

## FLUOROTECHNOLOGY: CRITICAL TO MODERN LIFE

FluoroTechnology makes important products and vital industries possible and extends the life and productivity of products essential to families and businesses. FluoroTechnology is essential to many important products, including: wire & cable insulation for computer and cell phone circuits to enable high-speed data transfer; high reliability hoses for aircraft and cars to reduce emissions; firefighting foams for extinguishing aircraft and oilfield fires; and processing chemicals for semiconductor manufacture.

### **INDUSTRIES DEPEND ON HIGH-PERFORMANCE FLUOROTECHNOLOGY**

- Aerospace
- Alternative Energy
- Automotive
- Building and Construction
- Chemical and Pharmaceutical
- Electronics
- First Responders
- Healthcare
- Oil and Gas
- Outdoor Apparel & Equipment
- Semiconductor

#### **Aerospace**

FluoroTechnology products offer unique, high performance properties to the aerospace industry, enabling the production and operation of modern aircraft. FluoroTechnology enables high and low temperature chemical resistant tubes, hoses and fluid seals; high and low temperature brake and hydraulic fluids used in aircraft control systems and brakes; and ultra-high frequency wire and cable insulation necessary for navigation, fly-by-wire control and aircraft communications.

Properties intrinsic to fluorinated chemicals also allow for unmatched oil/water, stain and soil protection, providing hygienic, longer lasting and lower-maintenance commercial aircraft interiors, which helps keep air travel affordable. Additionally, FluoroTechnology used in firefighting foam enables on-the-ground aircraft fires to be extinguished quickly, the difference between life and death for pilots, passengers and firefighters.

The use of FluoroTechnology in the aerospace industry supports more than 19,000 jobs in the U.S. and more than 36,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the aerospace industry generate a total of \$57.1 billion in economic output.<sup>1</sup>

#### **Alternative Energy**

FluoroTechnology plays a critical role in many alternative energy sources, leading to reduced emissions and energy costs. Thanks to the insulation properties and improved durability, efficiency and safety of fluoropolymers and fluorinated polymers, products such as lithium batteries, fuel cells and photovoltaic solar panels are possible.

Fluorinated polymers enable efficient electrolytic ionic migration, allowing for smaller, more efficient lithium batteries used in all types of electronics from automobiles to cell phones. Fluoropolymers provide chemical resistant membranes and dividers in fuel cells. They also provide

<sup>1</sup> Economic information is based on preliminary estimates of 2013 data by the American Chemistry Council.

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the high vapor barrier, high transparency, superior weatherability, and flexibility to make solar panel front and back sheet films durable, extending product life.

The use of FluoroTechnology in the alternative energy industry supports more than 800 jobs in the U.S. and more than 2,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the alternative energy industry generate a total of \$2.7 billion in economic output.

### Automotive

Today's safe and fuel efficient trucks, buses and automobiles rely on the unique, high performance properties of FluoroTechnology products used throughout each vehicle. From engines and brakes to fuel components and electronics, every automotive system uses FluoroTechnology's durability, heat, chemical resistance and vapor barrier.

Fluoropolymers used in wire coatings increase reliability of engine compartment wiring and gauges and improves auto safety by helping to reduce engine compartment fires. Fluoropolymers, including fluoroelastomers, enable chemical and heat resistant gaskets and o-rings, improving reliability and the length of time between maintenance and service. Cylinder head coatings and hoses made with FluoroTechnology increase fuel efficiency and reduce fugitive gasoline vapor emissions. Fluorotelomer-based surface protection treatments protect automobile carpets and seats against stains, soil, oil and water.

The use of FluoroTechnology in the automotive industry supports more than 59,000 jobs in the U.S. and almost 72,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the automotive industry generate a total of \$147.9 billion in economic output.

### Building and Construction

FluoroTechnology products are crucial to the building and construction industry, providing high durability, UV resistance and anti-corrosion properties to materials such as architectural membranes and coatings, caulks, and wire and cable.

