Starfire® Systems produces two families of ceramic forming polymers:

**Silicon Carbide (SiC) - Polycarboxilane Based**

These proprietary Starfire® Systems polymers are our original technology and yield near Stoichiometric SiC ceramics when converted. They are our highest strength polymers, thermally stable to 2500°C+, and available in a range of viscosities from low viscosity liquid to high viscosity liquid and a hot melting solid.

Starfire’s advanced technology offers a route through polymer to near Stoichiometric silicon carbides, delivering the benefits of SiC ceramic composites without the sintering and machining challenges. Our polymers form a high-strength green part with cure temperatures as low as 200°C and then form SiCs with nanoscale grain sizes as low as 800°C.

**Highlights:**
- Ability to mold complex, near net-shaped ceramic composite components
- Features a low temperature green cure
- Ceramic is formed using low cost furnaces
- Nanoscale ceramic grain yields tough parts
- Products are flexible - they feature low viscosity for infiltration or hot melt for layups

**Applications:**
- SiC ceramic matrix composite components
- Infiltrate low cost preform for enhanced performance
- Suitable for a variety of structural, thermal, or friction uses

**Silicon Oxycarbide (SiOC) - Polysiloxane Based**

Our silicon oxycarbide resins are Starfire® Systems’ newest technology that is specifically designed to offer a tough, durable ceramic for moderate service temperatures. Starfire® Systems’ technology produces low cost, high performance silicon oxycarbide ceramics with configurable properties.

We have the ability to customize the ratios of Si-O-C and have the most cost effective ceramic formers on the market with services up to 1200°C.

**Highlights:**
- Strong cost / performance value proposition
- Mold complex near net-shaped ceramic composite parts
- Composite design flexibility (e.g., 2D layup, preform, BMC)
- Green cure in conventional presses and molds
- Low cost furnaces for firing ceramic

**Applications:**
- SiC ceramic matrix composite components
- Infiltrate low cost preform for enhanced performance
- Suitable for a variety of structural, thermal, or friction uses
Starfire® Systems offers both SiC CVD precursors and a selection of fine chemicals.

**CVD Precursors**

Starfire® Systems offers compounds for chemical vapor deposition of SiC and related materials for coatings or infiltration. Our precursors are specifically developed to simplify coating and densification processes. We manufacture fine chemical intermediates based on our expertise in silane and silicon chemistry.

**Highlights:**

- Starfire® Systems is able to produce these precursors at a much higher yield by utilizing our unique synthetic processing methods.
- Gram to multi-kilogram quantities
- Short lead times
- Low impact on environment
- Decrease energy required for infiltration
- No corrosive by-products
- Delivered by bubbler or vapor draw
- Single-source, volatile precursors with near-zero residue
- No solvents present in deposition chamber
- Non-halide, no acid effluent
- Convenient deposition temperature range (825-950°C)
- Suitable for APCVD or low pressure CVD
- Easily delivered by remote vaporization, bubbler or vapor-draw
- FactStage modeling of deposition kinetics
- Glass bottle, carbon steel or semiconductor-grade 316 stainless reservoirs/bubblers available

**Applications:**

- Coatings of SiC or SiOC for electronic applications
- Infiltration of fiber preforms
- Sealing of surface pores and cracks
- Aerospace, industrial, nuclear
Starfire® Systems has developed both Bulk Molding Compounds (BMC) and Dry Molding Compounds (DMC) based on Starfire’s Polymer-to-Ceramic™ Technology. The BMC’s contain fiber, Starfire resins, and refractory particularly while the DMCs contain Starfire resins and various types of filler particulate.

**Highlights:**

- Easily moldable using compression mold tooling
- No solvent removal - 100% solids
- Medium modulus carbon fiber reinforced (BMC)
- High temperature stability
- Tailorable thermal and mechanical properties

**Applications:**

- Excellent performance in high temperature applications
- Strong, ultra-lightweight material systems
- For highly corrosive and/or high-wear environments
- Suitable for a variety of structural, thermal, and friction uses
Starfire® Systems has developed a family of polysiloxanes called Polyramic® resins. These unique resins have processing requirements similar to traditional plastic polymers but are inherently flame resistant.

