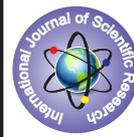


A review on hollow fiber composites as substitute Material formachineand structural Members



Engineering

KEYWORDS:

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ABSTRACT

Trucks, buses, automobiles and industrial equipment are negatively affected by the intrinsic weight, vibrational characteristics and critical speed of metal drive shafts. Laminated composite, circular cylindrical hollow shafts are used extensively as primary load-carrying structures in many applications under various loading configurations, due to their higher specific stiffness. Polymer matrix composites such as carbon/epoxy or glass/epoxy offer better fatigue characteristics, as micro cracks in the resin do not grow further like metals, but terminate at the holes of the fibers. The use of advanced composite materials for rehabilitation of deteriorating infrastructure has been embraced worldwide. The conventional techniques for strengthening of substandard bridges are costly, time consuming, and labor intensive. Many new techniques have used the lightweight, high strength, and the corrosion resistance of fiber reinforced polymers (FRP) laminates for repair and retrofit applications. The load-carrying capacity of a steel-concrete composite girder can be improved significantly by epoxy bonding carbon fiber reinforced polymers (CFRP) laminates to its tension flange. This paper presents the results of a study on the behavior of steel-concrete composite girders strengthened with CFRP sheets under static loading.

INTRODUCTION

Generally, composites have less susceptibility to the effects of stress concentration, such as those caused by notches and holes, than metals (Jones (1990) [1]. These composite materials are ideally suited for long, power drive-shaft applications (Shokrieh et al (2004). Composite drive shafts offer the potential of lighter and longer drive train with higher critical speed. Drive shafts as power transmission tubing, are used in many applications, including cooling towers, pumps, aerospace, trucks and automobiles. The first application of a composite drive shaft to an automotive was the one developed by the Ford econoline(1985) in Spicer U-joint divisions of Dana Corporation for van models. The use of advanced composite materials for rehabilitation of deteriorating infrastructure has been embraced worldwide. The conventional techniques for strengthening of substandard bridges are costly, time consuming, and labor intensive. Many new techniques have used the lightweight, high strength, and the corrosion resistance of fiber reinforced polymers (FRP) laminates for repair and retrofit applications. The load-carrying capacity of a steel-concrete composite girder can be improved significantly by epoxy bonding carbon fiber reinforced polymers (CFRP) laminates to its tension flange. This paper presents the results of a study on the behavior of steel-concrete composite girders strengthened with CFRP sheets under static loading.

Composite Shafts:

Studies on torsional response of cylindrical shaft are very limited. Some of that are mechanical analysis on cross ply or angle ply solely, increasing number of ply results more strong by stress re-distribution in sole angle ply, and study on inter-lamina shear response under torsion-compression combined loading. Thus, studies on torsional response of composite shaft, composed of angle ply together with other ply, is very seldom so far.

Under torsional load, cylindrical shaft put pure shear state on their wall. Generally such torque conveying shaft is mainly composed by paired angle ply, and then one side angle ply of 45 degree in laminate shaft will be compressed. Therefore over the certain load, initial failure will be occurred as some of the following: fiber buckling, inter-lamina separation or fiber splitting. To improve the static strength, we hit 90 degree hoop ply layout together with angle ply simultaneously. As a result, that composites tube has continuous spiral laminate structure. In this structure, the hoop ply will be expected to back angle ply and act as anti-backing reinforcement then suppress

the fracture of them.

Due to the physical geometry (larger radius) of the drive shafts used in the mentioned applications, including automotive applications, the shear strength which specifies the load carrying capacity, is of minor design importance since the failure mode is dominated by buckling; therefore, the main design factors are the bending natural frequency and the torsional buckling strength, which are functions of the longitudinal and hoop bending stiffness, respectively. The variable of the laminate thickness has a big effect on the buckling strength, and a slight effect on the bending natural frequency.

Advantages of polymer composites As Drive Shaft

The composite drive shaft has better Noise, Vibration and Harshness (NVH) characteristics when compared to the metallic one. The High Modulus Carbon-Epoxy composite drive shaft is considered in the design optimization study. The fundamental relationships of composite laminates are explained based on the lamination theory. The detailed mathematical model of the composite drive shaft considered for study, is presented.

