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COMMERCIAL
SERVICE**

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Europe

COMPOSITES

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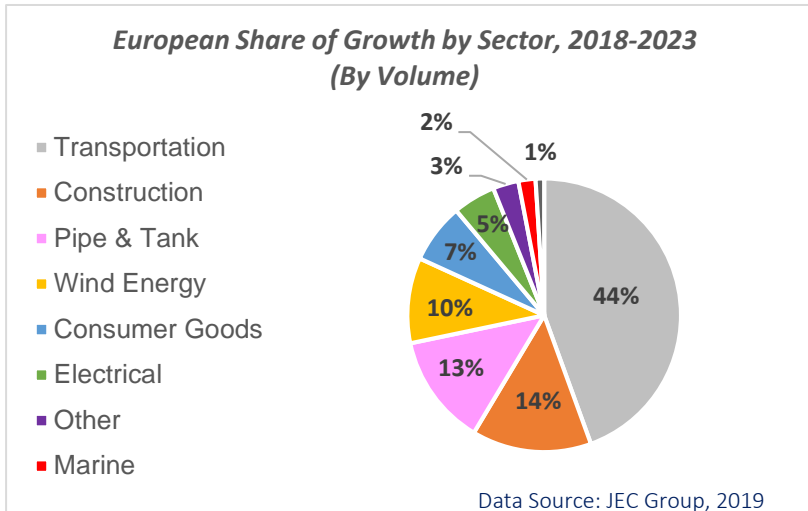
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1. Overview of the European Composites Market

The European composites market by volume is expected to grow at 2% per year from 2018-2023, registering a volume of 2.4 million¹ tons and a value of \$16.6 billion² USD in 2018. However, growth was not sustained in 2019, and in share of global volume and value, Europe is now surpassed by North America and China. According to JEC Group, the European transportation sector will see the most significant share of total growth (44%) by volume size in the next 4 years. This is followed by the construction (14%), pipe & tank (13%), and wind energy (10%) sectors.



The European composites market is characterized by many small sized firms, yet 80-90% of the volume of composites is produced

¹JEC Group, 2019

²Grand View Research, 2019.

by just 10-20% of existing companies³. By volume, the European composites market is heavily specialized in the transportation sector and construction sectors. Europe has a larger concentration in the transportation sector than any other region. It is for this reason that the recent sales crisis in the automotive industry can be attributed to Europe's relatively pessimistic growth outlook for 2019. In comparison to Europe, North America has a similar ranking of industry size, while China's most relevant industries are the pipe & tank, construction, and electrical sectors. Europe is forecasted to account for 13% of global composites' growth from 2018 to 2023, behind North America (24%) and China (46%)⁴. The European composites market remains quite fragmented, as market growth tends to follow economic development. Industry applications are highly differential when analyzed by country. In general, growth of the composites market is very closely linked to GDP trends.

Amidst the uncertainty of the European political environment, including the rise of new trade barriers with Brexit, international trade conflicts, and protectionist policies, the composites market is suffering. Another reason for slower growth of composites in Europe is the growing trend of outsourcing commodities production to countries which incur lower costs.

2. Raw Material Market

Resins

Thermoplastics production growth is much greater than that of thermosets. AVK reports specifically on glass mat and long fiber reinforced thermoplastics in Europe, which is currently growing by

³ AVK, 2019.

⁴ JEC Group, 2019.

5%, and has almost quadrupled since 1999, registering a volume of 156,000 tons in 2019. Glass mat and long fiber thermoplastics now account for 13.7%⁵ of the total European composite market, while estimates for total thermoplastics production reach as high as 33%⁶. Growth in thermoplastics demand is a result of their advantageous properties which include higher performance, lighter weight, and ease of processing and recyclability. This growth in Europe will surely continue given the new EU standards of recyclability. Thermoplastics are mainly used in the automotive and electronics industries. Unlike thermosets, thermoplastic resins are not crosslinked and therefore can be more easily reformed, repaired, or joined with other parts, and can be melted down for reuse at the end of their life cycle. Long fiber-reinforced thermoplastics (LFTs) are the largest category of thermoplastics in Europe. Sectors utilizing thermoplastics see a large growth potential with developments using LFTs via manufacturing hybridization processes such as injection molding and forming. Research is being performed to improve automation in thermoplastics production, with companies like Coriolis Composites⁷ configuring robotic elements combined with software to aid in automated fiber placement. Greater investment in technology development is necessary to promote further growth in thermoplastics, as the machinery and tooling necessary for injection and molding processes are very unique to those commonly implemented in thermosets production.

⁵ AVK, 2019.

⁶ Community Research and Development Information Service (CORDIS), 2013.

⁷ <https://www.coriolis-composites.com/company/>

Fibers

A. Glass Fibers

Glass-reinforced plastics⁸ (GRP) remain the most commonly used composite, taking a relatively high market share of over 90% in Europe. The construction and transport industries each represent 1/3 of total production in the European GRP market. The German Federation of Reinforced Plastics (AVK) released its 2019 European report in September, with a breakdown by country for the glass-reinforced plastics market. Germany retains its position as the highest European composites producer at 225,000 tons, but its growth rate is now negative, and thus behind the overall market average. Likewise, Southern European countries such as Spain, France, Portugal, and Italy all reported above average growth rates in 2018 but have since reported negative growth for 2019. The only countries to experience growth this year are those in Eastern Europe and Turkey, which have been experiencing the highest growth rate for years, increasing through 2019 with an average rate around 4.3% and 3.5%, respectively. Meanwhile, production growth rates in the UK, Ireland, Switzerland, and Austria are stagnant. Northern and Western European countries such as Scandinavia, the Benelux, and the Netherlands, which previously had unchanged levels of production, are now experiencing negative growth. Markets must now expect composite production to decline from the previous year. Below is the referenced table from AVK's 2019 report, showing GRP growth rates across Europe in the last 5 years.

⁸ The GRP market referenced in this report includes all glass fiber reinforced thermosets, and glass mat, long fiber, and continuous fiber thermoplastics

B. Carbon Fibers

World demand for carbon fiber reinforced plastics (CRP) was 128,500 tons in 2018, registering a growth rate of 12.7% from the previous year. Global demand for 2019 is expected to have grown by 10.1%. In terms of materials, CRP materials are experiencing the most growth in the market.⁹ However, the much higher cost of carbon limits penetration to certain cost-intensive markets such as aerospace, defense, sports, and racing/luxury cars. Europe has the highest demand for carbon fiber reinforced plastics in the world, forecasted to rise to 40% of global demand by 2020.¹⁰ Its demand to capacity ratio for carbon fiber reinforcements is much higher than North America or Asia, as it faces much higher energy costs and environmental standards to follow. Because carbon fiber production has a high-energy requirement, Europe tends to be more import-dependent in this market, with carbon fiber integration being concentrated in processing or end-use applications only. The European CRP market is driven by demand

	2015 (kt)	2016 (kt)	2017 (kt)	2018 (kt)	2019 (kt)
UK / Ireland	150	152	153	155	155
Belgium / Netherlands / Luxembourg	44	45	46	46	45
Denmark / Sweden / Norway / Finland	39	40	40	40	39
Spain / Portugal	156	158	161	167	166
Italy	150	154	158	162	161
France	108	110	112	115	114
Germany	212	220	226	229	225
Austria / Switzerland	18	18	19	19	19
Eastern Europe *	192	199	203	208	217
Sum:	1069	1096	1118	1141	1141

⁹ Carbon Composites, 2019.

