

Fortron® PPS for thermoplastic composites

The base polymer for high-performance applications



Composites based on Fortron® – Innovations in aircraft construction

Fortron® advantages

- + Linear polyphenylene sulfide with outstanding innovation potential
- + Substitution of metals and other materials in lightweight construction
- + Excellent property profile with a very broad product range
- + High mechanical/chemical resistance in combination with high thermal stability
- + Fortron® PPS grades 0214C1 and 1140L4/L0 comply with the statutory guidelines of the aircraft industry (FAR 25.853 and ABD0031; 1140L4/L0 tested under AIMS 04-01-018)

Twenty-five percent of the material in an Airbus A380 consists of composites. In aircraft of the next generation, that share will rise to an estimated forty percent. By contrast, in 1980 airliners were built with a mere eight percent share of composites. This example shows that the success of a project is always highly dependent on the material. Composites based on Fortron® PPS are the material of the future.

With polyphenylene sulfide Fortron® PPS, Ticona has the optimum basis for thermoplastic composites in its portfolio. The outstanding properties of unreinforced Fortron® 0214C1 are even further improved with the addition of glass fibers in the 1140L4 and 1140L0 grades.

All of the material grades nonetheless provide the strength and light weight necessary for a large variety of products, from aircraft seats to the leading edges of wings.

The search for new, optimal materials has already convinced the aircraft industry of the merits of composites made with a Fortron® matrix. Their many outstanding properties, such as temperature resistance and mechanical strength, make them attractive for other markets as well. Especially for components subjected to very high stresses, Fortron® is often the better choice as a base material.



Fortron® – the material for your application?

Fortron® has already proven itself in the aeronautics industry as a matrix material used in the construction of state-of-the-art aircraft. Make Fortron® PPS the material of choice for your demanding applications, too, and take advantage of the benefits that thermoplastic composites have to offer.

Piping systems

Its resistance to high pressures, fluids and chemicals along with its resistance to corrosion and ageing make Fortron® the ideal material for piping systems. Thermoplastic lines reduce the cost of both installation and maintenance versus metal pipes.

Aircraft construction

The aircraft industry is already making extensive use of Fortron® to reduce weight and costs, because in an airliner every kilo counts. Fortron®-based composites reduce the weight of components by up to 50 percent. But light weight on its own is not enough. Thanks to its robust property profile, Fortron® excels under even the most extreme conditions and it also meets strict fire protection regulations such as flame retardancy and low smoke index.

Transportation

Automakers are making more and more use of thermoplastics as a weight-reducing metal substitute and for reinforcement in lightweight construction. And train and ship developers are also reaping the benefits of the design latitude offered by composites based on Fortron®. As seat components or structural elements, Fortron® composites get new projects moving – on the road, railways or water.

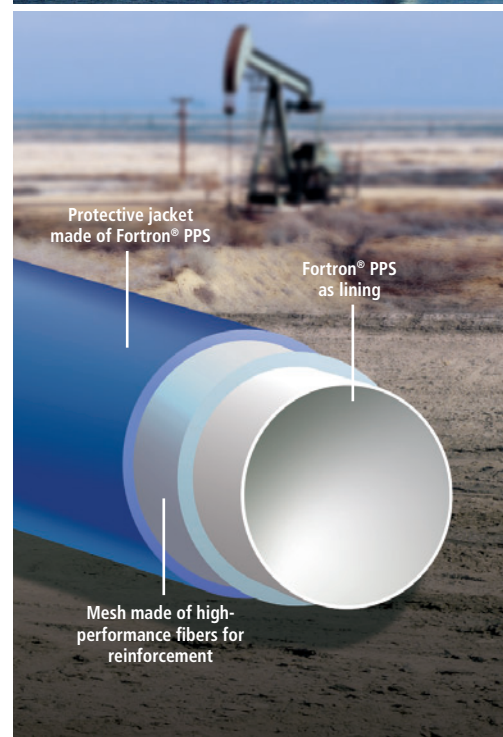
Energy projects

Light weight and strength are advantages that make Fortron® particularly attractive for use in wind and solar power plants. It can be processed cost-effectively and also offers another decisive advantage for renewable energy applications: the components are recyclable.

Bridge and building construction

Fortron® composites are so hard and rigid, they can even substitute for materials such as steel and concrete. They dampen vibrations better and their corrosion resistance lowers operating costs. In the size and shape of structural components, composite materials from Ticona are extremely flexible and make for “solid” structural design solutions in every sense of the word.

Your application, our composites: rely on Ticona’s specialized expertise in the market and the technology.





