A REVIEW ON RECENT APPLICATION OF HYBRID COMPOSITES

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ABSTRACT

Hybrid composites are composite material used when a material is required that has more than one property benefit from its constituent materials. This review involve about the fabrication on hybrid composite material from a type of synthetic fiber are made from synthesized polymers of small molecules .The compound that are used to make these fibers come from row material such as natural and petroleum. Hybrid composite materials have extensive engineering application where strength to weight ratio, low cost and easy of fabrication are required. Hybrid composite provide combination of property such as tensile modules, compressive strength and impact strength which cannot realized in composite materials. In recent time hybrid composite have been established as highly efficient, high performance structural materials and their use is increasing rapidly .Hybrid composite are usually used when a combination of properties of different type of fibers have to be achieved, or when longitudinal as well as lateral mechanical performances are required. The investigation of the novel applications of hybrid composite has been of deep interest to the researchers for many years as evident from reports.

Keyword: hybrid composite, strength, stiffness, tensile modulus and various application of hybrid composite.

1. Introduction

Recent technology breakthroughs and the desire for new functions generate an enormous demand for novel materials. Many of the well- established materials, such as metals, ceramics or plastics cannot fulfill all technology desires for the various new applications. Scientist and engineers realized early on that mixtures of material can show superior properties compare with their pure counterparts. One of the most successful example is the group of composite which are formed by incorporate of basic structure materials into a second substance, the matrix. Usually the system incorporate are In the form of particles, whiskers, fibers, lamellae, or a mesh. Most of the resulting materials show improved mechanical properties and a well-known example is inorganic fiber-reinforced polymers. Nowadays the are regularly used for lightweight material

with advance mechanical properties, for example in the construction of all types of civil construction. Hybrid composite provide combination of properties such as tensile modulus, compressive strength and impact strength which cannot be realized in composite materials. In recent time hybrid composite have been established as highly efficient, high performance structural materials and there use is increasing rapidly. Hybrid composite are usually used when a combination of properties of different type of fiber have to be achieved, or when longitudinal as well as lateral mechanical performance are required.

This paper present a review of recent a status of hybrid composite materials technology. There are many situation in which, for example, a high modulus material is required but in which catastrophic brittle failure usually associated with such as material would be an unacceptable. In the case of structure material a high initial modulus followed by limited yielding of the materials and accompanied by the smallest possible reduction of load carrying capacity is usually desirable.

2. APPLICATION AREAS OF HYBRID COMPOSITES

2.1 Hybrid Thermoplastic Ballistic Material with Application to Helmets

Thermoplastic advance composite have long held potential for mass-production lightweight structural parts. Which undergo time-consuming chemical cross linking during processing, thermoplastic-based composite are typically processed using only heat and pressure. The currently, the US Army uses helmet of the different design .the primary goal of the helmet shell is to protect the soldier from a various of threat. First, the requirement is to limit the perforation of fragments or bullet through the helmet. The current PASGT uses an effective air gap of approximately 13 mm between the inner shell wall and the soldier head to accommodate any deflection during projectile arrest. These helmet are made using a composite comprising fabric in a thermosetting matrix. The construction must also be strong enough to withstand the daily wear of soldier activities and provide improved ballistic protection. The FFW constructions that can fiber forge investigated including a tough, stiff carbon-fiber reinforced thermoplastic composite ballistic layer. The thermoplastic matrix aramid systems have excellent, mass-efficient ballistic properties. However, the thermoplastic matrix is typically 30% to 60% less rigid than even toughened thermosetting matrix.

