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Performance Evaluation of Basalt Fiber Concrete

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Abstract— *This paper present the art of knowledge of basalt fiber, it is relatively new material. Basalt fiber is a high performance non-metallic fiber made from basalt rock melted at high temperature. Basalt fiber reinforced concrete offers more Characteristics such as light weight, good fire resistance and strength. In future it is very beneficial for construction industry. Many applications of basalt fiber are residential, industrial, highway and bridges etc. In this study trial test for concrete with basalt fiber and without basalt fiber are conducted to show the difference in compressive strength and flexural strength by using cubes and concrete beams. Various application of BFRC shown in the study, the experimental test result, Techno-financial comparison with other type presented, indicate the tremendous potential of BFRC as an alternative construction material. Experimental investigation on basalt concrete has been carried out to evaluate properties of basalt fiber concrete. The testing carried out on 24 concrete cubes (150mmX150mmX150mm) for compressive strength, 12 numbers of cylinders (150mmX300mm) was tested for split tensile test and 4 numbers of beams was tested for flexural strength for different percentage of fiber like 0, 0.25%, 0.50%, and 0.75%. From the entire study it can be concluded that Use Basalt fiber in concrete is an effective technique to enhance performance of concrete. As basalt rock is available in India abundantly the use of basalt fibers in concrete for civil infrastructure provides a good solution at lower cost of basalt fiber.*

Key Words: **Basalt Fiber, Basalt concrete, Compressive, Flexure, Split Tensile, Strength.**

1. Introduction

Industry is always trying to find new, better and economical material to manufacture new product, WHICH is very beneficial to the industry. Today a significant growth is observed in the manufacture of composite material. With this in mind energy conservation, corrosion risk, the sustainability and environment are important when a product is changed or new product is manufactures.

Basalt fiber is a high performance non-metallic fiber made from basalt rock melted at high temperature. Basalt rock can also make basalt rock, chopped basalt fiber, basalt fabrics and continous filament wire.

Basalt fiber originates from volcanic magma and volcanoes, a very hot fluid or semi fluid material under the earth's crust, solidified in the open air. Basalt is a common term used for a variety of volcanic rock, which are gray dark in colour. The molten rock is then extruded through small nozzles to produce continuous filaments of basalt fiber. The basalt fibers do not contain any other additives in a single producing process, which gives additional advantage in cost. Basalt rock fibers have no toxic reaction with air or water, are non combustible and explosion proof. When in contact with other chemicals they produce no chemical reaction that may damage health or the environment.

2. LITERATURE REVIEW

Basalt is defined by its mineral content and texture, and physical descriptions without mineralogical context may be unreliable in some circumstances. Basalt is usually grey to black in colour, but rapidly weathers to brown or rust-red due to oxidation of its mafic (iron-rich) minerals into rust. Although usually characterized as "dark", basaltic rocks exhibit a wide range of shading due to regional geochemical processes. Due to weathering or high concentrations of plagioclase, some basalt rocks are quite light coloured, superficially resembling rhyolite to untrained eyes.

3. PROPERTIES OF BASALT FIBER

3.1 Physical Properties

Color :- It is available in golden brown in color.

Diameter:- It is available in different diameter like 5.8 micron.

Length:- Available in 6mm,8mm,12mm etc.

Density:- density of basalt fiber is 2.75 g/cm^3

Coefficient of friction:- The coefficient of friction may be between 0.42 to 0.50.

3.2 Chemical Properties

- Basalts are more stable in strong alkalis.
- Weight loss in boiling water, Alkali and acid is also significantly lower.
- Possess resistance to UV- Light & biologic and fungal contamination.
- Are compatible with phenolic resins.
- Absorption of humidity comes to less.

3.3 Thermal Properties

With a thermal range of –260 ◦C to 982 ◦C and melt point of 1450◦C as well as low thermal conductivity 0.031 – 0.038w/mk, the basalt fibers are ideal for fire protection and insulation applications. Basalt fibers are most cost effective than the other high-temper Materials including E-glass, silica, ceramics, stainless steel etc.