**Highlights:**
- Composite / coating capable
- Inherent flame retardance (no additives)
- Halogen free compliance
- Low CTE, Dk, and Df
- High-modulus composites
- Excellent thermal stability and shock resistance
- High temperature oxidation resistance
- Low smoke and toxicity

**Applications:**
- Electronics - PCB Laminates
- Flame resistant composites / coatings
- Friction Modifiers / additives
- High temperature composites
- Environmental barrier coatings
As we venture further into the boundless frontier of the solar system, our capacity for exploration is determined by the technologies of the aircraft that take us there. At Starfire Systems, our advanced systems are producing materials used by NASA to increase the stability of its space vehicles. Starfire® technologies have led to the successful development of leading edge parts, small and large area repair (LAR) kits, high temperature heat exchangers, aircraft brakes, re-entry protective components, thruster blocks, and NASA Shuttle tile repair caulk. With our ceramic-forming polymers, aircraft can be built more durably, can operate at increasingly higher temperatures, with advanced design, and at more affordable costs to increase performance for our customers.
In an ever developing world, cutting edge technology can offer a national defense advantage which is vital to security and success. Starfire® Systems offers Military Grade (MG) Polymer-to-Ceramic™ system solutions which are capable to function in the tough environments required for military applications. Due to the high strength and high temperature capability of these Military Grade (MG) polymer and ceramic composite materials, missile radomes, rocket nozzles, vehicle and personal armor, and military braking systems are possible. Where superior strength is required and reduced weight offers a strategic advantage, Starfire Polymer-to-Ceramic Composites (PTCC) deliver. The Starfire Military Grade (MG) composites are highly engineered composites based on the class of siloxane and carbosilane polymers and matched with equally superior fibers designed to offer performance currently unavailable with traditional solutions.
As energy demand increases to serve emerging markets, clean energy offered by nuclear power reactors is ideal. As safety becomes more and more of a requirement, Starfire Systems offers Polymer-to-Ceramic™ Technology which can improve safety and efficiency in these settings. Starfire Nuclear Grade (NG) composites can offer safety through improved strength. When incorporated into nuclear fuel, starfire pre-ceramic polymers can offer a customized and improved thermal conductivity not possible with current technology.
As the demand for improved efficiency increases, industrial equipment is required to run longer and withstand greater heat. In order for design engineers to meet this ever increasing demand, industrial materials must deliver under all conditions. Starfire Systems has developed Polymer-to-Ceramic Composite (PTCC) systems capable of operating in the harshest of environments to meet the demands placed on them. Through the use of Starfire’s PTCC technology, items such as engine exhaust filters, electrical box enclosures, protective heat shields, engine blocks and high pressure pump bushings can perform optimally.
In a society on the go, we depend on reliable braking systems when it comes time to stop. Starfire’s Polymer-to-Ceramic™ Composite (PTCC) materials produce lightweight, tough, and thermally stable composites used in automobile, motorcycle, aircraft, and train braking systems. With 33% the mass of traditional metal brake rotors and significant heat and corrosion resistance, our carbon fiber reinforced ceramic composites provide our clients in the friction materials markets with a competitive edge. In one test of our material, we subjected a rotor to tough conditions - similar to driving a 5,500 pound Chevrolet Tahoe at speeds of greater than 160mph to a dead stop. The rotor successfully endured the extreme heat while maintaining an excellent friction coefficient.
Modern technologies are advancing into smaller and smaller spaces. The capabilities of electronic devices have increased dramatically, yet our cell phones grow smaller, our computers grow lighter, and our televisions grow slimmer. With these advancements, smaller, lighter, and slimmer devices generate more heat, and Starfire polymers are designed for it. Printed circuit boards are a main technology driving electronic devices, and laminates produced by Starfire Systems can be used by electronic engineers designing circuit boards. In fact, Starfire laminates are a class of environmentally-friendly polysiloxanes called Polyramic® resins that are inherently heat and flame resistant, and combine organic manufacturing processes with the performance and stability of inorganic materials, giving engineers exceptional flexibility when designing electronic components.
Body and vehicle armor provide crucial protection for law enforcement and military personnel who put their lives on the line. Manufacturers rely on advanced materials to ensure their protective products provide superior strength. Starfire Systems offers a class of polysiloxane polymers which, when incorporated into body or vehicle armor, offer an improved level of protection not currently available with traditional fiber reinforced composite systems and uni-directional based designs.