Implementation of Fiber Reinforced Plastic In Concrete And Comparison of Test Results

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Abstract- *The report presents general characteristics of concretes and reinforced concretes, their classification, grading and designations.*

Definition of structure in homogeneity in these materials and its effect on service characteristics are given.

The report contains classification and mechanical properties of concrete reinforcement as well.

Concretes are conglomerates formed through the solidification of a mix of cement solution, water, fillers, and modifying additions, if needed A wide diversity of binding cement materials and concrete fillers (aggregates) as well as physical and mechanical characteristics of the concrete components significantly complicates the development of generalized microstructure models and strength theories for concrete

In addition, the character of fiber-reinforced concrete changes with varying concretes, fiber materials, geometries, distribution, orientation, and densities.

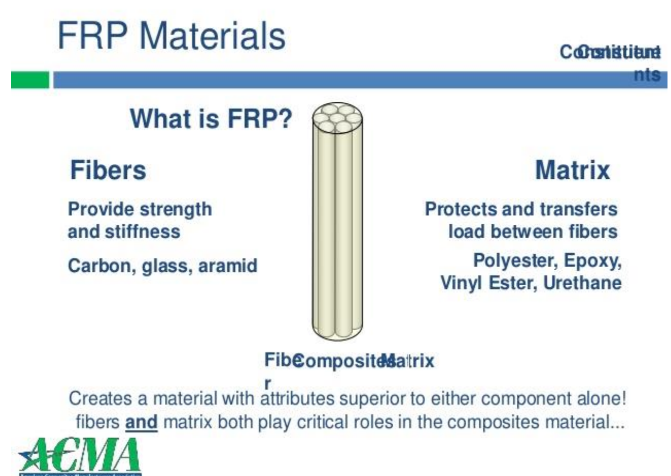
FRP (Fiber Reinforced Polymers) material is a type of composite material that is increasingly used in the construction industry in recent years. Due to their light weight, high tensile strength, and corrosion resistance and easy to implementation makes these material preferred solutions for strengthening method of reinforced concrete structural elements. In this study it is aimed to discuss advantages of FRP usage as a composite material. It is noted that the mechanical properties of these materials shows a useful behavior for strengthened theoretically to satisfy safe cross-section with FRP materials.

The amount of fibers added to concrete mix is expressed as a percentage of the total volume of the composite (concrete and fibers), termed "volume fraction" (Vf). Vf typically ranges from 0.1 to 3%.

Keywords- FRP, concrete fillers, microstructure models, corrosion resistance.

I. INTRODUCTION

The reinforced plastic materials constitute a very large special section of the plastic industry. Most of the increased use of reinforced plastics and composite materials in the near future will be in their traditional markets as workhouse components of transportation vehicles housing, bathrooms, tool components and ultra high strength parts. It is expected that these materials will be used for more extensively in the housing industry viz. stair treads and risers, window and door casements, wall panels, flooring, rooting etc. It is evident that India lags far behind as far as usage of FRP is consumed. Large-scale growth of S.M.C./D.M.C./B.M.C. are expected because of recent applications of FRP in the automotive construction, railways defense electrical/ electronics, textile renewable energy sectors in India. The industry is bestowed with bright prospects in future. The new comers can well venture into this field



Fig(1) : Structure Of FRP

II. HISTORY OF FIBER REINFORCED PLASTIC

Fiber Reinforced Plastic (FRP) products were first used to reinforce concrete structures in the mid 1950s

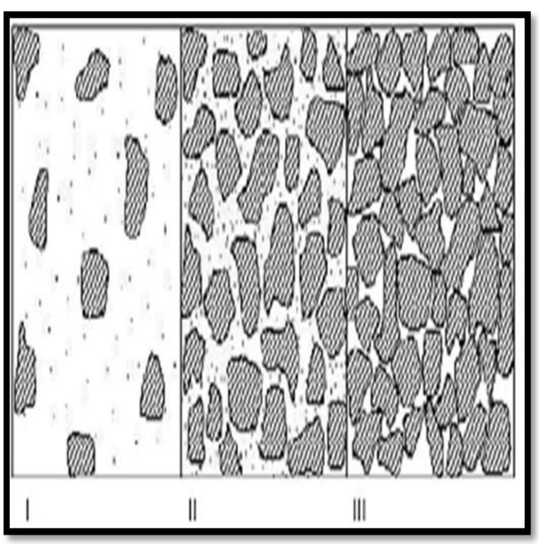
(Rubinsky and Rubinsky 1954; Wines 1966). Today, these FRP products take the form of bars, cables, 2-D and 3-D grids, sheet materials, plates, etc. FRP products may achieve the same or better reinforcement objective of commonly used metallic products such as steel reinforcing bars, prestressing tendons and bonded plates. Application and product development efforts in FRP composites are widespread to address the many opportunities for reinforcing concrete members
(Nichols 1988).