A material on the path to success – Fortron® PPS in the Airbus A380

Fortron® profile

- + High hardness, rigidity and dimensional stability
- + Service temperature up to 240 °C
- + Inherent flame retardancy without additives (according to UL 94 V-0) and self-extinguishing, high LOI value (> 50 %)
- + Resistance to kerosene and other fuels, oils, solvents and antifreeze, Skydrol®, brake fluids, anti-corrosion products and many chemicals
- + Superior permeation properties with liquid and gaseous fluids
- + Very good oxidation resistance
- + Good mechanical and electrical properties
- + Low water absorption (< 0.2 % after 24 hours)
- + High creep resistance, also at elevated temperatures

Composites made with a Fortron® matrix are already offering proof of their light weight and strength in the world's largest commercial airliner. The Airbus A380 lifts off with a thousand components made of Fortron® PPS composites on board. They reduce the weight of parts as backrest supports in seats, for example, or structural stiffeners for the fuselage or the leading edge of wings. The savings in weight versus components made from metal or light metal alloys range from 20 to 50 percent.

Additional reinforcement

Even some of the largest surfaces of the Airbus A380 are made of composites – like the wing leading edge nose, which is 2 meters wide and 26 meters long. The manufacturing process begins by processing Fortron® PPS

pellets to form a thin film, which is then bonded to a carbon fiber fabric in a press. The result is a robust, dimensionally stable composite that can be formed under pressure and high temperatures. The individual molded parts for the wing leading edge nose assembly are joined by means of induction welding. As this largely eliminates the need for rivets, bolts and screws used to assemble aluminum components, the composite material provides greater strength and reliability. The wing leading edge nose made of Fortron®-based composites is 20 percent lighter and meets all of the design specifications for aircraft wings.

Fortron® PPS processing

Fortron® PPS is a polyphenylene sulfide consisting of phenylene rings and sulfur atoms bonded in alternating para positions. Its linear structure and good flowability make this thermoplastic well-suited for a variety of processing methods such as injection molding, extrusion and blow molding. All Fortron® grades can also serve as matrices in composites. In order to achieve maximum efficiency in production and application, the high-molecular grades 0214C1, 1140L4 and 1140L0 are particularly useful.

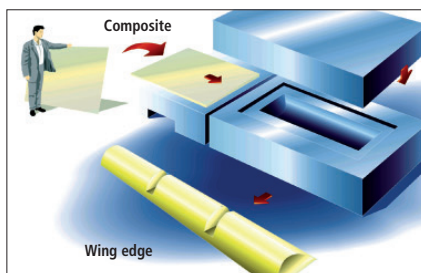
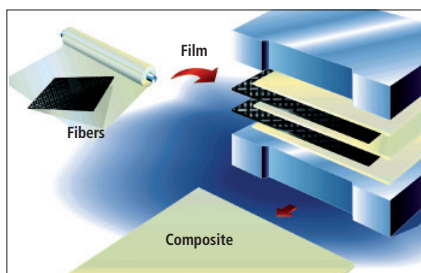
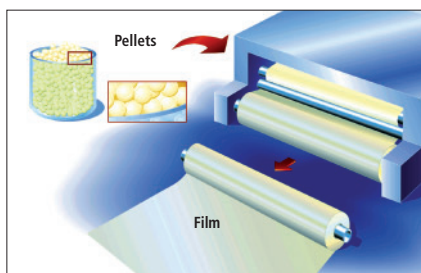
Composite fabrication

The production of the composites starts by pressing Fortron® pellets into a 50 to 200- μm -thick, crystal-clear film in a special calendering plant. The exceptional feature of this film is its thermal stability in the range 130 to 250 °C.

In the desired thickness, the Fortron® film is then bonded to fabric reinforced with glass or carbon fiber to produce high-strength composites that form a strong, inseparable unit. The compression is carried out under high pressure and high temperature. The composite plates are pre-heated and then formed under pressure into wing leading edge nose elements, for example.

Fortron® application

- + Also suitable for extrusion coating, cable sheathing, vacuum forming
- + Wide range of post-processing techniques (thermoformable, weldable)
- + Minimal wall thicknesses possible
- + Eco-friendly processing and good recyclability
- + Short cycle times for efficient production



We develop custom material and production solutions in support of your project aims.



The future demands experience and know-how

Ticona, a business of Celanese Corporation, is one of the world's leading manufacturers of engineering polymers. The company has been established for many years in the area of injection molding applications in key markets such as the automotive, electronics and telecommunications industries and medical technology. Thanks to their high-performance characteristics, the plastics successfully used there also offer promising potentials for other technologies and fields of application – especially for extrusion. In recent years the targeted development of special polymer

grades has opened up new applications in the areas of fibers and nonwovens for engineering textiles and composites.

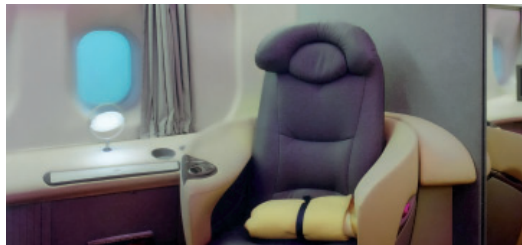
Ticona is more than just a materials supplier. As a manufacturer of plastics, the company offers its customers comprehensive customer service. Along with intensive project consulting, this also includes support in the selection and development of materials. In the area of injection molding applications, we support our customers in the design of components and molds, CAE calculation and the optimization of production processes.

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