Composite solutions for lighter materials represent one of Arkema’s key research areas. The Group recently launched a number of innovations for the aerospace, automotive, yachting and wind power sectors, and now offers a comprehensive range of solutions for high performance composite materials: resins and prepregs for thermoplastic composite parts, high added value additives, and new generation structural adhesives.

A renowned major player in thermoplastic composite materials, Arkema has adopted a collaborative approach with many industrial partners on the issue of lighter materials and recyclability: in particular the Group is involved in flagship projects, like Effiwind in the field of wind power, and Compofast in the automotive sector.

A wide range of products for efficient and recyclable thermoplastic composite matrices

Manufacturers are showing a growing interest in lightweight and resistant materials, and the recycling of their products. To address these concerns, Arkema has developed suitable resins and thermoplastic polymers. The Group is also willing to bring ready-to-use materials to composites molders.

- **New Polystrand®** materials combine high strength fibers and engineered thermoplastic resins to make Continuous Fiber Reinforced Thermoplastics (CFRTP). Polystrand® CFRTP materials are available in multilayer rolls of tape or prepregs (X-Ply®) that can be processed by thermo-compression or thermo-stamping. The use of Polystrand® offers opportunities to reduce weight while maintaining exceptional strength and impact resistance (see press release).

- **Elium®** resins: these innovative thermoplastic resins, liquid at ambient temperature, unique on the market, are used to manufacture thermoformable and recyclable thermoplastic composite parts. They are suitable for traditional processing technologies such as RTM, infusion and FlexMolding™, and so can produce thermoplastic composites with the same equipment as for thermosets (see press release).

- The **Kynar® UHM™** PVDF thermoplastic resin is used for overmoulding or bonding to composite parts. It offers superior mechanical properties, including greater rigidity as well as excellent high temperature and fire resistance. Easy to process, Kynar® PVDF resins feature outstanding UV and chemical resistance. The most demanding industrial applications will find in Kynar® UHM™ a material that is strong, reliable, durable and highly cost-effective compared to other solutions (see press release).
Kepstan® PEEK (polyether ketone ketone) is used to replace metal in extreme conditions (offshore, aviation). Reinforced with carbon fibers, the final composite features rigidity comparable to that of metals for a much lower weight, as well as exceptional resistance to impact, high temperature, and highly aggressive chemical agents (see press release).

Rilsan® high performance polyamide: 100% biosourced, in the form of fine powders or granules, it imparts chemical stability, abrasion resistance and impact resistance to composites even at very low temperatures. The Rilsan® polyamide matrix is used to produce thermoformable and recyclable thermoplastic composites.

Additives for thermoset composites

Arkema's innovative additives significantly improve the inherent properties of thermoset composite materials.

Nanostrength® nanostructured acrylic block copolymers: these additives act at the very heart of the material. They help enhance the impact resistance of the matrix with no loss of module, temperature stability, or UV and cracking resistance. They can be used both in epoxy or vinyl ester composite matrices and in structural adhesives.

Graphistrength® carbon nanotubes significantly improve the mechanical strength of composites. They also prevent the build-up of electric charges in the resulting components. Hence they fulfil the requirements of aerospace and automotive manufacture.

Resins from Sartomer®, an Arkema subsidiary and a major player in high performance resins for the composites market, provide solutions for replacing styrene (VOC-free, less toxic). The use of acrylate and methacrylate specialty resins (monomers, MCURE®, epoxy, etc.) significantly improves the performance of composite matrices.

Orgasol® ultra-fine polyamide powders minimise crack propagation at the fibre-matrix interface in thermoset prepregs. As a result, the final composites are tougher and longer lasting.

Luperox® organic peroxides and BlocBuilder® RC50 reactivity controller. Luperox® organic peroxides are crosslinking agents for unsaturated polyester resins that help speed up processing and ensure better control of continuous or semi-continuous processes to produce harder composite resins. BlocBuilder® RC50 reactivity controllers ensure the efficient performance of organic peroxides by controlling gelling and heat curing more effectively.

Structural adhesives for easy-to-process high-performance assemblies

Structural adhesives play a major role in the assembly of composite parts between them or with other materials (metal, plastics, aluminium, glass, etc.). Arkema offers several ranges:

SAF® two-component structural adhesives offered by AEC Polymers, a subsidiary of the Arkema Group: these methacrylate adhesives combine strong adhesion without the need for a primer on many substrates, very good flexibility thanks to the Nanostrength® block copolymer technology, and adjustable curing times (5 minutes to 2 hours).