Architectural membranes such as fluoropolymer-coated fabrics are used in the construction of large roofs, commonly recognizable above stadiums. These roofs provide weatherability and durability while remaining energy efficient and aesthetically appealing. Fluoropolymer based metal roof coatings also enhance durability and provide energy savings through solar reflectance and reduction of heat transfer into buildings. The use of fluoropolymers in paint coatings provides unmatched durability and UV resistance, reducing the need for maintenance that could put workers at risk, enhancing aesthetics, saving energy and extending the life cycle of building facades and bridges.

Fluorinated surfactants are used in adhesives, sealants and caulks to strengthen the bond to surfaces in building and construction materials. They help prevent infrastructure failures caused by corrosion and weather, while improving safety for construction workers and occupants and lowering the cost of building maintenance.

Properties such as high temperature endurance, fire resistance, chemical resistance and high stress crack resistance are crucial to wire and cable applications and are made possible through fluoropolymers.

The use of FluoroTechnology in the building and construction industry supports more than 7,000 jobs in the U.S. and almost 7,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the construction industry generate a total of \$26.1 billion in economic output.

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### *Chemical and Pharmaceutical*

The chemical and pharmaceutical manufacturing processes rely on FluoroTechnology products to provide sterile, corrosion resistant coatings, linings and equipment, and to protect workers from exposure to hazardous chemicals.

Fluoropolymers used in pipes, tanks, valve linings and hoses provide resistance to high heat and chemical insult, improving safety, increasing equipment durability, and reducing maintenance costs. Fluoropolymers used in lubricants provide chemical and thermal stability to allow use in high temperature reactions with aggressive liquids and solvents without product contamination or reaction interference.

Fluorinated polymers are applied to garments to protect workers from exposure to hazardous chemicals. In addition, fluorinated surfactants used in firefighting foams allow for the quicker extinguishing of solvent fires, resulting in saved lives and fewer injuries and protection of property to reduce asset losses.

The use of FluoroTechnology in the chemical and pharmaceutical industries supports more than 1,000 jobs in the U.S. and more than 2,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the chemical and pharmaceutical industries generate a total of \$1.7 billion in economic output.

### *Electronics*

FluoroTechnology products are critical to today's consumer, industrial, commercial and military electronics. High dielectric fluoropolymers enable the transmission of high frequency signals on which most modern electronics are based. FluoroTechnology improves insulation, weather-ability, transparency and water resistance for many key electronic products. It also helps make touch screens smooth and smudge resistant.

The use of FluoroTechnology in the electronics industry supports more than 23,000 jobs in the U.S. and more than 53,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the electronics industry generate a total of \$175.5 billion in economic output.

### *First Responders*

FluoroTechnology often represents the difference between life and death for first responders, whether through its use in safety gear or firefighting foams.

The low surface tension and positive spreading coefficient of fluorinated surfactants make them ideal ingredients in the production of firefighting foam, used to fight Class B flammable liquid fires and provide both shorter extinguishment times and critical burnback resistance.

Clothing utilizing FluoroTechnology offers life-saving protection to first responders, whether by helping to deflect bullets or by maintaining performance of protective gear in the extreme environment of a fire.

The use of FluoroTechnology in the emergency services industry supports more than 1,000 jobs in the U.S. and more than 9,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the emergency services industry generate a total of \$15.1 billion in economic output.

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## Healthcare

FluoroTechnology products are used throughout hospitals and healthcare settings. Fluoropolymers provide low-friction and clot-resistant coatings for catheters, stents and needles, improving patient comfort and safety, including in deep needle operations such as drug injections and biopsies. Fluoropolymers also allow for protein-resistant and sterile filters, tubing, o-rings, seals and gaskets for kidney dialysis machines and immuno-diagnostic instruments.

Fluoropolymers serve as high dielectric insulators that are critical to the proper function of electronics that rely on high frequency signals such as defibrillators, pacemakers and CRT, PET and MRI imaging devices.

Fluoropolymers provide a high barrier against humidity in blister packaging for sensitive pharmaceuticals, extending the shelf-life for dry formulations like pills and powders.

In hospital gowns, drapes and divider curtains, certain fluorinated polymers create a barrier that provides life-saving protection against infections and transmission of diseases in hospitals. Wall and floor paints employing FluoroTechnology allow for the aggressive use of biocides for cleaning, helping to prevent infections in hospitals.

