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Review on Fiber Reinforced Polymer

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Abstract : Fibre reinforced polymer (FRP) composites or advanced composite materials are very attractive for use in civil engineering applications due to their high strength-to-weight and stiffness-to-weight ratios, corrosion resistance, light weight and potentially high durability. Their application is of most importance in the renewal of constructed facilities infrastructure such as buildings, bridges, pipelines, etc. Recently, their use has increased in the rehabilitation of concrete structures, mainly due to their tailorable performance characteristics, ease of application and low life cycle costs. These characteristics and the success of structural rehabilitation measures have led to the development of new lightweight structural concepts utilizing all FRP systems or new FRP/concrete composite systems.

***Keywords:* Advanced Composites, Carbon Shell System, Modular Structural Systems.**

1. Introduction

Fibre-reinforced polymer(FRP),also Fibre-reinforced plastic, is a composite material made of a polymer matrix reinforced with fibres. The fibres are usually glass, carbon, or aramid, although other fibres such as paper or wood or asbestos have been sometimes used. The polymer is usually an epoxy, vinylester or polyester thermosetting plastic, and phenol formaldehyde resins are still in use. FRPs are commonly used in the aerospace, automotive, marine, and construction industries.

Composite materials are engineered or naturally occurring materials made from two or more constituent materials with significantly different physical or chemical properties which remain separate and distinct within the finished structure. Most composites have strong, stiff fibres in a matrix which is weaker and less stiff. The objective is usually to make a component which is strong and stiff, often with a low density.

Commercial material commonly has glass or carbon fibres in matrices based on thermosetting polymers, such as epoxy or polyester resins. Sometimes, thermoplastic polymers may be preferred, since they are moldable after initial production. There are further classes of composite in which the matrix is a metal or a ceramic. For the most part, these are still in a developmental stage, with problems of high manufacturing costs yet to be overcome .

Furthermore, in these composites the reasons for adding the fibres (or, in some cases, particles) are often rather complex; for example, improvements may be sought in creep, wear, fracture toughness, thermal stability, etc .

Fibre reinforced polymer (FRP) are composites used in almost every type of advanced engineering structure, with their usage ranging from aircraft, helicopters and spacecraft through to boats, ships and offshore platforms and to automobiles, sports goods, chemical processing equipment and civil infrastructure such as bridges and buildings.

The usage of FRPcomposites continues to grow at an impressive rate as these materials are used more in their existing markets and become established in relatively new markets such as biomedical devices and civil structures. A key factor driving the increased applications of composites over the recent years is the development of new advanced forms of FRP materials. This includes developments in high performance resin systems and new styles of reinforcement, such as carbon nanotubes and nanoparticles.

The fibre reinforced polymer composites (FRPs) are increasingly being considered as an enhancement to and/or substitute for infrastructure components or systems that are constructed of traditional civil engineering materials, namely concrete and steel. FRP composites are lightweight, no-corrosive, exhibit high specific strength and specific stiffness, are easily constructed, and can be tailored to satisfy performance requirements. Due to these advantageous characteristics, FRP composites have been included in new construction and rehabilitation of structures through its use as reinforcement in concrete, bridge decks, modular structures, formwork, and external reinforcement for strengthening and seismic upgrade.

The applicability of Fiber Reinforced Polymer (FRP) reinforcements to concrete structures as a substitute for steel bars or prestressing tendons has been actively studied in numerous research laboratories and professional organizations around the world. FRP reinforcements offer a number of advantages such as corrosion resistance, non-magnetic properties, high tensile strength, lightweight and ease of handling.

However, they generally have a linear elastic response in tension up to failure (described as a brittle failure) and a relatively poor transverse or shear resistance. They also have poor resistance to fire and when exposed to high temperatures

Composite materials have developed greatly since they were first introduced. However, before composite materials can be used as an alternative to conventional materials as part of a sustainable environment a number of needs remain.

a) Availability of standardized durability characterization data for FRP composite materials.

b) Integration of durability data and methods for service life prediction of structural members Utilizing FRP composites.

c) Development of methods and techniques for materials selection based on life cycle assessments of structural components and systems.

2. Advantages of FRP

When considering only energy and material resources it appears, on the surface, the argument for FRP composites in a sustainable built environment is questionable. However, such a conclusion needs to be evaluated in terms of potential advantages present in use of FRP composites related to considerations such as:

1) Higher strength
2) Lighter weight
3) Higher performance
4) Longer lasting
5) Rehabilitating existing structures and extending their life
6) Seismic upgrades
7) Defense systems
8) Space systems

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