¹⁰ CEMAC, 2016

from the automotive and aerospace industries, using weight reduction in order to fulfill legal initiatives seeking to reduce fuel consumption.

C. Natural Fibers

According to Grand View Research, the global natural fiber composites market is expected to have a compounded average growth rate of 11.8% between 2016 and 2024. Despite having the same weight as glass fibers, natural fibers are 25-30% stronger. Additionally, molding processes used for natural fiber composites require less energy than those used for glass fiber composites, thereby reducing production costs by 10%.¹¹ This also makes them more environmentally sustainable than glass and carbon fibers, since they require less CO2 emission in production. Natural fibers, also called biocomposites, are increasing in multiple end-use industries for their weight reduction, impact absorption and vibration damping, and occupational health benefits. They can be biodegraded and recycled at the end of their life cycle. Natural fiber reinforced plastics have seen the most growth in the automotive industry, but are also used in the construction, leisure, and consumer goods market. However, natural fiber applications are somewhat limited due to their moisture sensitivity and lack of fire resistance. More specifically, hemp and flax fibers may be of interest to the UK and Europe due to their native origin in the region. Germany is the largest user of natural fiber reinforced plastics, while principal processors of natural fibers include Germany, France, Poland, Czech Republic, and Slovenia. Examples of commercial uses for natural fibers include wood plastic composite outdoor decking and furniture, and interior and non-structural automotive parts such as door liners and trim panels.

¹¹ Grandview Research, 2018.

Recyclability

Production processes and end-use applications of composites tend to be better for the environment than traditional steel or aluminum counterparts. However, the characteristics that make them more ecologically competitive compared to other raw materials also make them more difficult and costly to recycle after their life cycle. Therefore, one of the largest opportunities in the composites market is the need for recyclable materials and sustainable recycling processes. For the global market, composite recycling is at a mere 1.5%.¹² The largest streams of composite waste are dry cutting waste and outdated prepreg materials. Because of the wide range of fiber materials, lengths, and processing methods, finding a commercial scale second application for recycling has proven difficult. Furthermore, glass fiber costs are already so low, that companies struggle to operate on profits when reselling recycled versions. For this reason, commercial recycling of carbon fiber has seen much more progress.

In the wake of stringent environmental standards put forth by the government and the Horizon 2020 project, the European market is a leader in composites recycling. With the high production costs and demand for carbon fiber, the fluctuating price of energy and oil, as well as the European Union directive requiring 85% of vehicle materials to be recyclable, companies developing an efficient recycling strategy will see a huge opportunity for growth. The EU has provided funding to projects which demonstrate circular economy applications, one specific example in the composites market being FiberEUse.¹³ Current recycling techniques include thermal treatment via the pyrolysis process,

¹² JEC Group, 2019.

¹³ <http://fibereuse.eu/>

chemical treatment via the solvolysis process, and mechanical crushing. Specifically, for thermosets, which cannot be easily converted, co-processing in cement kilns has become a valuable method of reusing composites materials as a source of energy for cement manufacturing in Europe, promoted by the EuCIA.

3. Composites Manufacturing Processes

Another trend observed in the modern composites market is the transition from traditional manual and continuous manufacturing processes to injection and compression processes such as resin infusion, injection molding, and sheet/bulk molding compounds. This is a causal result of the increase in thermoplastics, which are predominantly made via injection and compression processes.

SMC (sheet molding compounding) and **BMC** (bulk molding compounding) account for one quarter of GRP production and are the largest market segment. SMC is growing at 0.5% and produces 205,000 tons, while BMC is growing faster at 1.2% given its smaller production level at 82,000 tons¹⁴. An important aspect of the SMC sector is its dedication to innovative product enhancements using carbon, continuous, and natural reinforced fibers. Molding and injection processes are most commonly employed for large-scale production series, including semi-finished products used in the electronics and transport industries. Examples of applications include headlight systems, casings, and exterior parts for automotive vehicles.

Resin transfer molding (RTM) is a commonly used mold injection technique to mold complex parts at a high volume and is more common in thermoplastic processing. This manufacturing method has tripled in production weight over the last 10 years. Compared to other processes, RTM allows for a lower environmental impact

¹⁴ AVK, 2019.

while forming a product with a larger, more complex shape, better surface quality, and greater strength and tooling flexibility otherwise not achievable. It also significantly reduces cycle times for greater efficiency in producing many parts. It is applicable in many application industries because it can be used for small or large products, with many different types of fibers, and on a wide range of production scales. Examples of outputs include large containers, bathtubs, automotive body parts, and other hollow shapes.

In contrast, **open processes** (also called manual processes) are the fastest declining segment in Europe. In the last 20 years, hand lay-up and spray-up production market share has fallen over 16%¹⁵. Spray-up processing has fallen out of favor as a result of EU legislation to limit worker and environmental exposure to volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). Styrene, the most common monomer used for thermosets production, is classified as both. Because the emission of VOCs is difficult to control in open processing, manufacturers have switched to using closed molding and injection processes as previously described. Despite this, open processes remain the second largest segment of market production, as they are the common choice for parts repair, and products with small batch loads or custom-designs since investment costs are very low. Hand lay-up and spray-up processing can be used to make boats, storage tanks, bathtubs, and showers, and truck parts.

Lastly, trends in production of composites using **continuous processes** differ between pultrusion, flat panels, and filament winding. Production of flat panels is expected to decrease by 2.1% this year, largely on account of the automotive sales decline¹⁶. Flat

¹⁵ *Ibid.*

¹⁶ *Ibid.*

panels are predominantly used in commercial vehicle conversions, truck panels, and exterior car parts. Meanwhile, **pultrusion technology** will increase by 2%, with construction and infrastructure projects being the main driver of growth¹⁷. Outputs include reinforcement systems for bridges and buildings, as well as window, stair, and ladder profiles.

Filament winding is most commonly used to produce the cylindrical shape characteristic of pipes and tanks, pressure vessels, and rocket motor casing. Filament winding provides better corrosive resistance and lamination control properties than do open processes, along with a large flexibility in choice of resin and reinforcement inputs. Market share of this process has decreased 2% in the last 10 years, and production is expected to decrease by 1.4% this year¹⁸. The graph below shows the 20-year trend in composite manufacturing methods.