The use of FluoroTechnology in the healthcare industry supports more than 1,000 jobs in both the U.S. and Europe. Globally, FluoroTechnology materials and products specific to the healthcare industry generate a total of \$965 million in economic output.

## Oil and Gas

FluoroTechnology plays an important role in the oil and gas industry, providing reliable equipment to help improve the safety and affordability of oil-field and pipeline operations.

Resisting extreme heat and chemicals, fluoroelastomers improve the reliability and safety of fuel system seals and hoses, O-rings and downhole and field equipment gaskets.

Fluoropolymers provide acid-resistance piping for crude oil transfer, improving safety of oil-field and oil-pipeline operations.

FluoroTechnology also contributes to the fire-fighting foams used to enhance the safety of oil refining.

The use of FluoroTechnology in the oil and gas industry supports more than 7,000 jobs in the U.S. and more than 9,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the oil and gas industry generate a total of \$20.6 billion in economic output.

## Outdoor Apparel & Equipment

FluoroTechnology products offer unique, highly-beneficial performance properties to the outdoor industry, such as breathable membranes and long-lasting Durable Water Repellent (DWR) finishes that provide water repellency, oil repellency, stain resistance and soil release with abrasion resistant finishes for apparel and equipment.

In the most important applications, FluoroTechnology products help keep people safe by delivering life-saving protection in extreme weather and temperatures. Ultra-harsh and emergency conditions become survivable and are less drastic.

Oil repellence, long considered a luxury by the outdoor user, is increasingly understood to prevent loss of water repellency from oils such as body oil, sun tan lotion, food and dirt.

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Garments and equipment treated with FluoroTechnology also have a longer useful life, therefore reducing energy and water used to manufacture replacements. They also require less frequent laundering, lower wash temperature and shorter drying time, further reducing use of water and energy.

The use of FluoroTechnology in the outdoor apparel and equipment industry supports more than 5,000 jobs in the U.S. and almost 40,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the outdoor apparel and equipment industry generate a total of \$27.3 billion in economic output.

### Semiconductors

FluoroTechnology products enable the manufacture of semiconductors. This technology is used in tanks, valves, pumps and piping to create the ultra-pure manufacturing environments that are necessary for micro-electronics. FluoroTechnology also increases equipment longevity by providing corrosion resistance against harsh chemicals and improves safety by reducing the potential for leaks. Fluoropolymers and other fluorinated substances are also used for plasma machinery, etching materials, cleaning fluids and wetting surfactants for chemical etchants.

The use of FluoroTechnology in the semiconductor industry supports more than 95,000 jobs in the U.S. and more than 91,000 jobs in Europe. Globally, FluoroTechnology materials and products specific to the semiconductor industry generate a total of \$752.6 billion in economic output.

### FluoroCouncil's Commitment to Sustainability

FluoroCouncil and its members are working with regulatory authorities and other stakeholders worldwide to innovate and drive increasingly sustainable FluoroTechnology solutions, including the global transition from long-chain PFAS<sup>2</sup> to alternatives such as short-chain fluorochemicals. Short-chain fluorochemicals are alternatives to the long-chain PFAS that provide the same valuable properties, but with improved environmental and human health profiles.

All FluoroCouncil companies are charter members of the [2010/2015 PFOA Stewardship Program](#), a global partnership with U.S. Environmental Protection Agency (EPA) based on goals to eliminate perfluorooctanoic acid (PFOA) and related chemicals from facility emissions and product content by the end of 2015. Similar programs are in place with Environment and Health Canada. A significant volume of data has been developed and rigorously evaluated by industry and regulators, supporting the conclusion that the short-chain alternative substances offer equivalent performance with improved environmental and human health profiles.

According to [the U.S. EPA](#), “data indicate that [shorter-chain chemicals] have substantially shorter half-lives in these animals than PFOA and are less toxic than long-chain PFAC chemicals.”

<sup>2</sup> PFAS = per- and polyfluoroalkyl substances

#### THE FLUOROCOUNCIL MEMBERS ARE:

Archroma Management LLC, Arkema France, Asahi Glass Co., Ltd., Daikin Industries, Ltd., Solvay Specialty Polymers, and The Chemours Company LLC.