective Laser Sintering is layer-based manufacturing that does not use molds or tools to create parts. Improved design freedom, part consolidation, metal replacement and cost reduction are possible. High temperature VESTAKEEP® is the solution for hot air ducting, clips and brackets in a wide variety of commercial and military applications.
VESTAMID®

Specialty VESTAMID® heat stabilized Polyamide 12 (PA12) compounds contain a non-migrating flame retardant, free of halogens and phosphorous. In compliance with the flammability requirements of FAR 25.853 and ABD0031, they are especially suited for aircraft interior parts.

Airframe OEMs have achieved significant weight savings by replacing phenolic materials with these compounds. They can be used for extrusion and injection molding.

VESTOSINT®

VESTOSINT® Polyamide 12 (PA 12) are ultra fine powders for Additive Manufacturing. VESTOSINT® provides dependable quality and repeatability of processing.

It offers mechanical properties that enable complex geometry for optimum design freedom, part consolidation and simplified logistics. Ultra-flexible grades offer eight times the flexibility and five times the tensile strength versus competitive grades.
HELICOPTER APPLICATIONS

ALBIDUR®, ALBIPOX®, NANOPOX® exterior
- Main rotor blade
- Tail boom and structural stiffeners/stringers
- Main cabin (prepregs)

ALBIDUR®, ALBIPOX®, NANOPOX® interior
- Doors, walls and ceilings
- Structural adhesives for composite bonding
- Floor panels

COMPIMIDE® bismaleimides structural applications
- Engine inlet and pylon cowling
- Tail boom and skins for structural stiffeners/stringers
- Nacelle and cowling components

ROHACELL® exterior
- Engine inlet and pylon cowling
- Horizontal stabilizer
- Main rotor blade
- Radome/forward cowling
- Skids
- Tail boom and structural stiffeners/stringers
- Tail rotor blade

VESTAKEEP® exterior
- Secondary structures/flooring

VESTAKEEP® interior
- Latches, handles, hinges and mechanical parts

VESTAMID® interior
- Interior profiles/rub strips

VESTOSINT® interior
- Additive manufacturing: brackets, clips and ducts
AIRCRAFT APPLICATIONS

ALBIDUR®, ALBIPOX®, NANOPOX® exterior
1. Toughening agent for composites
2. Fuselage (prepregs)
3. Wings (prepregs, structural adhesives)
4. Tail fin (prepregs, structural adhesives)
5. Hydraulics (filament winding)

ALBIDUR®, ALBIPOX®, NANOPOX® interior
6. Toughening agent for composites
7. Structural adhesives for aluminum and composites
8. Primary floor structures (laminates)
9. Secondary floor structures

COMPIMIDE® bismaleimides structural applications
10. Engine cowling/doors
11. Flap fairings
12. Radome
13. Leading edge
14. Nacelle
15. Engine inner fixed structures: thrust reverser/soundproof panels/ducting
P84® NT powder exterior
16 Sealings, bearings, bushings and guidances
17 Toughening agent for composites

P84® interior
18 Anti-friction/insulating coatings electronics
19 Sealing materials

VESTAKEEP® exterior
14 Aileron
15 Fuselage
16 Leading edge/j-nose
17 Nacelle

VESTAKEEP® interior
18 Additive manufacturing
19 For high temperature applications
20 Ducting, cable ties and sheathing
21 Hinges, latches, handles and mechanical parts
22 Secondary floor structures

VESTAMID® interior
24 Interior profiles/rub strips

VESTOSINT® interior
25 Additive manufacturing: brackets, clips and duct
Evonik foam products and matrix resins continue to play a vital role in the global space launch vehicle construction market.
EVONIK PRODUCTS IN SPACE

■ COMPIMIDE®

Extensive applications of COMPIMIDE® bismaleimides in the modern spacecraft design include both structural parts and thermal protection/insulation in launch carriers, satellites, and multiple reentry vehicles.

■ ROHACELL®

ROHACELL® foam cores offer unparalleled strength-to-weight ratio. It’s the preferred core designed in and specified for producing high performance sandwich composite structures in launch vehicles including payload and payload adapter fairings, interstages, nose cones and thermal protection shields.
For more information on these products please contact us.

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