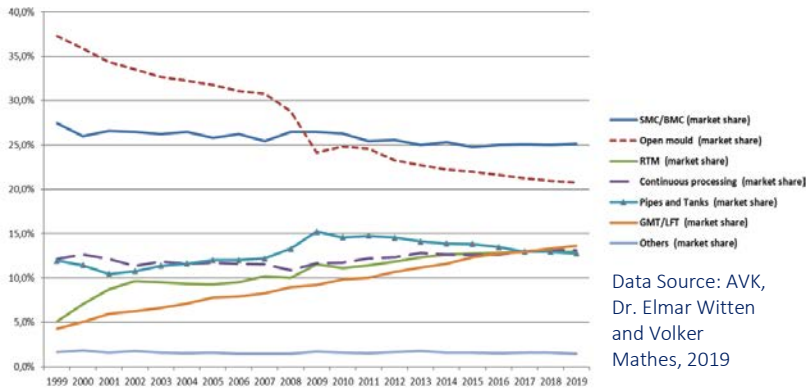
4. Main End-Use Industries

Automotive

Market experts agree that the European automotive industry is suffering a sales crisis as of 2019. The highest forecasted growth in this industry is forecasted to come from China, as U.S. and European car manufacturers have already invested significantly in steel and aluminum infrastructure. Despite this, the penetration rate of composites in the European automotive industry is strongly increasing against steel. By 2023, JEC Group forecasts steel and composites to have an even average weight distribution per car at 24% each. Composites provide better anti-corrosive, e-mobility, and weight reduction properties that are becoming more essential given the current political context of the European

¹⁷ Ibid.

¹⁸ Ibid.



market. Autonomous vehicles will also improve the growth outlook for composites in the automotive industry, especially given the fact that metals are an obstacle to internet signal. Another trend for composites in this sector is their use in compressed vessels within fuel storage systems and hydrogen tanks that can power electric vehicles, which are frequently made of carbon fiber composites so they can withstand high force. Lastly, some European composites growth in this industry can be attributed to increased percentage of composites usage in luxury cars, with brands like BMW and Lamborghini having 6-8% of their vehicle weights in composites. Some high-profile relationships between car manufacturers and composite producers include BMW and SGL, along with Volvo, Benteler-SGL, and Henkel. However, Europe continues to face issues with high production costs and a lack of industrial processes for long run lengths. The industry must adapt to use composites in mass products with high run lengths production if growth is to continue in the future. Manufacturers have resorted to better engines and more aerodynamic designs to increase efficiency without incurring the high costs of composites usage. In terms of life-cycle costs in the automotive industry, though maintenance and use costs of composites are much lower than traditional materials, up-front

manufacturing costs are much higher and may hinder market entry for some companies. Furthermore, composites penetration has been limited to static-load resistance car parts rather than structural parts. The European market must focus on more composite integrative designs with lightweight construction to support the increasing environmental policy demands. As a result, market players expect carbon fiber applications to see the most growth within the automotive industry in the coming years.

Aerospace

Composites in the global aerospace industry are growing faster than any other material. Given the volatile price of fuel, weight reduction in aerospace manufacturing is imperative when possible. Composites are also useful due to their resistance to harsh weather conditions, high stiffness and strength, structural damping, damage tolerance, and fatigue performance. In fact, composites have the highest added value when used in the aerospace industry. Like the automotive industry, players in the aerospace sector have found other ways to maximize performance while keeping costs low, and there is a lack of composites for programs with higher run lengths. Titanium and aluminum alloys are seeing higher performance in the aviation sector, where new jet engine models have managed to reduce fuel consumption. With the recent lack of demand for the A380 XWB, for which 53% of its weight was in composites, main European supplier Airbus may be looking to shift its focus back to single-aisle, shorter-distance planes which have less of a need for weight reduction. Still, the aerospace industry is a driver in the CRP market due to its strict performance requirements and its process improvement research involving composites usage. Composites can be found extensively in aircraft wings, fuselages, tails, and

doors. Space applications are more reliant on carbon fiber composites, as they have greater stiffness and thermal protection capabilities. Space applications include solar array panels, optical platforms, fairings, and antennae reflectors.

Wind Energy

On a global scale, wind energy has seen the largest penetration rate of composites of any end-use industry by far, with a penetration rate of 67% of total industry volume¹⁹. The wind industry uses a relatively high amount of carbon fiber to produce turbine blades, and is especially important to Europe, whose share value of worldwide wind energy is estimated at 66% by 2020²⁰. The Clean Energy Manufacturing Analysis Center reports that Europe has the highest share of worldwide demand for wind energy carbon fiber, expected to reach 65% by 2020. As of 2018, Europe has the largest installed capacity for wind energy in the world at 196 gigawatts. China is close behind at 181 gigawatts and has been experiencing a much larger growth rate in the sector over the last 20 years. Nevertheless, Europe's demand for carbon fiber wind energy will continue to increase on account of the EU's 2020 goal to source 20% of its energy from renewables.

¹⁹ JEC Group, 2019.

²⁰ CEMAC, 2016.

Construction

As a result of this year's economic slowdown that particularly stalled growth in the automotive industry, the construction/infrastructure sector is now the largest user of GRP applications in Europe at 36% of the total market share, with a value of about 2.9 trillion USD. Though there is currently very little penetration of carbon fiber composites in this sector, experts expect significant growth for construction manufacturers and processors due to the increasing demand for anti-corrosive, non-conductive materials with high strength and low weight. The future market will see a vast majority of production using continuous processes, especially pultrusion. Despite the positive growth outlook, new applications are being stalled due to a lack of standardization in security and safety measures, with decision-makers not yet fully realizing the full market potential of composites. Examples of construction projects include concrete framework, facade cladding, window profiles, bridge elements, light wells, cable ducts, and manhole covers.

5. Market Entry

Prospective international market entrants must keep in mind that sales of input materials like resins, prep-pregs, pellets, and fabrics are regularly issued directly between suppliers and end-users. Due to the nature of composite raw material, it is necessary to have a manufacturing plant near potential buyers.

Additionally, intermediaries are required for processing needs such as additive manufacturing, software, tooling, and machinery. While there remain many opportunities for U.S. companies in Europe, there are also challenges to entering or expanding in

European markets. Any market entry strategy should begin with a thorough understanding of the costs and benefits of doing business in a specific country. In most cases, it is essential to visit the market to establish relationships with local partners. Investing in these relationships early and routinely will increase the likelihood of a more successful venture.

Before entering a market, U.S. companies should consider their own resources, previous export or business experience abroad and long-term business strategy. For many companies, representation in Europe by agents, distributors, liaison offices or partners will be key to their success. A local partner can provide knowledge of the local regulatory framework, language assistance and valuable business contacts. As business develops, companies may establish subsidiaries and make further local investments to expand their market share.

It is also very important for a U.S. company to understand that each European country has its own specificities. Having a rep covering several countries might work in some cases and not in others.

The U.S. Commercial Service offers numerous programs and services to assist U.S. businesses in establishing a presence in foreign markets and developing appropriate contacts. Staffed with experienced Commercial Specialists with dozens of years of collective industry and sector expertise, the U.S. Commercial Service team can tailor your business approach to the right audience and provide advice on your business strategy. To find out more about how the U.S. Commercial Service can assist you in

entering this important market, please visit our Export.gov website: <https://www.export.gov/welcome>

6. Country Profiles

Germany

Germany is home to the largest composites market in Europe. Like in other countries, most processed composites in Germany are based on glass fiber reinforced plastics (GFRP). It has been, and remains, the most often used base material for composites. Local GFRP composite production has a strong focus on transportation and electronics/electric applications. Despite substantial cost, demand for carbon fiber composites is still growing in Germany, particularly by the aerospace and automotive industries. The special material characteristics of carbon fibers, such as tensile strength, lightweight and other features offer clear advantages for these industries over the traditional GFRP. Consequently, growth expectations for carbon fibers in Germany are higher than for the already well-established glass fiber materials.