Tarek Hassan and Sami Rizkalla, FASCE⁽³⁾ (2003) Strengthening of Steel-Concrete Composite Girders Using Carbon Fiber Reinforced Polymers Sheets undertook a study on the behavior of steel-concrete composite girders strengthened with CFRP sheets under static loading. A total of three large-scale composite girders made of W355x13.6 A36 steel beam and 75-mm thick by 910-mm wide concrete slab were prepared and tested. The thickness of the CFRP sheet was constant and a different number of layers of 1, 3, and 5 were used in the specimens. The test results showed that epoxy-bonded CFRP sheet increased the ultimate load-carrying capacity of steel-concrete composite girders and the behavior can be conservatively predicted by traditional methods.



SOLUTION METHOD

Both experimental and analytical investigations undertaken to evaluate bond characteristics of near surface mounted carbon FRP (CFRP) strips. A total of nine concrete beams, strengthened with near surface mounted CFRP strips were constructed and tested under monotonic static loading. Different embedment lengths were used to evaluate the development length needed for effective use of near surface mounted CFRP strips. A closed-form analytical solution is proposed to predict the interfacial shear stresses. The model is validated by comparing the predicted values with test results as well as nonlinear finite element modeling. A quantitative criterion governing the debonding failure of near surface mounted CFRP strips is established. The influence of various parameters including internal steel reinforcement ratio, concrete compressive strength, and groove width is discussed.

sthash.jFfmV(2004)in his review on A review of polymer/carbon nano tube composites viewed that carbon nanotube/polymer composites. Carbon nano tubes are promising new materials for blending with polymers with potential to obtain low-weight nano composites of extraordinary mechanical, electrical, thermal and multifunctional properties. The size scale, aspect ratio and properties of nanotubes provide advantages in a variety of applications, including electrostatically dissipative materials; advanced materials with combined stiffness, strength and impact for aerospace or sporting goods; composite mirrors; automotive parts that require electrostatic painting and automotive components with enhanced mechanical properties. The various processing methods for producing these nano composites are discussed, in particular melt mixing, solution processing and in-situ polymerization. Some key results are summarized, relating to the mechanical, electrical, thermal, optical and surface properties. Finally, the challenges for the future are discussed in terms of processing, characterization, nanotube availability, nanotube constructed tailoring, and the mechanisms governing the behavior of these remarkable nanoscale composites.

Table 1. Mechanical Properties and Prices of Typical Graphite Fiber*.

Material Name	PAN/Pitch	Density lbs/in ³	Tensile Kpsi	Modulus Kpsi	Price/ Pound
T-300	PAN	0.064	530	33.5	\$ 23
T-650/92	PAN	0.064	730	42.0	\$ 50
T-40	PAN	0.065	820	42.0	\$ 59
T-50	PAN	0.065	420	57.0	\$ 90
T-1000G	PAN	0.065	924	42.7	\$ 75
P-55S	Pitch	0.072	275	55.0	\$ 52
P-75S	Pitch	0.072	300	75.0	\$ 385
P-120	Pitch	0.079	350	120	\$ 800
K-1100	Pitch		350-550	130	\$ 1,750

COMPOSITE STRUCTURES:

ZUSAMMENFASSUNG^[4](2008) IN HIS STUDY ON Composite filled hollow structure, constructed a fence post, with a hollow member filled with a core to increase its strength. One aspect of the structure is that the core material normal expands upon setting, so that, when hardening within the hollow member, the expansion is restrained by the hollow member and the core is formed into an integral structure with the hollow member. Further strength is added by constructing the hollow member of reinforced fiberglass with the fiberglass ravings oriented at an angle to the axis of the pipe and by using a hard coating on the outside of the pipe. He finally concluded that composite filling further strengthens the hollow structures.

