Epoxy Resin Composites – Reinforced Resins

Everywhere Every Day Building Blocks

Epoxy Resin Composites. We encounter them every day. From the computers and sports equipment, we use, to the cars and boats we drive - epoxy resin is enhanced with a variety of fibrous materials – and integrated into the manufacturing process of so many things...

In this guide, we’ll explore the myriad industries and the ways that they are incorporating epoxy resin composites to advance their businesses. The advantages and benefits realized are numerous, as are the technological advances leveraged for both efficiency and effectiveness...

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What are Epoxy Resin Composites?

Epoxy resins form the structural base and bonding agent that, when combined with reinforcing fibers made from a variety of materials, are used in myriad applications due to their improved strength, durability and chemical and corrosive resistance. Aside from these features, another huge benefit to epoxy resin composites is their light weight which makes them even more attractive for use in so many manufacturing solutions.

The combined fibrous materials are of several sources depending upon the application as well, as structural properties and the performance and reinforcement required. Fiber types include:

- Glass Fiber – the oldest and most commonly used composite fiber*, glass fiber reinforced epoxy composites have strength equal to steel**, and while weighing more than carbon fiber – is more impact resistant and has “greater elongation to break” – which means that it elongates to a greater degree before it breaks*. Lightweight and translucent, glass fibers are commonly used in building foundations, structural panels, roofs, domes and even safety gear like helmets**
- Carbon Fiber – used in high-performance applications, this class of fiber provides extreme material stiffness and low thermal expansion - good for everything from sporting goods due to the former property - to electronic instruments in aerospace for the latter
- Advanced Fibers – specialty high-performance fibers include aramid fiber (made by Dupont in the U.S. and Teijin in the Netherlands) and known as Kevlar and Twaron respectively; and boron fibers – all of which may be used for a host of applications however, their manufacturing costs are higher which are often a deterrent to their selection*
Epoxy Pro Guide – Epoxy Resin Composites

- Natural Fibers – a more recently developed eco-friendly option, natural fibers made from cellulose plant materials have begun replacing carbon or polyester-based fibers in industries such as automotive, textiles and sporting goods. This renewable resource, while not quite as strong as other composite alternatives, has the added benefit of a 20-50 percent lower carbon footprint.

Why Epoxy Resin Composites?

Composites manufacturing however, aside from the enhanced properties of strength and light weight, also focuses on several more technical aspects provided by this combination in specialized applications. Epoxy resin composites offer design and manufacturing engineering properties and advantages not found in traditional manufacturing materials:

- Vibrational Damping & Low Coefficient of Thermal Expansion – for use in delicate electronics for instance
- Resistance to Fatigue – beneficial when used in harsh environments
- Design & Manufacturing Flexibility – reducing the number of parts needed and therefore requiring less raw material and shorter assembly & production times
- Proven Resistance to Temperature extremes, Corrosion & Wear – significantly reducing lifecycle cost particularly in industrial applications and settings

All of which translates into manufacturing efficiencies including shorter production times, enhanced product reliability and with its lightweight – epoxy resin composites have been a boon for both fuel efficiency in sectors such as aircraft and aerospace as well as the manufacturing sporting goods like watercraft and bicycles.

Applications & Industries – Helping People Around the World

Epoxy resin composites are primarily used in industry sectors that require high-performance materials that are reliable, structurally superior and able to perform under extreme conditions. However, we encounter these materials frequently in our everyday lives - in the buildings we live and work within - as well as the myriad transportation, communication and computing modes we use. Epoxy resin composites help make our lives easier, safer and more productive, and help the environment as well through manufacturing process and energy efficiencies.
Industries around the globe employ epoxy resin composites to enhance both production processes as well as the products themselves:

**Automotive** - epoxy resin composites are used in vehicle body panels and parts to reduce weight, improve performance and save energy. And, new flying concept cars are being tested made of composites as well as we "drive" toward the future...

**Aerospace** - Epoxy resin is used in a number of innovative ways in the aerospace industry from the fabrication of spacecraft hardware to aiding in the flame retardancy and reinforcement of space suits. The flexible and adaptive nature of this thermosetting polymer makes it an extremely valuable component in the ever-evolving creation of solutions for space travel.

**Building & Construction** - Epoxy resin is a versatile composite material used for so many projects by artisans for crafts, home do-it-yourselfers for furniture creation and repair, and in the marine industry for myriad boat building applications. However, epoxy resins are also used for the basis of a wide variety of modern applications in the commercial, residential and industrial building and construction industries.

**Marine** - Boat builders employing leading-edge technology have turned to epoxy infusion, or vacuum resin infusion, in their manufacturing processes to make their hulls and decks superior, both in reduced weight and increased strength. To create epoxy resin infused boat hulls, a "closed molding process" is used - beginning with a hull mold cavity filled with construction material of the builder’s choice (foam core, fiberglass laminates, Kevlar, cotton fiber, etc.). **READ MORE**

**Energy & Conservation** – epoxy resin composites play a large role in harnessing wind energy: "Technology further enhanced blade performance by combining resins and reinforcements in a more rigorously controlled manner before placement in the blade mold. Resin technology has expanded somewhat to include both polyester and epoxy resin on a broad scale." ~ Wind Systems Magazine

**Sporting Goods** – many of today’s sporting equipment are either enhanced with or made entirely out of epoxy resin composites - provide a combination of increased flexibility and strength while decreasing weight - for optimal playing performance.

High-performance materials like epoxy resin composites have become essential building blocks for diverse cross-industry applications. Aside from their practical use in so many sectors, there is also a large research and development arena within business and academia devoted to their continuing development and evolution.

**Sources**

*CompositesWorld, Composites 101: Fibers and resins, edited by Jeff Sloan
**Epoxy Resin Composites, by Vishal K P
Composites Manufacturing Magazine, Market Segments*