Most of the approximately 3,000 German composite firms are small- to medium-sized, a few are larger: Evonik supplies core materials and BASF is active in pellet production for intermediate processing. BASF also manufactures primary materials, both thermosets as well as thermoplastics. Krempel and Covestro are also well-established as composite material processors.

Germany hosts concentrations (or clusters) of composite companies in a few regions. These local clusters are active in composites research and development. Some are more specialized than others. The clusters are focusing on advanced materials, lightweight or carbon fibers. The cluster members network among each other joining forces to provide major OEMs

or end-users in a certain region and beyond. Carbon fiber cluster M.A.I. Carbon, located in Bavaria, for example, mainly works with the automotive and aerospace industries in the south of Germany.

The main industry applications of composites (as well as the best prospect industry sectors) in Germany are: Aerospace; Automotive; Construction; Transportation; Sports & Leisure and Wind Energy.

A recent survey among local composites manufacturers revealed that most German composite companies expect a positive development in the German composites market in 2020. Market expectations for the leading industry applications aerospace and automotive remain high. Insiders foresee slightly less growth for the automotive sector due to declining sales and trade uncertainties, such as Brexit. Positive signals, meanwhile, are coming from aerospace and an increasing demand in the booming construction sector. Global trade uncertainties and lower growth expectations for the German GDP are expected to also impact the German composites industry: Its overall annual growth rate for 2020 is estimated at a moderate 1.5%.

The German/European market is highly receptive to U.S. composite products, particularly to materials. U.S. companies that offer materials at competitive pricing and high-quality meeting the following criteria have best market prospects: Light-weight; reduced energy consumption, durability and minimal maintenance.

For composites market entry, major distribution channels are the following:

- Direct Purchase: Sales of highly innovative materials or custom-tailored machinery require direct communication between supplier and processor to ensure satisfactory product results.
- Wholesalers/ Distributors: Standard materials and machinery/equipment are often marketed through local distributors. Distributors vary in size. U.S. firms are usually better positioned in the local markets by using a larger distributor. Experience has also shown that changing market conditions can negatively affect small distributors more easily than larger companies.
- Agents: There are only a limited number of agents in the German composites industry. Moreover, those agents usually operate at full capacity, so it is extremely difficult for a U.S. company to find an agent.

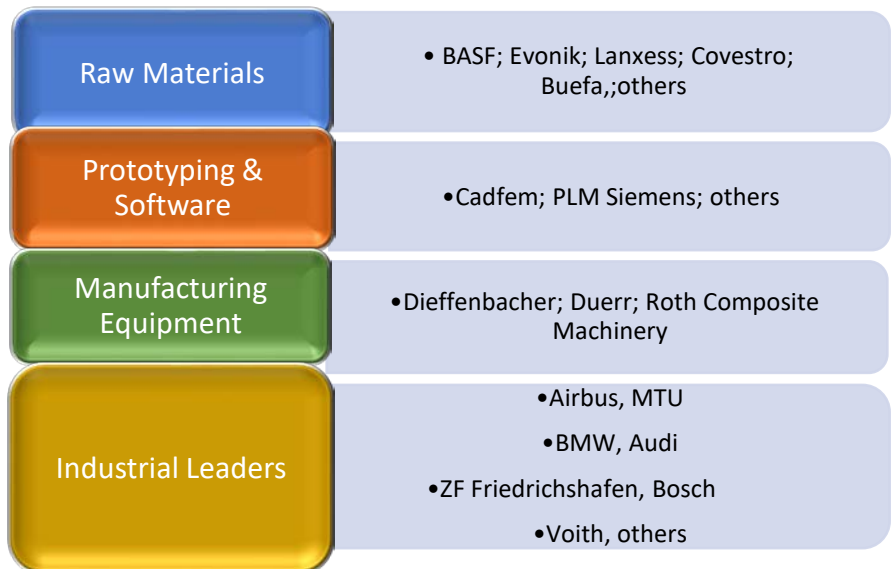
Local buyers expect high-quality, immediate delivery, and fast service. German companies usually prefer long-term business relationships. In addition to pricing, quality, and supplier reliability are major buying factors. German-language product literature is appreciated. 24/7 service is expected: If processing machinery needs to be taken out of operation because of technical problems, fast repair and maintenance is a must. A machine shutdown, even for a short period, can cost a fortune. Moreover, it can also directly impact down-stream users.

Advantages of the German market:

- Germany is home to the largest composites market in Europe

- U.S. companies use Germany as a hub for other European markets
- Germany is highly receptive to U.S. composite products, particularly to materials
- High demand in industries such as: Aerospace; construction; transportation; automotive; sports
- Good growth for carbon fiber composites; 1.5% growth rate for GFRP materials
- Positive Outlook for innovative composites machinery and peripherals
- Germany hosts a strong local composite cluster network
- As a major high-tech market Germany offers many opportunities for composites
- Best prospects: Light weight; reduced energy consumption, minimal maintenance

Main Players



Trade fairs

- Composites Europe (<https://www.composites-europe.com/en>)
Stuttgart, November 10-12, 2020

Associations

- Industry Association Fiber Reinforced Plastics: AVK
<https://www.avk-tv.de/>
- Composites Germany: <https://www.composites-germany.org/index.php/en/organization/founder-members/104-avk-federation-of-reinforced-plastics-en>

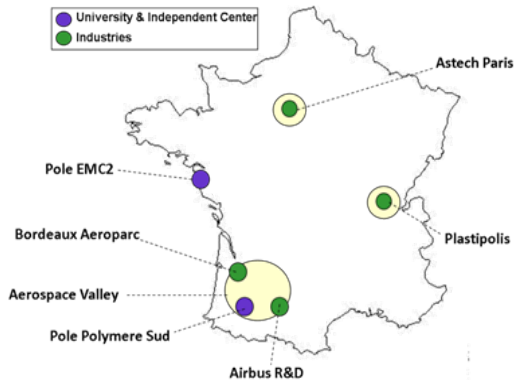
France

According to JEC Group, the number of French firms whose main activity is in the composites sector is estimated to be between 500 and 550 companies. However, when including the entire value chain, this number rises to over 2,000 companies. A large majority of these firms are SMEs.

With a GDP of approximately \$3.07 trillion in 2018 (+ 1.5% growth), France is the world's seventh-largest economy and Europe's third largest economy after Germany and the UK. While manufacturing has declined as a percent of GDP, many of France's remaining industries, such as aerospace and pharmaceuticals, are still world leaders and receptive to foreign partners and suppliers.

The composite market is driven mainly by France's most innovative sectors such as transportation (automotive and trucks), building and construction, electronics and electricals, consumer goods, pipes and tubes, wind energy, aerospace and marine. Many of the companies who work or perform research with composites are located within a "pôle de compétitivité," or a cluster dedicated to a specific sector and located in one region of the country.