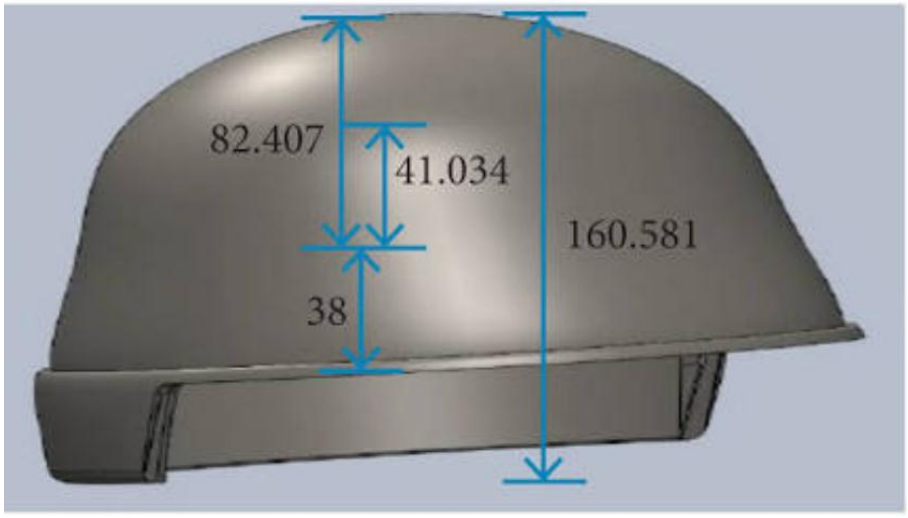

figure:1. Helmet design using composite material for military aircraft

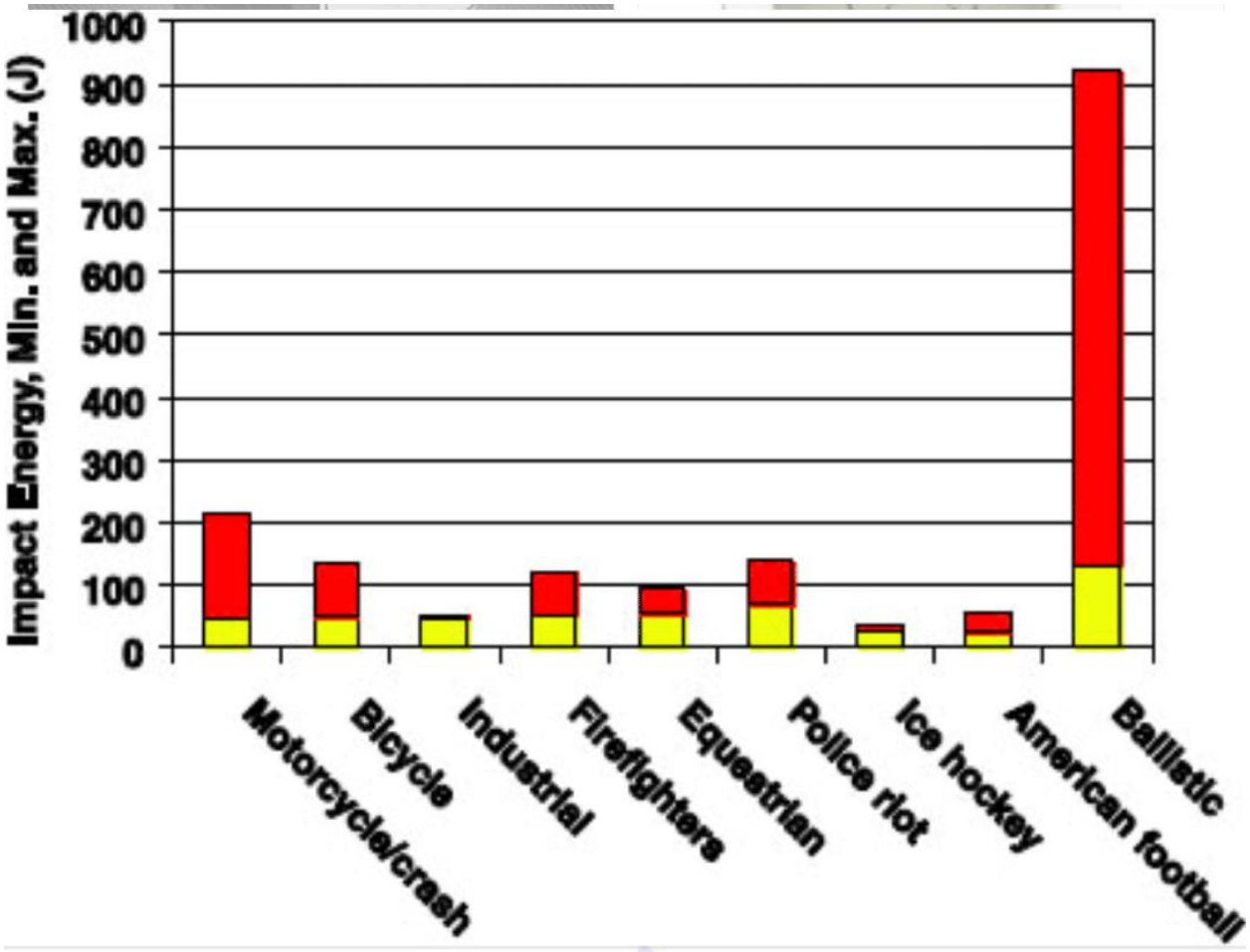

figure:2. Effective momentum of high-rate ballistic impact.

2.2. Hybrid for Civil Construction

Hybrid modular constructions combine two or more off-site construction type to minimize on-site that overview the configuration system of hybrid construction. In the last decade, the research and development of all hybrid FRP structures in civil engineering has progressed substantially on several countries. The first all hybrid FRP bridge are construct in Okinawa, Japan prefecture in 2001. All the structure element have been made with hybrid fiber reinforcement plastic. The structural design is also controlling the configuration of off=site construction due to load acting on modules during fabrication, transportation and site loadings, as well as long term sustain loads. The hybrid residential building is divided into 14 different suites as fig.3. Each suite has different plan where the interior panel have different lengths.

With such research and development, it is anticipated that a potential application in a residential building and bridge can be materialized in the near future across the globe. An effective application of FRP materials from the aspect of strength and cost, the authors on an innovative hybrid FRP giber reinforced plastic and carbon fiber, while CFRP has higher tensile strength and stiffness, it is more expensive than other construction materials such as concrete and steel, whereas GFRP is comparatively less expensive but it is mechanical properties are lower than that of CFRP.

figure:3. Hybrid construction technique and structural action

Figure: 4. Hybrid concrete construction

2.3. Hybrid Composite for Telecom Applications

In this telecommunication industries need of power transmission along with data transmission is increasing, which felt the need to explore the innovative product cable is very innovative and versatile cabling solution with in built power transmission required for network with OFC cables. Hybrid composite cable need a day, firstly to support for power transmission for always ON telecom need. New hybrid cable design fig.5 is made such that it reduces cost of installation and total cost of two separate cables. The telecom network elements and terminations are powered with help of this copper pair. Secondly, the copper pair also used for critical signaling need for railway signaling and fiber optical element for Telecom application. the copper conductor and type of fiber cable reinforcement and protection are provide based on requirement of the field. Conventionally railway used quad-cable for communication as well as signaling. Due to change in technology and increase in application of communication for data transmission optical fiber cables are now become backbone of communication. Customer expectation are increase for communications during travelling. On other hand railway are forced to proved service with lower

investments. Railway have no choice to select only one communication media.