Table 2. Driveshaft Comparisons

Percentages	Carbon Fiber Steel	Aluminum	Titanium
Tube Weight	100%		

Rotational	100%			
Inertia	100%			
Lateral	100%			
Stiffness	100%			
Spring Rate	100%			
Critical Speed	100%			

BESCHREIBUNG^[12](1992)

In his work constructed pole 10 is essentially based upon the filling of pipe 14 with core 12, but core 12 has unique properties which produce a non-metallic pole with strength equivalent to that of steel poles. Core 12 is a gypsum based product with the important characteristic of normally expanding as it hardens. It is important that the core material normally expand in order that it have a permanent positive stress and produce a force fit with exterior pipe 14. It is also vital that the hardened core have significant strength, which is best indicated by a compressive strength rating of at least 1500 psi, so that it adds significant strength to the structure and does not act to merely fill the interior space of the pipe. The structural strength of the hardened core must, however, be less than the structural strength of pipe 14 in order to prevent the forces produced by the attempted expansion during hardening of core 12 from distorting and weakening pipe 14 as it restrains the expansion of core 12.

In the preferred embodiment, cylindrical pipe 14 has a two inch outer diameter with 0.080 inch wall thickness and is constructed with a standard isohalic polyester resin base reinforced with fiberglass rovings throughout its entire thickness. Such a material has a tensile strength of at least 30,000 psi. Added bending strength can be attained if the significant portion of the fiberglass rovings are oriented to be at an angle of approximately 45 degrees to the axis of the pole.

ANSPRÜCHE^[5] (2009) WORKED ON SRENGTH ENHANCEMENT DUE TO FILLING OF HOLLOW STRUCTURE WITH FIBER REINFORCED COMPOSITES. HE filled structure characterized by the combination of high compressive strength and tensile strength to allow a high bending load experimented on a glass fiber reinforced hollow structure having glass fiber rolings throughout an entire thickness thereof and angled with respect to a longitudinal axis thereof so as to have a tensile strength of at least 30,000 psi and having an inside surface forming a boundary which encloses a space and concluded that Filled structure characterized by the combination of high compressive strength and tensile strength to allow a high bending load.

CONCLUSION

Carbon fiber drive shafts can be used today to enhance the profitability of trucking operations. They will reduce drivetrain vibrations, thereby reducing wear and tear in driveline and other components. In light trucks and cars carbon fiber drive shafts will reduce noise, vibration, and harshness of ride, providing greater driver comfort. They can also raise current driveshaft-limited top speeds in certain performance automobiles.

These conclusions have been proven in industrial, aerospace applications.

REFERENCES

- 1.N. Kimoto, M. Okochi, N. Matsumoto, T. Nakamura * Research & Development Division, Fujikura Rubber Ltd., Saitama, JAPAN 18th INTERNATIONAL CONFERENCE ON COMPOSITE MATERIALS 2. Strengthening of Steel-Concrete Composite Girders Using Carbon Fiber Reinforced Polymers Sheets
- 2.M. Tavakkolizadeh, M.ASCE; and H. Saadatmanesh, M.ASC(2003)
3. Investigation of Bond in Concrete Structures Strengthened with Near Surface Mounted Carbon Fiber Reinforced Polymer Strips Tarek Hassan and Sami Rizkalla, F.ASCE(2003)
4. Composite filled hollow structure US 5770276

AZUSAMMENFASSUNG(2008)

5.ANSPRÜCHE(2009) Filled structure characterized by the combination of high compressive strength and tensile strength to allow a high bending load, the filled structure comprises;

6. Review of Design of hybrid aluminum/ composite drive shaft for automobile Bushan K. Suryawanshi, G. Damle International journal of Innovative Technology and Exploring Engineering ISSN:2278-3075, vol-2, issue-4, March-2013

7. J.H.Park, J.H.Hwang, C.S.Lee, W.Hwang, 2001, "Stacking Sequence Design of Composite Laminates for Maximum Strength Using Genetic Algorithms", Journal of Composite Structures, Vol.52, pp217-231.

8. Materials science Vol.11, no.2,2005.

9.Abolmaali et al (2004 b). "Stiffness Characteristics of Closed Circuit Television Camera FRP Poles."Proceedings of the 84th Transportation Research Board Conference, January 9-13, on CD Rom.

10. Jin Kook Kim, Dai GilLee, and Durk Hyun Cho, 2001, "Investigation of Adhesively Bonded Joints for Composite Propeller shafts", Journal of Composite Materials, Vol.35, No.11, pp.999-1021.

11. Jones R.M. 1990 Mechanics of composite materials Mc Graw-hill book co. NY

12.BESCHREIBUNG

This is a continuation of application Ser. No. 07/915,315, filed Jul. 20, 1992 now abandoned.