Of the 71 clusters in France, 24 are directly or indirectly involved with composites. Each cluster is comprised of large enterprises, SMEs, research centers, training organizations, and partner companies. The sectors represented are aerospace, biochemistry, energy, materials engineering, and transport, with the latter two being the most common. Below are the most active French clusters in the composites market:



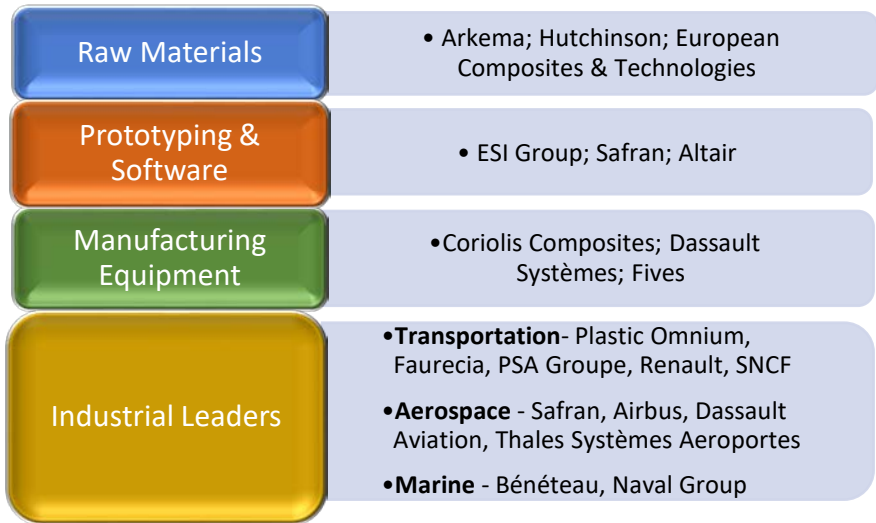
France has developed an expertise in composites reinforced with natural fibers. The association FiMaLin (https://www.fimalin.com/en/flax_home) oversees the promotion of bio-composites.

The prevailing manufacturing method in France is SMC/BMC is favored for its high production rate capabilities, required especially in the automotive sector.

Advantages of the French market

- An educated workforce with first-class universities,
- Sophisticated financial markets, strong intellectual property protections, and innovative business leaders.
- World-class infrastructure, including high-speed passenger rail, maritime ports, extensive roadway networks and public transportation
- The ninth largest global market for foreign direct investment (FDI)
- 17th in the world in terms of global competitiveness

Main Players



Trade fairs

- JEC World 2020 (<https://www.jec-world.events/fr/>)
March 3-5, 2020 – Paris, France
- Composites Meetings Nantes
(<http://france.compositesmeetings.com/index.php/en/>)
- November 2021

Magazines

- JEC Magazine Composites
(<http://www.jeccomposites.com/knowledge/jec-composites-magazine>)

Associations

- JEC Group (<http://www.jeccomposites.com/>)
- AMAC (<http://www.amac-composites.org/>)
(Association pour les Matériaux Composites)
- GPIC (<https://www.gpic.fr/composites>) (Industrial Plastic & Composites Federation)

United-Kingdom

The UK is one of the leading countries in Europe in the composites industry with strong research and manufacturing capability. With around 1,500 companies involved in the UK industry, more than 85% of activity is undertaken by the 50 largest companies (including GKN, NP Aerospace, Airbus UK, Hexcel, BAE Systems, Rolls Royce and Bombardier).

According to a market research report by Lucintel, the future of the UK composites market looks attractive with opportunities in transportation, aerospace & defense, construction, wind energy, and others industry. The UK composites market declined in 2018, however it is forecast to grow with a CAGR of 4.1% from 2019 to 2024 to reach an estimated \$1.2 billion by 2024. The major drivers in this market are increasing demand for lightweight materials in the aerospace & defense, automotive, and wind energy industries; the UK composites market will also see increased demand due to the need for materials that offer corrosion and chemical resistance in the construction industry.

In this market, different types of UK composites such as glass composites and carbon composites are used as fiber type. Lucintel forecasts that carbon composites are expected to witness the highest growth rate over the forecast period. Increasing penetration of carbon composites in automotive and other weight sensitive applications will spur growth for carbon fiber over the forecast period from 2019 to 2024.

Transportation remains the largest market by value and volume due to increasing demand for lightweight materials to achieve higher fuel efficiency and to reduce greenhouse gas

emissions. Wind energy is expected to witness the highest growth over the forecast period due to growth in offshore wind turbine installations and has huge potential.

By resin type, thermoset and thermoplastic resins are used to make composite parts. In thermoset, polyester composite is expected to remain the largest market by volume consumption. In thermoplastic resins, polyamide (PA) is expected to remain the largest market by value and volume consumption due to increasing demand in transportation and consumer goods applications.

Emerging trends, which have a direct impact on the dynamics of the UK composites industry, include development of low-cost carbon fibers as well as high performance glass fiber, and development of rapid cure resin systems.

One of the major inhibitors to the uptake of composites in new sectors is that regulations, codes and standards are often inappropriate for composites. This is because they are both explicitly and implicitly based on named materials, such as steel, and do not permit consideration of composites applications despite the strengths and benefits of the materials in many cases.

The competitive advantage for U.S. firms is in innovation in composite component structures achieved through the R&D in the aerospace and defense sector that is supported by the U.S. Government.

The UK Composites Strategy

The UK Composites Strategy is an ongoing collaboration between the Government and the composites industry to ensure that funding and support is available in the right way to grow the UK in this area.

The document aims to reduce the market barriers for the composites industry, including addressing the skills gap and investing in sustainability and recycling. The current strategy focuses on advanced composites: Structural Fibre-reinforced Polymer and Matrix Composites.

https://compositesuk.co.uk/system/files/documents/Strategy%20Final%20version_1.pdf

Major Players

Materials/Fabrics	<ul style="list-style-type: none">• Sigmatec; Cristex; PRF Composite Materials; 3D UK; SHD Composite Materials
Prototyping & Software	<ul style="list-style-type: none">• Fenton Precision Engineering Ltd; Faulkner Moulds; Standex International LTD; Lawday Engineering
Manufacturing Equipment	<ul style="list-style-type: none">• Composite Integration Ltd; Atlas Composites; AMRC; Norco Composites; Paxford Composites
Industrial Leaders	<ul style="list-style-type: none">• Aerospace- Airbus; BAE Systems; Bombardier; Rolls-Royce; GE; GKN• Automotive - McLaren; JLR; Nissan; Williams; GKN• Transportation - Thermoplastic Complastics; Gurit; FAR Composites; Composite Braiding Ltd; Transport Design International; Warwick Manufacturing Group

Italy

The composites market in Italy is characterized mainly by glass fiber and carbon fiber reinforcement. In tonnage terms, glass fiber represents more than 90 percent of all reinforcement fibers used in composites worldwide. In Italy GRP production in 2019 reached 161 Kt. In Italy composites have major applications in sectors such as aerospace, transport, and industry, while the energy and building sectors are slowly opening to composites materials.

The Italian aerospace sector is currently leading innovation for the use of carbon fiber reinforced composites. The Italian company Leonardo supplies 14% of the components of the new Boeing 787 Dreamliner commercial airplane. They also produce components in composites for Airbus and other manufacturers, using both conventional autoclave polymerization and innovative resin fusion processes. Other collaboration programs with Boeing include the construction of the 767 steering rudder and the 777 radome and external flaps, all made in composite materials. In the transport sector, Italian companies are at the forefront in the production of profiles and components for train body.