Platamid® hotmelt adhesives: plasticiser-free and solvent-free, these thermoplastic copolyamides ensure excellent adhesion, with little product required, on a wide range of substrates: composite materials, textile, metal, leather, plastics. They help improve productivity through shorter cycle times, and can be reused and recycled.
Arkema’s expertise in thermoplastic composites at the heart of major collaborative projects

- **Effiwind: for recyclable wind turbine blades**

  Hundreds of thousands of tonnes of composite are used every year by the wind industry. When these wind turbine blades reach their end of life, the waste they will represent will need processing. As part of the Effiwind project, Arkema develops, along with 10 partners, the technologies of the future, which will enable wind turbine blades not only to be more efficient but also to have a better environmental footprint. One of the key objectives of this project entails manufacturing wind turbine blades and nacelles from thermoplastic composites so they can be recycled at their end-of-life stage. The Elium® resin plays a part in this project: it makes it possible to maintain the current blade manufacturing process, by vacuum infusion at ambient temperature, while also offering a method for recycling the composite, whereby resin and fibre can be reused. Glues from AEC Polymers, an Arkema subsidiary, are also used to further strengthen the blades.

- **Compofast, for lighter and recyclable vehicles**

  This project coordinated by Arkema is part of the Vehicle of the Future programme, and involves some fifteen partners, including Renault and Chomarat. Its aim is to develop thermoplastic composites that help reduce the weight of vehicles within the constraints of cost and production output for the mass production of cars. The final objective is to successfully manufacture bodies-in-white entirely from thermoplastic composites. Tests are currently underway with Elium® resins and polyamides. These thermoplastics offer the same benefit as thermosets in terms of weight reduction compared to metals, with the added bonus of being recyclable. Although accounting for just 5% of today’s composites market, they could eventually represent 50% of this market.
Arkema launches Polystrand® thermoplastic tapes in Europe

To expand its current offer to the composites industry, Arkema is launching the Polystrand® range of products in Europe, featuring a full range of glass-reinforced thermoplastic tapes and prepregs. These high performance materials are giving access to lightweight, recyclable and structural composites, for the automotive, transportation, energy, consumer and construction markets.

Arkema is willing to bring ready-to-use materials to Composites molders, such as reactive thermoplastic resin for RTM and Infusion (Elium®), structural adhesives for composite-composite and metal-composite assembly (AEC Polymers®) and now thermoplastic tapes and prepregs for thermo-compression, thermo-stamping and lamination (Polystrand®).

Polystrand® tapes are continuous glass fibers impregnated by various polymers, such as polypropylene, polyamides and fluoropolymers. These tapes have outstanding properties in terms of stiffness, strength and impact resistance, as compared to traditional compounds. They can be laminated or laid up ply per ply in the load direction, in order to bring glass fiber properties where they are needed. The X-ply® prepregs are similar to impregnated fabrics but present the advantage of higher mechanical performances due to the absence of weave formation. These materials are already used in many applications in North America, for example in the automotive industry to reinforce front ends. Overmolding with short-fiber compound is possible to integrate functions within the composite part or to locally reinforce short-fiber composites. These continuous fiber materials bring endless opportunities to manufacture structural thermoplastic composite parts.

All these technologies and other Arkema Composites solutions will be displayed at the JEC Europe show, from March 10 to 12 2015, in the Arkema booth (nº D41) and Polystrand booth (nº K4).

A global chemical company and France’s leading chemicals producer, Arkema is building the future of the chemical industry every day. Deploying a responsible, innovation-based approach, we produce state-of-the-art specialty chemicals that provide customers with practical solutions to such challenges as climate change, access to drinking water, the future of energy, fossil fuel preservation and the need for lighter materials. With operations in close to 50 countries, some 19,000 employees and research centers in North America, France and Asia, Arkema generates pro forma annual revenue of some €7.6 billion, and holds leadership positions in all its markets with a portfolio of internationally recognized brands.

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Arkema and MVP will demo Thermoplastic-RTM with Elium® resin at two major composite fairs

On the occasion of Composites Europe fair in Düsseldorf and at the CAMX Expo in Orlando, Florida, Arkema will showcase its new range of Elium®, the first thermoplastic resins that can be processed on the same equipment as thermoset resins. Several RTM live demos will be performed with the Patriot Thermoplastic Innovator injection machine from Magnum Venus Products (MVP), to demonstrate the ease of processing of this new technology.

The main advantages of Elium® resins are the recyclability of composite parts, the use of well-known processes (RTM, Infusion) to mold structural and semi-structural parts, and the cost-effectiveness of the technology to make continuous-fiber reinforced thermoplastic composites. The Elium® live demos can be attended in the CT Platon booth at Composites Europe (8a/A32) and in the Lean Mean Closed Mold Machine Super Demo area, produced by Composites One at the CAMX Expo.