The concept of using fibers as reinforcement is not new .Fibers have been used as reinforcement since ancient times. In the 1950s the concept of composite materials came into being and fiber reinforcement concrete was one of the topic of interest . The practice of adding certain fibers to construction material dates back to the ancient times. When horse hair, straws were used to strengthen the bricks. In 1911 Porter found that fiber could be used in concrete. Early 1900 saw the use of asbestos fiber.

III. HISTORY OF FIBER REINFORCED PLASTIC

Fibers are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage .They also reduce the permeability of concrete and thus reduce bleeding of water

Some recent research indicated that using fibers in concrete has limited effect on the impact resistance of the materials .

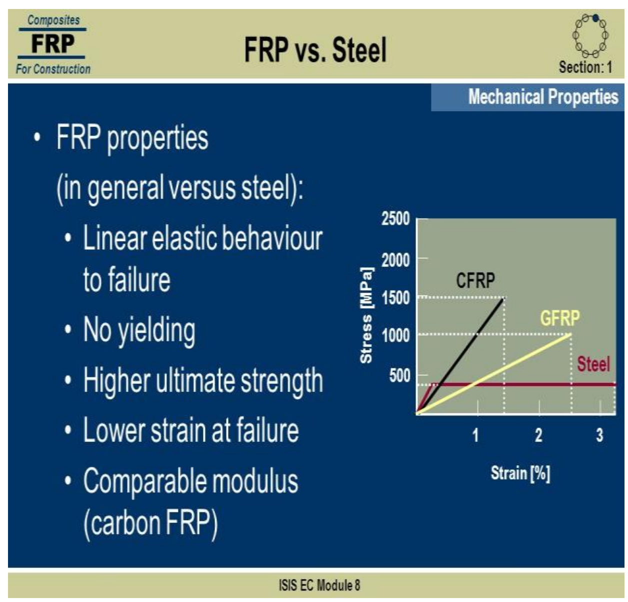


Fig(2) : Bonding In Concrete Particles

Effects of fiber length on laminate properties—Fiber placement can be affected with both continuous and short fibers. Aside from the structural implications noted earlier in this chapter, there may be part or process constraints, which impose choice limitations on designers. The alternatives in these cases may require changes in composite part cross section area or shape. Variables in continuous-fiber manufacture, as well as in considerations in part fabrication, make it impossible to obtain equally stressed fibers throughout their length without resorting to extraordinary measures.

Bonding interphase—Fiber composites are able to withstand higher stresses than can their constituent materials because the matrix and fibers interact to redistribute the stresses of external loads. How well the stresses are distributed internally within the composite structure depends on the nature and efficiency of the bonding. Both chemical and mechanical processes are thought to be operational in any given structural situation. Coupling agents are used to improve the chemical bond between reinforcement and matrix since the fiber-matrix interface is frequently in a state of shear when the composite is under load.

IV. COMPARISON BETWEEN STEEL AND FRP



Fig(3) : Stress Strain Diagram For FRP

V. IMPLEMENTATION OF FRP IN CONCRETE

MATERIALS USED

- Cement.
- Coarse Aggregate.
- Fine Aggregate.
- Water.
- PVC Pipes.
- Bitumen.

- Binding Wire.

CONCRETE MIX DESIGN

- Grade Designation – M20
- Cement – PPC ()
- Fine Aggregate – Zone 2 ()
- Max. Nominal Size Of Aggregates – 20MM
- Max. W/C Ratio – 0.55
- Type Of Aggregate – Crushed Angular