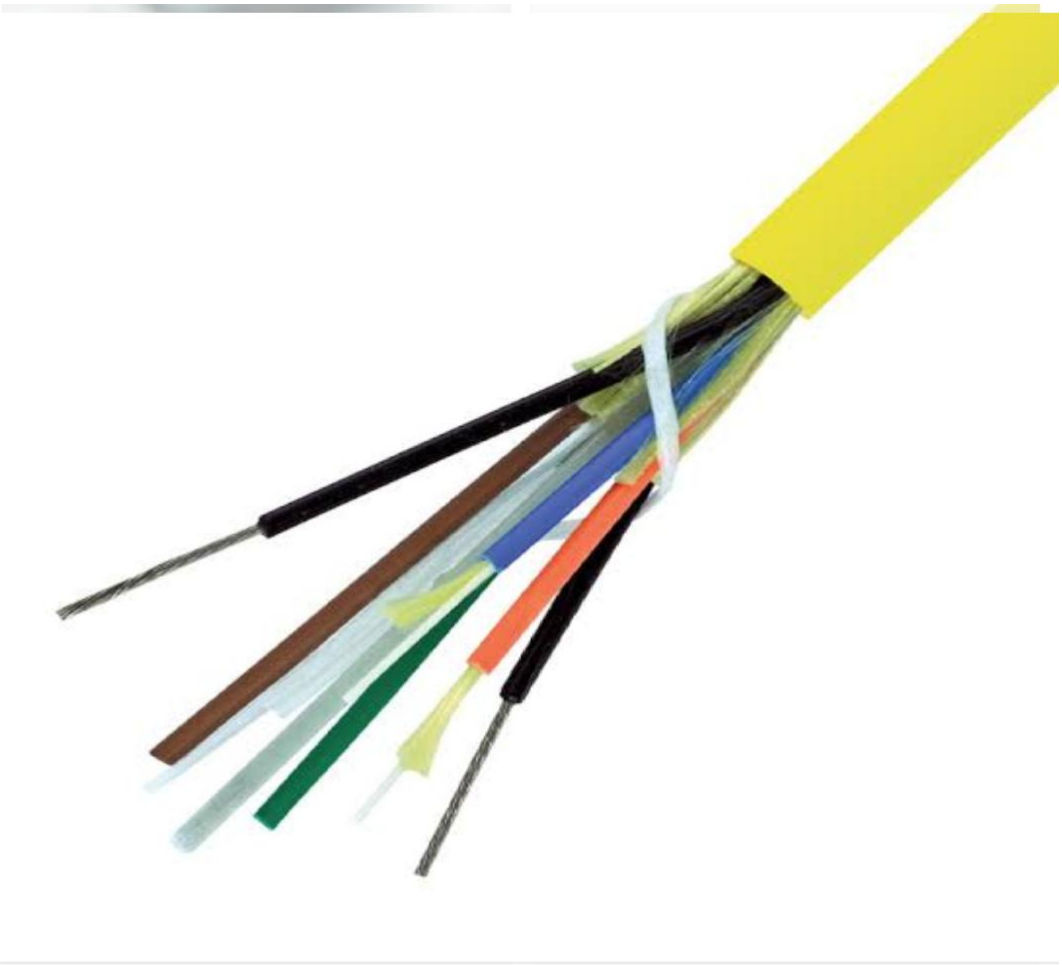

Figure:5. Copper/fiber hybrid composite cable

2.4. Hybrid Composite for Aerospace Application

Composite material can provide a much better strength-to-weight ratio than metals. Commercial aircraft applications are the most uses of hybrid composites. They are modern civil aircraft must be so designed as to meet the numerous criteria of power and safety. The lower weight result in lower fuel consumption and emission and because plastic structures need fewer riveted joint, enhance aerodynamic efficiency and lower manufacturing costs. Composite material played a major part in weight reduction, and today there 3 main type in uses: carbon fiber, glass and and amid-reinforced epoxy. there are other such as boron-reinforced. The use of composite-based component in space of metal as part of maintenance cycle is growing rapidly in commercial and leisure aviation. Overall, carbon fiber is the most widely used composite fiber in aerospace application. This required the optimization of the metal-matrix composite (MMCs) that had first been investigated at the beginning of the space race. These MMCs had to have the combined properties of high strength, high-temperature resistance, and low coefficient of thermal expansion (CTE) so the matrix material used with fiber glass and carbon fiber however, limits it

is use to low temperatures, usually below 121^0c, although it is not a debilitating limitation for the fiber, as it is properties can still be used and maintained at temperature beyond 426^0c to 482^0c. Fiber epoxy composite have been used in aircraft engine to enhance the performance of the system. The pilot cabin door has also made with hybrid resin composite and these are now used in other transport system.

In the second generation(1960s): High performance composite was used to producing Fiberglass-epoxy composite application ranging from printed circuit boards to Winchester shotgun barrels. The space race provided an impetus for the development of the carbon and boron fiber that had recently been discovered. The use of new stronger reinforcement fiber: carbon fiber were produced using rayon as the starting compound, high stiffness and strength of boron fiber they had developed. Boron also reacted with the metal matrix above about 600^0c,so coating had be devised before boron-reinforced MMCs become viable. A simple example of this tailoring would be for, say, HM CFRP, where the shear modulus for the layer is, 1/5 of that of aluminum alloy, but when built as an angle ply at $\#45^0$,is approximately double while at same time being only 2/3s as heavy. So it is important to realize that the use of composite required at integrated approach between user and designer/manufacturer to ensure functionality.

