Design of Reinforcement in the Composite Product

Reinforcement is used with resin systems to improve the mechanical properties of cured resin and to provide a useful product. The most important fiber originally used with polyester and epoxy resin systems is glass fiber. It can be used in various forms, such as continuous roving, woven roving and mats, randomly chopped strands, all serving special processing needs.[1, 2]

The design goals of fiber reinforced composites often include high strength and / or stiffness based on weight. These characteristics are expressed in terms of specific modulus parameters, which correspond to the ratios of tensile strength to specific gravity and modulus of elasticity to specific gravity, respectively. Fiber reinforced composites with exceptionally high specific strength and modulli have been produced that use low-density fiber and matrix materials. The amount of load to break down that composite material depends on the size of the fiberglass, its thickness, width and length. Critical fiber length depends on the strength and diameter of the fiber and the fiber matrix bond strength / matrix shear yield strength.[3, 4]

There are also many different ways in which fiberglass can be combined into resin for example, does fiberglass all align in the same direction, fiberglass is woven in mat form, fiberglass aligns irregularly, Fiberglass is long or short form, fiberglass are oriented at an angle to enhance mechanical properties according to requirements.[5]

The fiber content or fiber volume fraction plays an important role in the final properties of the composites according to the rule of mixture.[6] The overall behavior varies as the load is applied in different directions with respect to the fiber. Unidirectional composites have the greatest strength of all composites, with a load aligned with fibers; In other directions their strength decreases significantly and depends on the matrix material.For bi-directional composites, the ultimate strength is low, but occurs in two directions. As the direction of the fibers is more statistically distributed overall, the ultimate strength decreases, but the properties are more uniform in all loading directions.[7]

The mechanical characteristics of a fiberglass reinforced composite material depend not only on the fiberglass property, but also on the extent to which an applied load is transmitted to the fiberglass by the matrix phase.

RFor discontinuous fiberglass of short length, the matrix deforms around the fiberglass reinforcement. To effect a significant improvement in the strength of the composite material, the fiberglass must be continuous. Even woven fiberglass can give better results in such cases.[3, 4]

The arrangement of fiberglass orientation relative to each other, fiberglass concentration and distribution all have significant effects on the force and other properties of fiber reinforced composites. [4]

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- Ms. Leena Mody
Chief Technical Officer
EPP Composites Pvt Ltd