Italian companies in the automotive sector are developing innovative technologies to produce structural parts for mass production, while sport carmakers already make a widespread use of advanced composites. Large and innovative uses of composites are made in the building and construction sector and in the nautical industry for pleasure and racing boats. All composites applications related to renewable energy, environmental protection, nanotechnologies and life science will gain importance and conquer new market segments.

Advantages of the Italian market

- Constant growth of Italian composites market
- Aerospace – the largest market in terms of sales and services, followed by transportation
- Several aerospace clusters: Piedmont, Lombardy, Lazio, Campania, Umbria and Apulia
- The presence of key players, such as Leonardo, Avio, Boeing, Lockheed Martin
- Advanced and sophisticated industries, with technological skills such as transportation and R&D centers

Major Players

Materials/Fabrics	<ul style="list-style-type: none">• CIT Composites Materials; Delta Preg; G. Angeloni; HP Composites; Polynt; CRP Technology
Prototyping & Software	<ul style="list-style-type: none">• Engisoft; Roboze; Aerosoft
Manufacturing Equipment	<ul style="list-style-type: none">• Belotti; Biesse Breton; CMS; Cannon; Itamatic; MAE
Industrial Leaders	<ul style="list-style-type: none">• Aerospace- Leonardo, Avio, Lockheed Martin, Boeing• Automotive - Ferrari, Lamborghini, Maserati, Ducati, Piaggio• Transportation - Alstom (plant), Hitachi (plant), Fincantieri

Trade fairs

- Compotec, Marina di Carrara, Italy, February 5-7, 2020, <http://www.compotec.it>

Associations

- Assocompositi: Italian Industry Association for Composite Materials: <http://www.assocompositi.it>
- Lombardy Aerospace Cluster: <https://www.aerospacelombardia.it/en/>
- Apulia Aerospace District: <https://www.dtascarl.org/en/>
- Campania Aerospace Cluster: <https://www.daccampania.com/en/>
- Piedmont Aerospace Cluster: <https://www.distrettoaerospazialepiemonte.com/>
- Umbria Aerospace Cluster: <http://umbriaaerospace.com/en/>
- Lazio Aerospace Cluster: <http://www.aerospace.lazio.it/>
- Italian Transport Cluster: <http://www.clustertrasporti.it/>

The Netherlands

The Netherlands has expanded its potential in the composite market from only focusing on aerospace to diverting to different sectors within the composite market. This is due to the high-quality academic knowledge in the field of materials chemistry that the Netherlands offers: its rich and diverse landscape for knowledge and innovation development for composite technology, often embedded in regional initiatives and field labs. Over 200 composite companies exist in the Netherlands, which make use of the field labs that the Netherlands offers in terms of research and new innovations in the composite sector. These companies mainly focus on the aerospace, automotive, energy, infrastructure, and maritime sectors.

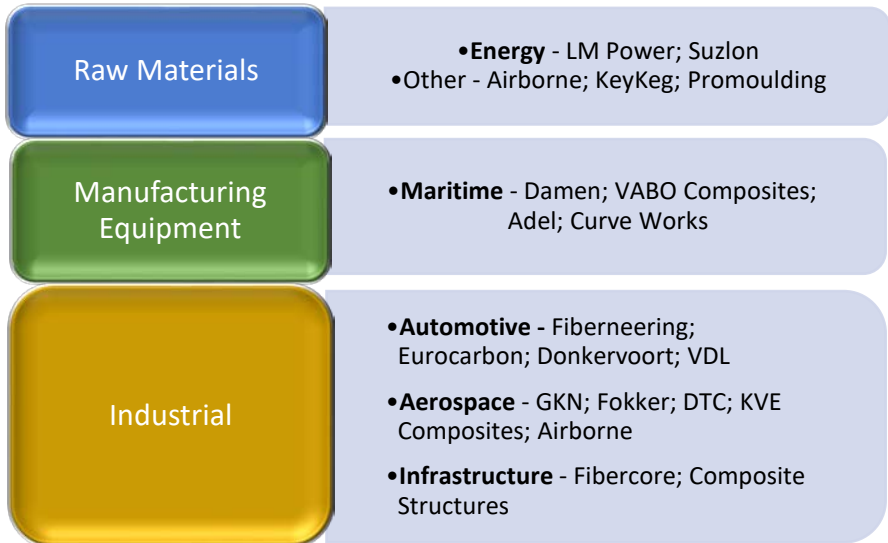
The Netherlands traditionally hold a strong position in the European composites industry, driven by parties such as the Netherlands Aerospace Laboratory, Fokker, Damen, Ten Cate and VDL. From a technological perspective, the Netherlands are global players in the field of the design and industrialization of products, material development and sustainability in high-grade fiber-reinforced plastics. Worldwide, the pace of innovation is increasing, and increasingly stringent requirements are attached to robust, automated production solutions. Everything is aimed at reducing the cost price of composite products or products containing composite.

Advantages of the Dutch market

- A well-educated workforce
- Access to field labs and regional initiatives
- Major players like Airborne, Fokker, and VDL

- Various top sectors like Aerospace, Automotive, Energy, Infrastructure and Maritime
- The Netherlands ranks as the 5th top-European country in the composites market
- Dutch government plans to invest a total of € 2.5 billion in the composites market

Major Players



Trade fairs

- ESEF Expo 2020, Utrecht, March 17-20, 2020, <https://www.maakindustrie.nl/>
- SAMPE Europe, Amsterdam, 30th September – 1st October 2020, <https://www.sampe-europe.org/>

Associations

- NAG (Netherlands Aerospace Group),
<https://nag.aero/>
- Netherlands Maritime Technology,
<https://maritimetechnology.nl/>
- The Dutch Composites Association,
<https://compositesnl.nl/>
- AutomotiveNL, <https://www.automotivenl.com/>

Spain

Spain has a long history of expertise and experience with composites, globally recognized for its work within the sector. The country ranks 5th in the European composites market. In 2018, the Spanish industry grew by 2.6%, while the country's entire GDP reached \$1.3 trillion. The global demand for carbon fiber has been steadily increasing in the tons. The number of Spanish composite manufacturers accounts for approximately 500 and their production is primarily directed at the transportation and construction sectors, including automotive, aerospace, railway, marine, health as well as the energy sector. Most of the market players are SMEs.