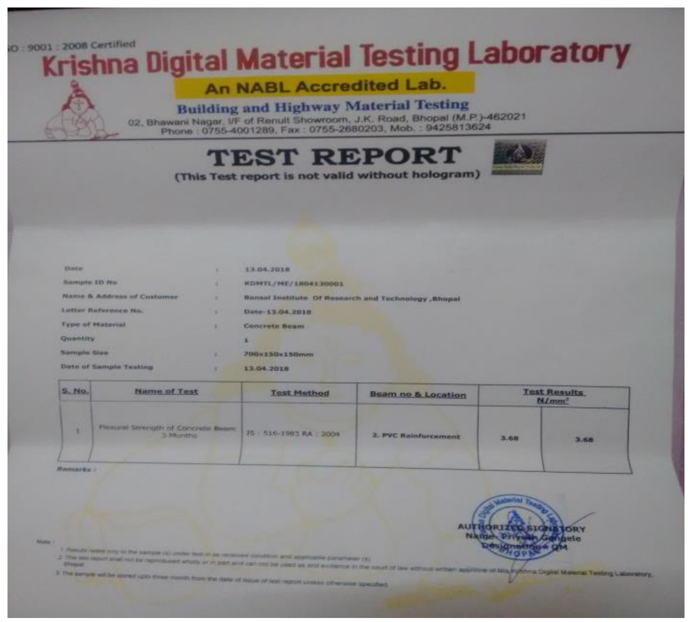
- Beam with steel reinforcement.
- Beam with PVC (hollow) reinforcement.
- 3. Beam with PVC (filled in bitumen) reinforcement.
  And test reports are based on their curing period.

VI. TESTING OF SAMPLES

PREPARATION OF SPECIMEN

- Moulds: Standard beam moulds for producing hardened concrete specimens, of non absorbent, rigid material, not chemically attacked by cement paste, of a size 150 mm × 150 mm × 700 mm.
- Calipers, capable of reading the dimensions of test specimens to an accuracy of 0.1 mm.
- Flexure strength testing machine. Testing machine that shall meet the machine Class 1 requirements in EN 12390-4, capable of operating in a (closed-loop) controlled manner, i.e., producing a constant rate of displacement (deflection), and with sufficient stiffness to avoid unstable zones in the load deflection curve.
- Rule (ruler/scale), capable of reading the dimensions of test specimens to an accuracy of 1 mm.

VII. REVIEW OF TEST RESULTS



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TEST REPORT

(This Test report is not valid without hologram)

Date : 13.04.2018
Sample ID No : KDMTL/ME/1804130001
Name & Address of Customer : Bansal Institute Of Research and Technology ,Bhopal
Letter Reference No. : Date-13.04.2018
Type of Material : Concrete Beam
Quantity : 1
Sample Size : 700x150x150mm
Date of Sample Testing : 13.04.2018

S. No.	Name of Test	Test Method	Beam no & Location	Test Results N/mm²	
1	Flexural Strength of Concrete Beam 3 Months	IS : 516-1983 RA : 2004	2. PVC Rainforcement	3.68	3.68

Remarks :

AUTHORIZED SIGNATORY
Name- Priyam Gangele
Designation- QM

Test Results For I Sample

ISO : 9001 : 2008 Certified

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Date : 13.04.2018
Sample ID No : KDMTL/ME/1804130001
Name & Address of Customer : Bansal Institute Of Research and Technology ,Bhopal
Letter Reference No. : Date-13.04.2018
Type of Material : Concrete Beam
Quantity 2
Sample Size : 700x150x150mm
Date of Sample Testing : 13.04.2018

S. No.	Name of Test	Test Method	Beam no & Location	Test Results N/mm²	
1	Flexural Strength of Concrete Beam 7 Days	IS : 516-1983 RA : 2004	1. Reinforcement	17.23	11.68
			2. PVC with Bitumen Reinforcement	6.12	

Remarks :

AUTHORIZED SIGNATORY
Name- Priyesh Gangele
Designation

Note :
1 [illegible]
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Test Results For II Sample

VIII. CONCLUSION

Fibre reinforced plastics (FRP) have been widely accepted as materials for structural and non-structural applications in recent years. Interest in FRP for structural applications is due to the high specific modulus and strength of the reinforcing fibres. Glass, carbon, kevlar and boron fibres are commonly used for reinforcement. However, these are neither renewable nor biodegradable. In fact, the use of carbon and kevlar is limited mainly to aerospace applications due to their very high cost. Although glass fibres are strong, relatively easy to manufacture, and less expensive than other synthetics, they have many disadvantages. 'They are very abrasive, cause wear in processing machines and could present a health hazard to those working with them. This is where natural fibres come into play.

Thermoplastic composite materials are becoming a viable alternative to steel and aluminium for use in semi-structural applications in the automotive industry. The aim of this work was to develop a natural fiber reinforced thermoplastic composite, namely KLFRT,SLFRT,JLFRT and to use the results for the design and test of a structural crashworthy component.

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