WHAT IS THE DIFFERENCE BETWEEN

A STRUCTURAL AND NON-STRUCTURAL COMPOSITE?

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A COMPOSITE IS TWO OR MORE DISSIMILAR MATERIALS, OR ELEMENTS COMBINED TOGETHER.
FOR EXAMPLE, CEMENT IS A COMMON COMPOSITE.

Today, when we speak of composites for the pump industry, we are normally referring to non-metallic composites; however, a composite can contain metallic fibers as well as non-metallic fibers.

The fibers in a composite create mechanical strength, and carry the bulk of the load. The resin, or matrix, transfers the load between the fibers. The fibers are primarily responsible for setting the material properties of the composite. The material properties of the composite are set by the:

TYPE OF FIBERS 01

SIZE OF THE FIBERS 02

LAYOUT, OR ORIENTATION OF THE FIBERS 03

RATIO OF THE RESIN TO THE FIBERS 04

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THERE ARE THREE MAJOR TYPES OF COMPOSITES

NON-STRUCTURAL 01

The composite does not have reinforcing fibers, or the composite contains powdered fibers, or fillers.

SEMI-STRUCTURAL COMPOSITE 02

The reinforcing fibers in the composite are "cut." As a result of the fibers being cut, the mechanical strength of the composite is "cut," or limited.

STRUCTURAL COMPOSITE 03

A STRUCTURAL COMPOSITE is one in which the reinforcing fibers are continuously interwoven in a weave. The fibers are NOT cut, chopped, or macerated. The composite utilizes a thermoset resin system.

SIMSITE® STRUCTURAL COMPOSITE CARBON FIBER IMPELLERS AND CASING RINGS

Non-metallic composites get their strength from the reinforcing fibers. If the fibers in a composite are cut in any way the composite has very little mechanical strength and must rely solely on the mechanical properties of the resin, or matrix that holds the cut fibers.

For example, the human body is a composite and the bones are the reinforcing fibers – if we did not have bones in our body, we would have to "flop" around. If our bones are broken, we cannot walk and we have no real mechanical strength. It is a similar principle.

TYPES OF COMPOSITE MANUFACTURE

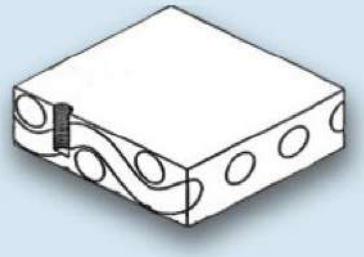
MOLDED 01

COMPRESSION MOLDED, RESIN TRANSFER MOLDED, PULTRUSION, 3-D PRINTING, INJECTION MOLDED, CAST, BAG MOLDED

MACHINED 02

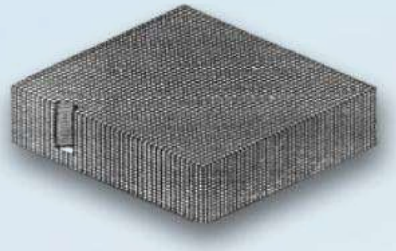
MACHINED FROM A SOLID BLOCK

The diagram below (on the right) shows the interwoven fibers in a **SIMSITE®** structural engineered carbon fiber composite manufactured by machining on 5 to 8 axis machining centers, as compared to a molded composite, (on the left) which will have air pockets and internal voids, some porosity, and a much lower mechanical strength.



MOLDED SEMI-STRUCTURAL COMPOSITE

A MOLDED, NON-STRUCTURAL COMPOSITE IMPELLER WHERE THE VANES BROKE BECAUSE THEY WERE NOT STRUCTURAL!



