



## Composites

Composite materials offer many exceptional properties that are difficult or impossible to match with traditional materials, such as steel, aluminum and wood. Today, they are used in almost every dynamic, high performance structure whether on land, at sea or in the air. Composite materials are stronger, stiffer and lighter than traditional materials and allow the design and manufacture of complex components, many of which are also able to resist corrosion, blast, fire or impact. To achieve optimum results, specialist knowledge and skills are required

Composite materials as we understand them are very much the same as fiber reinforced plastics (FRP) which over the last 50 years have evolved from the very crude resin matrix/glass fiber laminates to the advanced sandwich cored laminates of Carbon Fiber/Epoxy resin of today.

## Characteristics

The key characteristics of Composites are that they Light weight and High strength. Composites have a high resistance against all environmental occurrences, namely corrosion and chemical, elevated temperature, abrasion, thereby increasing their lifespan and making it repair and maintenance free.

Why are composites so strong and light as compared to more traditional materials like Wood (a natural composite material) or metal?

The basic principle of composites can be understood if we compare a solid plate of glass with a plate of polyester or epoxy resin of same thickness but reinforced with an equivalent amount of glass fibers. When testing the two plates to destruction, the micro flaws in the solid glass plate will make it fail prematurely long before the theoretical properties of the material are reached, on the contrary the glass fiber/resin laminate will resist much higher loads without breaking although the glass in it will have a similar number of flaws.

This is because the surface area of the fibers is several orders of magnitude higher as compared with the glass plate. This creates great redundancy and allows the surviving millions of fibers (without defects) to transfer the load to each other through the matrix (the plastic resin). Advanced Composites make use of these basic principles to create extremely strong and stiff structures capable of supporting very high loads and with a fatigue resistance that outperforms any other structural material known to man.

This reason coupled with its lightness and the ease with which it can be manufactured into the most complex shapes is why the use of Composites in general is becoming so widely accepted. Composite materials are now entering a new era as they reach maturity and process ability becomes mainstream with more and more applications appearing in all the industries from aircraft to boat construction to automotive to appliances to civil engineering.

## Advantage

Composites offer a number of advantages over traditional engineering materials by way of its key characteristic of high performance and durability in the most extreme of conditions. These beneficial characteristics have enabled the rapid acceptance of composites in many products.

Composite materials have a high specific stiffness (stiffness-to-density ratio). Composites offer the stiffness of steel at one fifth the weight and equal the stiffness of aluminum at one half of the weight. Due to this higher specific stiffness and strength, composite parts are lighter than their counterparts.

Composites can be formed into complex and accurate shapes easier than other materials. This gives designers the freedom to create any shape or configuration and provides great ease in fabrication, manufacturing, handling and erection thereby providing shorter project time delivery

## Material Comparison

Why are composites so strong and light as compared to more traditional materials like wood (a natural composite material) or metal?

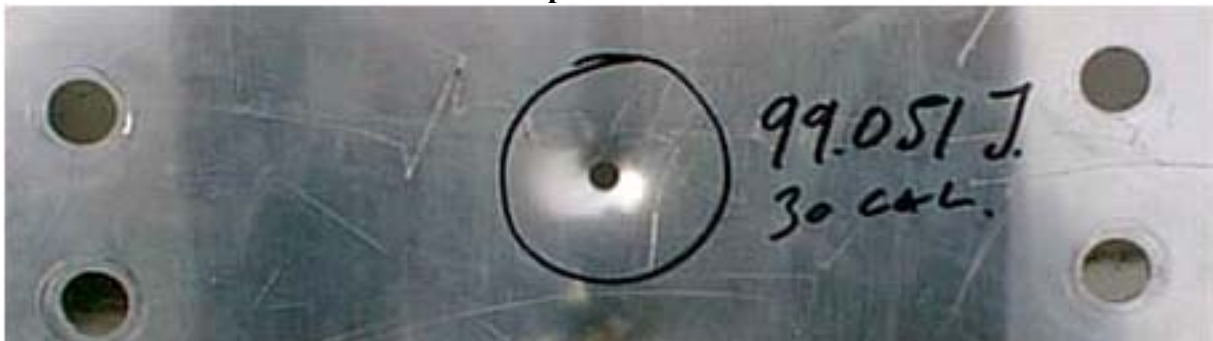
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### Independent Comparison Test

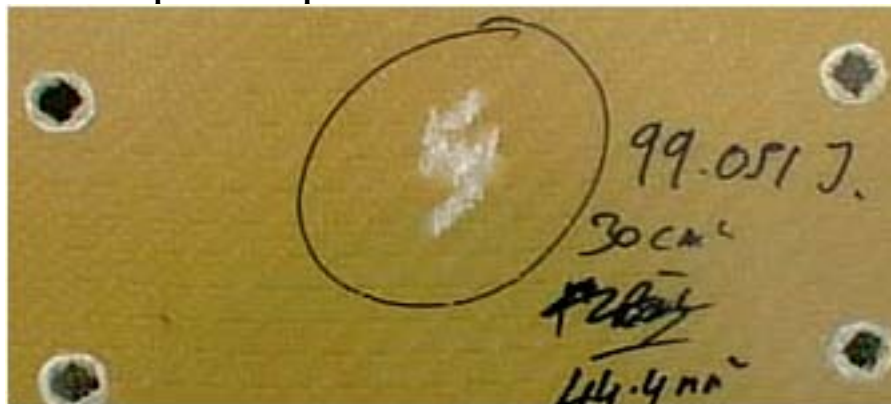
30 Caliber (99J) Impactor strike to outer surface both panels

**Standard 3/16" Marine Aluminum hull plate**



**FULL PENETRATION**

**3/16" Composite hull panel**



**MINOR SURFACE DAMAGE**