figure: 6. Sailplane Wing With Hybrid Composite

2.5. Wind Power Generation

The wind power engineering is a priority area of energy generation due to its resource saving and ecologically safe. The power cost primary is determine substantially by basic power element

blades. At present hybrid fiber, carbon glass are mainly used for fabrication of the blades shown as figure 7, whereas the works for reinforcing of epoxy matrices with basalt and other fiber are known. Basalt reinforcing element of a composite was prepared on basis of Georgian raw materials. The problems consist in a partial or total constitute of expensive carbon fiber in the material. The task of cost reduction may be solved through application of the less expensive materials in comparison with carbon fibers. For blades creation an application of new composite hybrid material is suggested on the basis of epoxy matrixes, strengthened by mullite-like crystal, as well as combination of high strength and high modulus basalt and carbon fiber in the material. An application of hybrid reinforcing fibers and of strengthened matrix will permit a considerable reduction of the blade cost without significant loss of physical mechanical properties of the material.

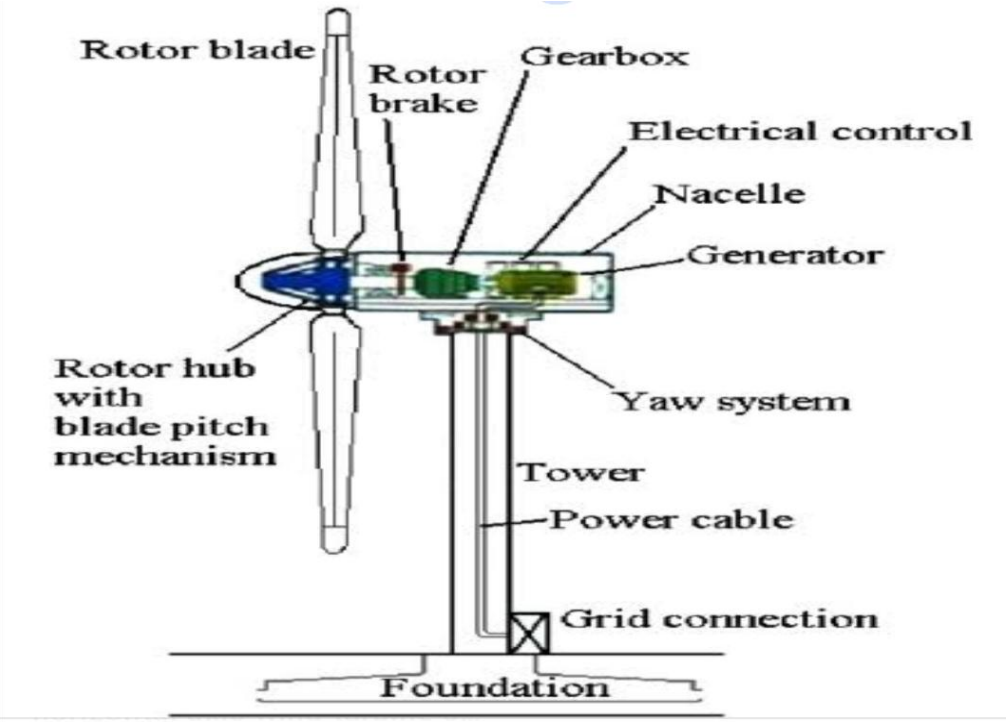

Figure :7. A Typical Horizontal Axis Wind Turbine

CONCLUSION

The following conclusions can be various applications of Hybrid Composites:

Firstly, the details of manufacturing process of hybrid laminates is provided as applicable to various industries such as transportation industry, aeronautics, naval, automotive industries and components for the electronic industry. Considerable efforts have been focused on the applications of Hybrid composites for better understanding of the phenomena associated to the cutting edge technology. As far as the material is concerned, glass and carbon fibre reinforced composites have been equally investigated; however, epoxy resin is preferred as the matrix material. An effort towards this literature on hybrid composites will throw some light on researchers and scientists pursuing work on hybrid composite technology.

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