SIMSITE® STRUCTURAL COMPOSITE - FIBERS CONTINUOUSLY INTERWOVEN

A MACHINED SIMSITE® STRUCTURAL CARBON FIBER COMPOSITE IMPELLER, WHICH WILL OUTLAST AND OUTPERFORM CAST IMPELLERS IN CORROSIVE ENVIRONMENTS

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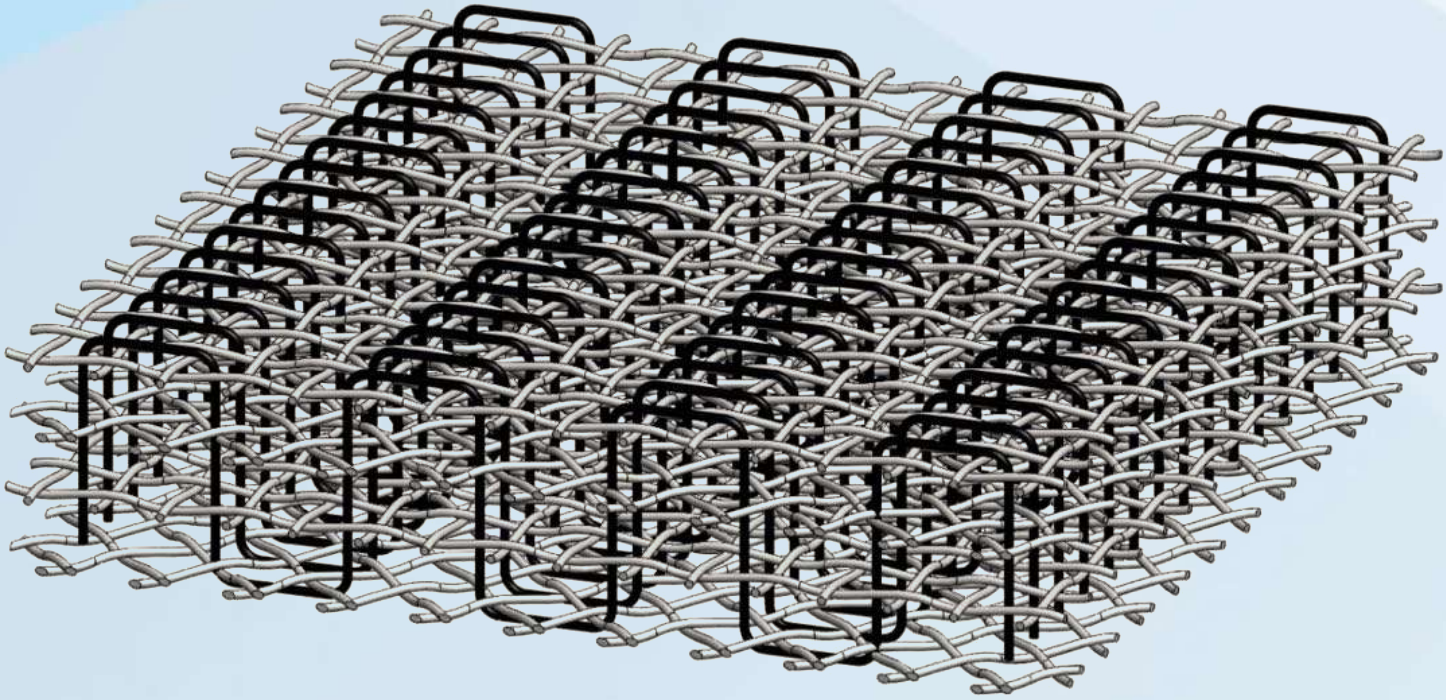
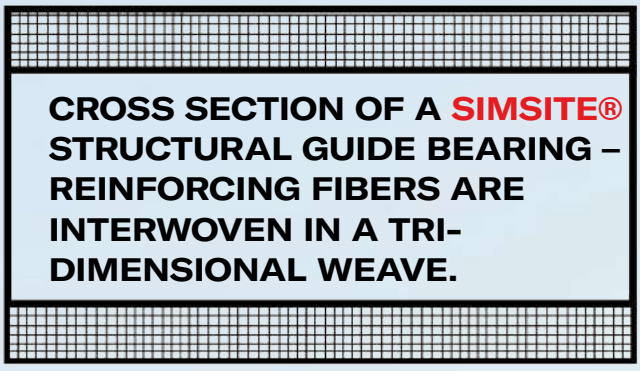
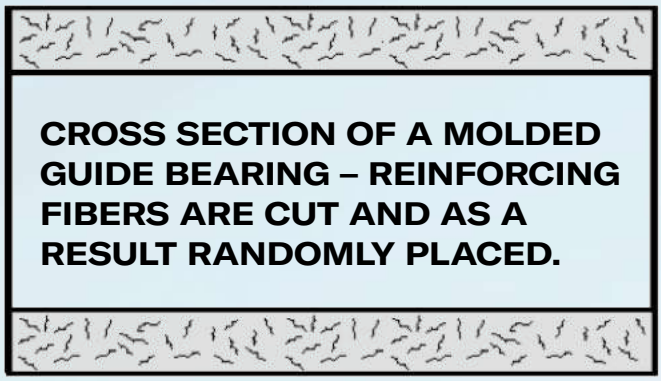
SIMSITE® is a Structural Composite in which the reinforcing fibers are continuously interwoven in a tri-dimensional weave, for which SIMS PUMP has a patent on material and process. Structural engineered composites, like **SIMSITE®** produce the highest mechanical properties and the greatest reliability.