In addition to the Elium® range and Luperox® organic peroxides - used as initiator for Elium® resins - Arkema is developing a large range of high performance materials, additives and adhesives, for applications involving composites with a thermoset or a thermoplastic matrix:
- A polyetherketonketone (PEKK) called Kepstan® to replace metal in extreme conditions (aerospace, offshore)
- The Rilsan® range, a high-performance polyamide that is 100% bio-sourced and imparts resistance to abrasion and impact, even at low temperature, to thermoplastic composites
- Nanostrength® additives and Orgasol® polyamides, which significantly improve the natural resistance properties of composites.
- Lastly, AEC Polymers, an Arkema subsidiary specialized in structural adhesives, markets BlackMamba® waterproof sealant adhesives and SAF® structural adhesives, for complex composite assemblies.

composites.arkema.com

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Sybille Chaix  Tel: +33 1 49 00 70 30  sybille.chaix@arkema.com
Arkema introduces new Kynar® PVDF resin grade that offers an outstanding range of mechanical properties

Arkema has a new grade of Kynar® PVDF resin that provides a whole new set of properties for PVDF. Kynar® UHM™ resin has a high flexural modulus, heat deflection temperature, abrasion resistance, tensile strength, pressure capability and, at the same time, offers excellent creep resistance.

Kynar® UHM™ thermoplastic resin was designed with the most demanding applications in mind. This high performance polymer has been specially engineered to be chemically resistant to chlorine, bromine, strong acids, strong oxidants, halogens, aromatic solvents, and aliphatic hydrocarbons. As with traditional Kynar® PVDF grades, the Kynar® UHM™ thermoplastic resin is easily melt processed by most standard methods, including injection molding and extrusion. Kynar® UHM™ resin also provides resistance in harsh thermal, chemical and ultraviolet environments.

With its many high performance features, Kynar® UHM™ resin can be used in a variety of industries and applications, including, but not limited to: chemical processing, petrochemical, wire and cable, electricity and electronics, high purity and transportation. Demanding industrial applications such as semiconductor, pulp and paper, nuclear waste processing, mining, general chemical processing, and tower packing will find that Kynar® UHM™ resin is a strong, reliable, long-lasting, and more cost-effective than other solutions.

"Arkema recognizes the global need for new, high performance materials," said Erwoan Pezron, Global Managing Director for Arkema's Fluoropolymers business unit. "Working closely with our customers, we have been able to focus our development activities in areas that will help them grow their businesses with new, innovative materials being developed by Arkema. It is exciting to offer this material at the same time that we begin to celebrate the 50th anniversary of Kynar® resin."

Kynar® UHM™ resin can be fabricated into a wide range of components, including tubes, pipes, fittings, valves, sheets, rods, stock shapes, tubing, tanks and vessels, as well as nozzles. This product is also bondable to other substrates, including a variety of polymers. Kynar® UHM™ resin also has demonstrated excellent flame resistance capabilities as a free-standing product or as a composite.

Arkema is a global leader in the manufacturing of polyvinylidene fluoride resin, under the Kynar® trademark, with manufacturing facilities on three continents.

A global chemical company and France’s leading chemicals producer, Arkema is building the future of the chemical industry every day. Deploying a responsible, innovation-based approach, we produce state-of-the-art specialty chemicals that provide customers with practical solutions to such challenges as climate change, access to drinking water, the future of energy, fossil fuel preservation and the need for lighter materials. With operations in close to 50 countries, some 19,000 employees and research centers in North America, France and Asia, Arkema generates pro forma annual revenue of some €7.6 billion, and holds leadership positions in all its markets with a portfolio of internationally recognized brands.
Press release

Colombes, March 9 2015

Arkema expands its specialty polymer (PEKK) production capacities in France and the United States

Arkema is actively developing its new Kepstan® PEKK (Poly-Ether-Ketone-Ketone) ultra high performance polymer with applications in the fields of carbon fiber composites and 3D printing. Success in these fields has prompted Arkema to increase its production capacities in France now and in the United States in the near future.

In order to meet growing demand in carbon fiber composites and in 3D printing, Arkema announces that it is to double its production capacities in France by the first half of 2016. Furthermore, the Group plans to build a worldscale PEKK production plant on its Mobile site (Alabama, United States) that would be scheduled to come on stream in the second half of 2018.

PEKK stands out from the PAEK (Poly-Aryl-Ether-Ketone) family by its extensive range of processing technologies and excellent thermomechanical behavior.

PEKK complements Arkema’s range of thermoplastic resins and broadens their range of applications in the aerospace, energy and electronics sectors, in which Arkema is already highly present through its Rilsan® (PA11) and Kynar® (PVDF) specialty polymers, as well as its Elium® acrylic resins.

Arkema will showcase its Composites offering in its booth (n° D41) at the JEC Europe trade show from 11 to 13 March 2015.

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