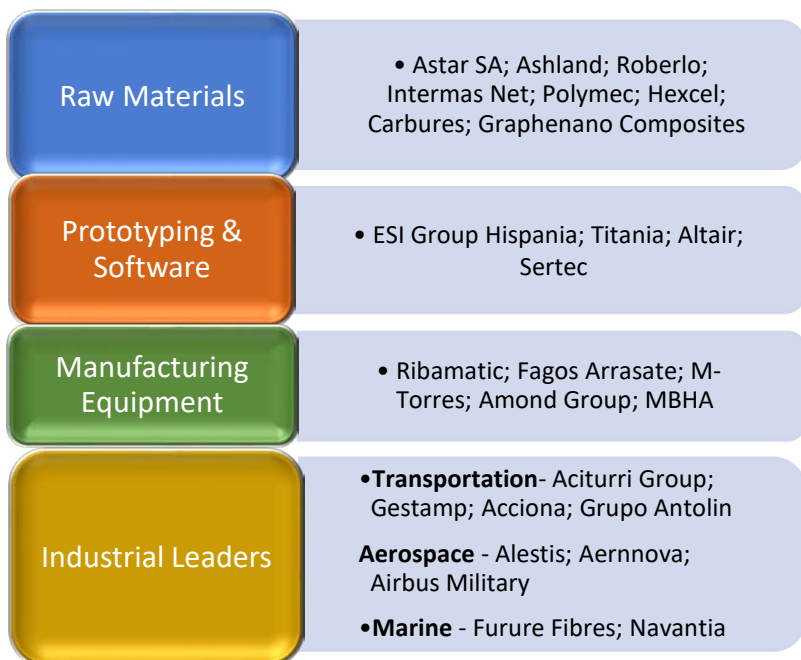
Spain is the third European composite industry for aviation after Germany and France. The aerospace industry in Spain pioneered the use of composites materials in the manufacture of parts and section of the aircraft. Spain's investment in the field, both in research and production, has led to the popular use of these materials. The prevailing manufacturing methods that are in use in Spain include: hand lay-up, RTM and pultrusion method.

Spain boasts of some of the largest research facilities in Europe. Much of the research on carbon fiber composites in Spain take place at the Airbus facilities in Madrid, Toledo and Seville.

Spain has six R&D centers and two clusters. AESICOM, Cluster of the Spanish composites Industry was established in 2005 to actively contribute and to promote the competitiveness and economic development of Spanish companies of the composites sector. AESICOM's mission is to promote and represent the Spanish companies of the composites sector in Europe.

Advantages of the Spanish market

- Spain is a significant potential export market for American suppliers of composites technologies especially in the aerospace, automotive, construction and sport equipment sectors.
- The Center for Aerospace and Advanced Technology (CATEC) located in the south of Spain, is one of the major European research centers in the aerospace industry.
- Major Players



Trade fairs

- MetalMadrid, November 25-26, 2020

Association and Clusters

- AEMAC (Spanish Association of Composite Materials) www.aemac.es
- AESICOM (Cluster of the Composites Industry) www.aesicom.es
- CATEC - FADA (Advanced Center for Aerospace Technology) <http://www.catec.aero/es>
- AIMEN (Technology Center) www.aimen.es
- AIMPLAS (Technological Institute of Plastics materials) www.aimplas.net
- CTAG (Automotive Technologic Center of Galicia) www.ctag.com
- FIDAMC (Research Foundation for composite materials) www.fidamc.es
- METERPLAT (Advanced Materials and Nanomaterials Spanish Technological Platform) <http://materplat.org/en/>

Turkey

The rapid growth of the Turkish composites industry has paralleled that of the industries it serves, with growth for 2019 expected to be 8-12%. There are currently 180 medium- and large-sized companies in the industry. However, this number increases to 700 - 800 when firms in related subsectors are included, employing around 8,200 in all. The value of the Turkish composites market is \$1.7 billion, and total market capacity is 280,000 tons.

Turkey has a balanced trade in the composites sector, with exports and imports each valued at about \$300 million.

Product	Import (Million \$)	Export (Million \$)
Polyester Resin	17	56
Glass Fiber	78	11
Carbon Fiber	-	28
Technical Textile	5	11
GRP Pipe	-	67
Chemical Raw Products	189	-
Other Composite Products	11	127
TOTAL	300	300

Turkey produces one of the most used materials - glass and carbon fiber. The Turkish composites industry exports polyester resin, GRP pipe, carbon fiber, glass fiber and technical textiles and primarily imports the chemical raw materials needed by the industry - glass and polyester resin and other composite products.

Among the resins, while unsaturated polyester resin and vinyl ester resin are produced in Turkey, the rootstocks of epoxy resins and thermoplastic resins are imported. Domestic production of styrene, phthalic, maleic, and glycols used in the production of unsaturated polyester do not meet market demand; therefore, Turkey relies on imports of these materials. Production of technical textiles used in composite production, however, is sufficient to meet the demand.

Experts believe that consumption of composite materials is an important indicator of the development of a country. While average global consumption of these materials is 4-10 kgs/person, in Turkey it is only 3 kgs. Globally, composite materials cost around \$7.60/kg, whereas, the cost is around \$5.90 in Turkey.

Composite materials are used predominantly in the pipe-tank-infrastructure (42%), transportation-automotive (25%) and construction-building (20%) industries in Turkey. In the upcoming years, composite use and production is expected to increase in nearly all industries, including renewable energy, (wind power, solar panels), construction (greenhouse applications, building reinforcements), pipe-tank (polypropylene random co-polymer (PPRC), glass-reinforced plastic (GRP)), electronic goods (combi boilers), marine and aviation sectors.

In addition, thermoset composite processing, pultrusion, resin transfer molding (RTM) (used primarily in the wind power, maritime, transportation and automotive industries), as well as

usage and production of sheet molding compound (SMC) and injection molding are also expected to increase in the Turkish market.

Advantages of the Turkish market

- Educated workforce
- Automotive – powerful market in the region in terms of sales and services
- Presence of international investors, such as TPI Composites, Enercon, and Ford
- Access to investment funds
- Need to implement innovative solutions.
- Expected growth in usage of composite materials in nearly all sectors.

Main Players

Raw Materials	<ul style="list-style-type: none">• SiseCam; Turkuaz Polyester; Aksa Akriklik; Boytek; DowAksa
Prototyping & Software	<ul style="list-style-type: none">• Odak Kompozit; Global Teknik; Polkima
Manufacturing Equipment	<ul style="list-style-type: none">• Gama Metalurji; Akar Makina; Hanko Makina
Industrial Leaders	<ul style="list-style-type: none">• Transportation & Automotive- Ford; Renault; Toyota; Global Teknik• Pipes - Asut Fiber Glass; Firat; Subor• Aerospace- TAI; Kale Aero; Turk Teknik

Trade fairs

- Composite Summit Turkey, Istanbul, October 2021
- Eurasian Composites Show, Istanbul, November 2021

Associations

- Turkish Composites Manufacturers Association,
<http://www.kompozit.org.tr/en/home/>
- Plastic Industrialists Association,
<http://www.pagder.org/>
- Automotive Manufacturers Association,
<http://www.osd.org.tr/homepage>
- Automotive Distributers Association,
<http://www.odd.org.tr/>

Poland

According to Frost & Sullivan, the Polish composite market has been increasing in size during last several years. In 2018, the Polish industry grew by 5.8%, while the country's entire GDP growth rate reached 5.1 %. Therefore, a need for innovative solutions such as composites has constantly been growing. The number of Polish composite manufacturers exceeds 500 and their production is primarily directed at the construction and transportation sectors, including automotive, aerospace, railway, marine, as well as the energy sector. Most of the market players are SMEs.

The prevailing manufacturing methods that are in use in Poland include: injection, hand lay-up, and RTM. The pultrusion method and filament winding is also widely used in Poland. In addition, Poland is the Central and Eastern European leader in manufacturing of epoxy raisins, which are widely utilized in the production of composites.

The composite market is driven mainly by Poland's most innovative sectors, such as aerospace, automotive and construction. In 2016, Poland's first, and the world largest bridge, was built from polymer composites strengthen by glass and carbon fibers. Currently, there are only few construction projects that have used this method worldwide.