REINFORCING FIBERS ARE CONTINUOUSLY INTERWOVEN IN A SIMSITE® STRUCTURAL COMPOSITE



CROSS SECTION OF A SIMSITE® STRUCTURAL GUIDE BEARING – REINFORCING FIBERS ARE INTERWOVEN IN A TRI-DIMENSIONAL WEAVE.



CROSS SECTION OF A MOLDED GUIDE BEARING – REINFORCING FIBERS ARE CUT AND AS A RESULT RANDOMLY PLACED.

SIMSITE® IS A STRUCTURAL COMPOSITE, BECAUSE THE REINFORCING FIBERS ARE CONTINUOUSLY INTERWOVEN IN A TRI-DIMENSIONAL WEAVE.

SIMSITE® Structural Carbon Fiber Graphite Composites are NOT Plastic, Fiberglass, FRP, or like Fiberglass, and have much higher mechanical strength and very different material properties. Fiberglass (FRP) pumps, impellers and pump parts are molded and manufactured with short cut glass fibers. The fibers are cut, so they are NOT structural and mixed with a resin. The fibers and resin are set in a mold and then either compression molded, bag molded, or resin-transfer molded into place. Even if interwoven fiber sheets are used in a resin-transfer process, the sheets must be cut to be placed into the mold. In a resin-transfer process the resin is drawn through the “placed” fibers or cut sheets using a vacuum process. In order to achieve high mechanical strength, the reinforcing fibers must be continuous (the reinforcing fibers must not be "chopped" or "cut") and the composite must be manufactured with a thermoset resin system. Fiberglass (FRP) pumps can be used for low pressure; low temperature applications where temperature, pressure, and stresses are not a factor. Fiberglass and FRP pumps are subject to cracking and breaking in high pressure, stress, or temperature applications.

All Fiberglass (FRP) pumps, impellers and pump internals are molded.

If the composite is manufactured with a thermoplastic resin system then the composite can break down, deteriorate, or deform, under pressure and temperature, because the molecules in a thermoplastic resin system are not cross linked like they are in a thermoset resin system. Therefore, a composite that is manufactured with a thermoplastic resin system can never be considered "structural" even if the reinforcing fibers are continuous and not "cut."

EXAMPLES OF FAILED MOLDED IMPELLERS & SLEEVES – YOU CAN SEE THE "CUT" RANDOM FIBERS AND AS A RESULT, THE MECHANICAL WEAKNESS OF THIS TYPE OF PROCESS

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Many people also have the misconception that all non-metallic composites are "plastics," and have limited mechanical strength. This is not true. The reason people have this misconception is because many non-metallic composites are "Cast," or "Molded;" and as a result, most of them use thermoplastic resin systems in the manufacturing process. Thermoplastic composites use plasticizers in their resin systems. Plasticizers are additives that increase the plasticity, or "fluidity" of the polymer material. The major applications for plasticizers are for plastics, rubber, and polyvinyl chloride (PVC). Without a plasticizer, most polymers would be too brittle and rigid to be useful. That is why most thermoplastics are commonly referred to as plastics.

