Analysis and Design of Glass Fiber Plates for Weir Gate

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Abstract- ***Glass fibers are formed from melts and manufactured in various compositions by changing the amount of raw materials like sand for silica, clay for alumina, calcite for calcium oxide, and colemanite for boron oxide. Therefore, different types of glass fibers show different performances like alkali resistance or high mechanical properties using various amounts of silica or other sources. Glass fiber products are classified according to the type of composite at which they are utilized. Moreover, chopped strands, direct draw rovings, assembled rovings, and mats are the most important products that are used in the injection molding, filament winding, pultrusion, sheet molding, and hand layup processes to form glass fiber-reinforced composites. Protection of the glass fiber filaments from breakage or disintegration is an important issue either during manufacturing of glass fiber or during composite production. Applying sizing agent to the glass fiber during manufacturing of fibers causes lubrication of the glass fiber filaments in addition to inhibit static electricity accumulation, adhesion of the fiber filaments together, and adhesion between fiber filaments and polymer matrix of the composites. During manufacturing of composites, an interphase layer, at which interpenetration of the sizing to the matrix or diffusion of the matrix polymer to the sizing, is formed. The resultant interphase layer can either increase or decrease the performance of the composite considering harmony between sizing components and matrix polymer. Compatibility between sizing and matrix polymer enhances high mechanical properties and on the contrary incompatible sizing results poor mechanical properties. From energy point of view, reduction in the weight of vehicles is the main reason to save energy in the transportation industry, and in this regard growth in the production of lightweight cars to about 50% indicates importance of the glass fiber-reinforced composites. Consequently, growth in the glass fiber production is what that happened and will be continued in the future.***

I. INTRODUCTION

Glassmakers throughout history have experimented with glass fibers, but mass manufacture of glass fiber was only made possible with the invention of finer machine tooling. In 1893, Edward Drummond Libbey exhibited a dress at the World's Columbian Exposition incorporating glass fibers with the diameter and texture of silk fibers. Glass fibers can also occur naturally, as Pele's hair.

Glass fiber has roughly comparable mechanical properties to other fibers such as polymers and carbon fiber. Although not as rigid as carbon fiber, it is much cheaper and significantly less brittle when used in composites. Glass fibers are therefore used as a reinforcing agent for many polymer products; to form a very strong and relatively lightweight fiber-reinforced polymer (FRP) composite material called glass-reinforced plastic (GRP), also popularly known as "fiberglass". Unlike glass wool, GRP contains little or no air or gas, is more dense, and thus is a poor thermal insulator compared to glass wool; it is instead used structurally due to its strength and relatively low weight.

II. PROBLEM STATEMENT

- River Bridge under plates are used for blocking the water for storage purpose. This plate is made up of MildSteel and hence it is very difficult to handle.
- The weight of this plate is more, also working

condition is in under water and the plate may be exposed forcorrosion as shown in fig 1. hence the life of plate decreases and its less durable,

- Transportation problem with these MS plates.

For solving this entire problem, we need to change the material of the plate and find the best material for the plate which provides us a more strength and light weight in nature.

III. PROPERTIES: TYPES OF FIBER GLASS USED

- Composition:

The most common types of glass fiber used in fiberglass is E-glass, which is alumino-borosilicate glass with less than 1% w/w alkali oxides, mainly used for glass-reinforced plastics. Other types ofglass used are A-glass (Alkali-lime glass with little or no boron oxide), E-CR-glass (Electrical/Chemical Resistance; alumino-lime silicate with less than 1% w/w alkali oxides, with high acid resistance), C-glass (alkali-lime glass with high boron oxide content, used for glass staple fibers and insulation), D-glass (borosilicate glass, named for its low Dielectric constant), R-glass (alumino silicate glass without MgO and CaO with high mechanical requirements as Reinforcement), and S-glass (alumino silicate glass without CaO but with high MgO contentwith high tensile strength).

Material	Specificgravity	trength MPa(ksi)	ressive strengthMPa (ksi)
Polyester resin (Not reinforced)	1.28	55 (7.98)	140 (20.3)
Polyester and Chopped Strand Mat Laminate 30% E-glass	1.4	100 (14.5)	150 (21.8)
Polyester and Woven Rovings Laminate45% E-glass	1.6	250 (36.3)	150 (21.8)
Polyester and Satin Weave Cloth Laminate 55% E-glass	1.7	300 (43.5)	250 (36.3)
Polyester and Continuous Rovings Laminate 70% E-glass	1.9	800 (116)	350 (50.8)
E-Glass Epoxy composite	1.99	1,770 (257)	
S-Glass Epoxy composite	1.95	2,358 (342)	

IV. PROPERTIES OF STEEL AND E-GLASS FIBER PLATE:

Sr. no.	Description	Steel plate	E-Glass fiber plate
1.	Density	7932 kg/m3	2.54 gm/cm3
2.	Tensile strength	400 MPA	3448 MPA
3.	Young's modulus	200 GPA	72.4 GPA
4.	Corrosion	More	No corrosion
5.	Erosion	More	Less
6.	Durability	5-6 years	More than 50 years
7.	Initial cost	Less expensive	More expensive

8.	Maintenance cost	More	Less
9.	Manpower	More	Less
10.	Weight	Heavy weight	Light weight
11.	Poisions ratio	0.29	0.21
12.	Thermal expansion	10.4×10-6/°c	5×10-6/°c

Following are the major concluded points:

- Density of E-glass fiber plate is less than steel plate therefore glass fiber plate comparatively light in weight than steel plate and hence glass fiber plate requires lessmanpower to handle it.
- Tensile strength of E-glass fiber plate is more than steel plate hence it can carry maximum water pressure than steel plate.
- Young's modulus of glass fiber plate is comparatively less than steel plate but its strength ismore than steel plate.
- E- Glass fiber plate is highly corrosion resistance and hence it is more durable than steelplate.
- Due to highly corrosive nature of steel plates, it causes more erosion and water losses indams.
- Initial cost of E-glass fiber plate comparatively more than steel plate but maintenance costis less than steel plate.

CONCLUSION

As per our research and test results we conclude E-Glass Fibre plate have better result on the basis of strength, durability, corrosion resistant nature, and maintenance cost as compare to steelplate while using this plate as a gate in dams.

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