In 2017, the Polish Cluster of Composites Technology was created with the goal of promoting Polish companies and creating a single entity that would represent all companies in the market. Previously, there only were active clusters related to specific industries, such as Aviation Valley Association or the Polish Automotive Industry Association. Currently, the cluster is comprised of fifty-three members.

Advantages of the Polish market

- An educated workforce
- Aviation Valley, with over 150 companies and 25,000 employees, is the most innovative Polish cluster
- Automotive – the largest market in the region in terms of sales and services
- The presence of international investors such as Lockheed Martin, Pratt & Whitney, etc.
- Access to investment funds
- A need to implement innovative solutions.

Major Players

Raw Materials	<ul style="list-style-type: none">• Ciech Sarzyna; Bella; KrosGlass
Prototyping & Software	<ul style="list-style-type: none">• Bosmal; NBL Kompozyty; Nexo Technology
Manufacturing Equipment	<ul style="list-style-type: none">• Kimla; Allcomp
Industrial Leaders	<ul style="list-style-type: none">• Transportation- Grupa Boryszew; Solaris Bus&Coach; Wielton; Man; Bridgestone; Polaris; 3M• Aerospace - Pratt & Whitney; Lockheed Martin; MTU Aero Engines; Agusta Westland

Trade fairs

- Kompozyt Expo, Krakow, October 6-7, 2020
- KompozytMeeting, Sosnowiec, February 26-27, 2020
- ITM Polska, trade fair, Poznan, June 2-5, 2020.

Associations

- Polish Composites Technology Cluster, <http://kompozyty.net/>
- Aviation Valley Association, <http://www.dolinalotnicza.pl/>
- Association of Automotive Parts Producers and Distributors, <http://sdcm.pl/>
- Polish Association of Automotive Industry, <http://www.pzpm.org.pl/en/>

7. Relevant EU Regulations

Raw Materials –

U.S. suppliers of raw materials need to assess the applicability of the REACH and CLP regulations to their products. REACH requires the registration of all chemical substances imported into the European Union in quantities exceeding one metric ton. The CLP regulation implements the UN Global Harmonized System of classifying, labeling and packaging of hazardous substances. Both regulations contain specific provisions defining the categories of substances that fall within the scope of applicability. U.S. suppliers of raw materials should assess whether their products fall within the scope of each regulation and, if so, what compliance measures they need to undertake as a result.

The Member States of the European Union have established the European Chemical Agency (ECHA) to implement the REACH and CLP regulations. The agency's website contains a wealth of information about the registration and classification

of chemical substances. For more information see, <https://www.echa.europa.eu/>

For more information on the practical aspects of registering a substance, although published in 2016, this article published by ECHA remains relevant and useful today: https://newsletter.echa.europa.eu/home/-/newsletter/entry/2_16_reach-for-non-eu-manufacturers

Manufacturing Equipment:

CE Mark: To enter the EU market, most manufacturing equipment requires a CE Mark. The CE Mark certifies that a product meets EU health, safety, and environmental requirements. These requirements are set in EU law (Directives or regulations). Manufacturers must demonstrate that their products comply with the various EU regulations related to the machinery they produce. This involves testing, including risk assessment. Depending on the risks associated with the product, self-certification is possible, or a third-party conformity assessment must be done (for higher risk products). Machinery manufactured in conformity with European Harmonized standards, which have been drafted by EU standards organizations such as CEN-CENELEC and published in the Official Journal of the European Union, are presumed to comply with the essential health and safety requirements of the law. Companies can use other standards, but these will not give the same level of legal certainty. At the end of the process, manufacturers will issue a declaration of conformity to the relevant directives and affix the CE mark on their machine. CE

marked products can be sold in the EU, the European Economic Area and Turkey. It is a “passport” to the European market.

Machinery Directive: One of the main laws governing the health and safety requirements for machinery at EU level is the Machinery Directive 2006/42/EC. The Directive specifies a number of essential health and safety requirements which are designed to guarantee that any piece of industrial machinery will be safe to use. Under EU law, ‘machinery’ means: ‘an assembly, fitted with or intended to be fitted with a drive system other than directly applied human or animal effort, consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application’. Self-certification by the manufacturer is possible for low-risk machines whereas a Conformity Assessment Body located in the EU (Notified Body) must be involved for higher risk machines. The Directive lists high-risk machines that need conformity to be certified by a third-party. These include machines such as sawing or wood working.

Watch out! The Machinery Directive will be revised in 2020 to address safety issues linked with emerging digital technologies e.g. **A.I, IOT, cybersecurity** for industrial machines. Contact us for latest updates:

<http://www.export.gov/europeanunion/contactus/index.asp>

More information on the Machinery Directive:
https://ec.europa.eu/growth/sectors/mechanical-engineering/machinery_en

In addition to the Machinery Directive, manufacturing equipment is likely to be covered by other directives on:

The **low voltage directive** (LVD) (2014/35/EU) is the European Directive that outlines safety requirements for all electrical equipment sold within the EU - specifically, 50-100V AC or 75-1500V DC. The type of products covered under the Low Voltage Directive, include the following Electrical appliances, Lighting equipment, Cables and wires. Self-certification is possible under the Low Voltage directive: Any test lab in the US or EU can do the testing. The legal requirements and European Harmonized Standards that can be used to prove conformity with these requirements, as well as guidance, are available on the European Commission website:

https://ec.europa.eu/growth/sectors/electrical-engineering/lvd-directive_en

The **electromagnetic compatibility Directive** (EMC) (2014/30/EU) ensures that electrical and electronic equipment does not generate or is not affected by electromagnetic disturbance. Conformity assessment modules, Notified Bodies (including US labs), Standards and guidance are available on the European Commission website:

https://ec.europa.eu/growth/sectors/electrical-engineering/emc-directive_en

Other relevant legislation for manufacturing equipment includes the ATEX directive (Explosive Atmospheres), Radio Equipment directive, Pressure Equipment Directive, Gas Appliances Directive, Ecodesign, construction products, lifts, personal protective equipment, Restriction of Hazardous substances in Electrical and Electronic Equipment (ROHS), etc. For example, Non-road Mobile Cranes must conform to the regulations on the safety of machinery, electromagnetic

compatibility, Noise Emission Directive, and the engines on the machines must conform to the regulation on the emission of gaseous and particulate pollutions from internal combustion engines.

For more information:

- **Contact us!** The U.S. Foreign Commercial Service can help you through the process of getting the CE mark: <http://www.export.gov/europeanunion/contactus/index.asp>
- General information about placing products on the market in the EU can be obtained in the EU Blue Guide: https://ec.europa.eu/growth/content/'blue-guide'-implementation-eu-product-rules-0_en

For an introduction to the CE mark, see our video 'CE marking': <https://www.export.gov/article?id=CE-Marking>

8. Web Resources

Associations

- [EUCIA](https://eucia.eu/) (<https://eucia.eu/>)
- [European Society of Composites Materials](http://www.escm.eu.org/) (<http://www.escm.eu.org/>)
- [Glass Fiber Europe](http://www.glassfibreeurope.eu) (European Glass Fiber Producers Association) <http://www.glassfibreeurope.eu>

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