SIMSITE® Pumps, Impellers, Bearings, Mechanical Seals, and Other Pump Interns are NOT molded; rather, they are 100% machined from one center position on 5 to 8 axis machining centers from solid blocks of the patented SIMSITE® structural graphite composite.

A SIMSITE® STRUCTURAL COMPOSITE IMPELLER BEING MACHINED ON A 5-AXIS CNC MACHINING CENTER FROM A SOLID BLOCK OF THE PATENTED SIMSITE® COMPOSITE.

Because **SIMSITE®** Pumps, Impellers and other Pump Upgrades are machined from solid blocks of the patented **SIMSITE®** structural composite; SIMS PUMP is able to engineer the Operating Point to be the Best Efficiency Point. Machining **SIMSITE®** Products from one center position enables the rotating parts to have perfect balance (both mechanically & hydraulically) eliminating shaft deflection, radial and axial movement and balance related problems for the life of the pump. This results in improved performance, reliability, and longevity!

SIMSITE® Impellers are light weight (85% less weight than bronze), have superior mechanical strength, do NOT support electrolysis, and do not suffer from corrosion or performance deterioration like metallic pumps and impellers!

SIMSITE® STRUCTURAL CARBON FIBER COMPOSITE IMPELLERS – 100% MACHINED FROM SOLID BLOCKS FROM ONE CENTER POSITION, AND 85% LESS WEIGHT THAN BRONZE OR STAINLESS STEEL.

DESIGNED AND ENGINEERED TO MAKE THE CUSTOMER'S OPERATING POINT THE BEST EFFICIENCY POINT!

A SIMSITE® STRUCTURAL COMPOSITE PUMP; 8" X 8" - 13" ON A US NAVY SHOCK & VIBRATION TEST MIL-S-901D. SIMS PUMP HAS NEVER FAILED A US NAVY SHOCK & VIBRATION TEST.

A FIBERGLASS (FRP) PUMP WILL NOT PASS THIS TEST. IT WILL NOT BE ABLE TO ENDURE THE STRESSES INDUCED BY THE BLOWS.

BENEFITS OF USING SIMSITE® IMPELLERS & CASING RINGS:

Eliminate Corrosion Problems

Eliminate Cavitation Problems

Eliminate Electrolysis – Galvanic Corrosion

Eliminate Performance Problems

Eliminate Balance Problems

Machined from a solid block – Not Cast or Molded!

Light Weight! – 15% the weight of Bronze or Stainless Steel

Engineered so the operating point is the Best Efficiency Point

Pump Performance does not deteriorate like it does with metallic pumps!

Higher Efficiency

Longer Life

Better Reliability

Less Shaft Deflection

Non-Sparking

Non-Galling

Extend the life of Metallic Casings because Simsite® Impellers are inert!

Increase Pump Efficiency

Extend the Life of the Pump Casing!

Eliminate Repair and Maintenance Expenses!

Pump Performance does not deteriorate like it does with metallic impellers!

A SIMSITE® STRUCTURAL COMPOSITE CARBON FIBER CASING RING - MACHINED FROM A SOLID BLOCK OF SIMSITE® STRUCTURAL COMPOSITE - NEVER CORRODES IN SEAWATER, WASTE WATER, SEWAGE, OR RIVER WATER AND PREVENTS PUMP CASING WASH-OUT & ELECTROLYSIS!

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SIMSITE® STRUCTURAL COMPOSITE PRODUCTS

- Longer Life
- Corrosion Resistant
- Lightweight
- High Strength
- No Electorlysis
- Always Balanced
- Higher Efficiency

SIMSITE®
Horizontal Pumps

SIMSITE®
Vertical Pumps

SIMSITE®
Vertical Turbine Pumps

SIMSITE®
Impellers & Casing Rings for ALL Centrifugal Pumps

SIMSITE®
Shaft Stabilizing Bushings

SIMSITE® Guide Bearings

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