3.4 Mechanical Properties

- The specific tenacity (rupture stress to density ratio) of basalt fibers exceeds that of steel, many times.
- Basalt fibers are non-capillary and non-hygroscopic, giving good moisture resistance.
- Basalt has shot content generally less than 3%.

4. OBJECTIVES OF THE STUDY

1. Study the design aspects of the BFRC.

2. Understand the various applications involving BFRC.

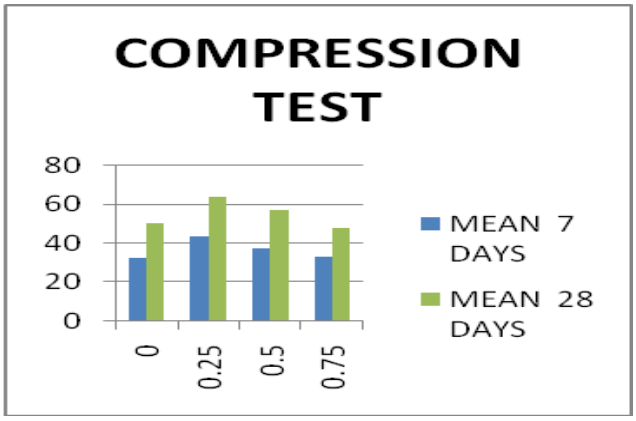
3. Perform laboratory test that are related to compressive, tensile and flexure by use of basalt fiber in the concrete.

5. TEST RESULTS AND OBSERVATIONS

This paper presents an experimental investigation that was carried out to evaluate the performance characteristics of basalt fiber reinforced concrete cubes, beams, and cylinder. The basalt fibers were supplied by Muktagiri industrial corporation Borivali, Mumbai. The primary objective of this investigation was to determine the strength of the basalt fiber in concrete and to compare the experimentally determined ultimate strength capacity of basalt fiber reinforced concrete cubes, beams, cylinder etc. and their calculated ultimate strength capacities according to IS 516:1959, ASTM 790-1, IS 5816:1999 methods of tests for strength of concrete.

Table 1: Compressive Strength of Specimen after 28 days in Mpa

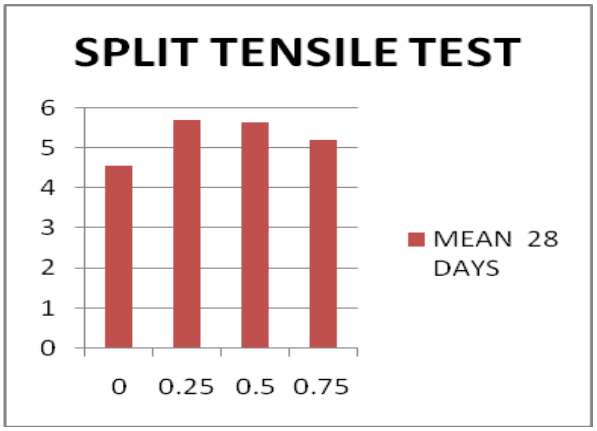
Specimen No	% of basalt fiber	Compressive strength at (28) days Mpa
1	0	49.98
2	0.25	65.51
3	0.50	56.64
4	0.75	47.93



Graph 1 Compressive test

Table 2: Split Tensile Strength after 28 days in Mpa

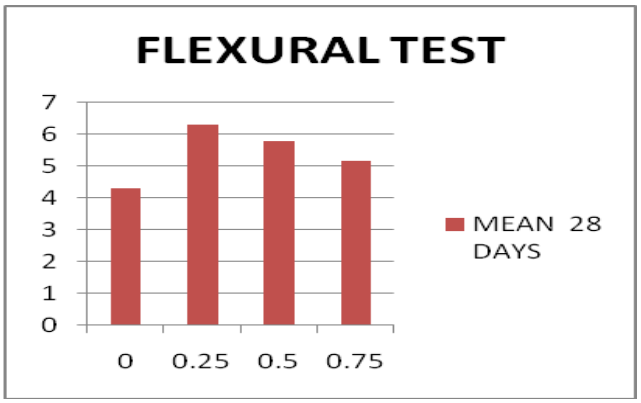
Specimen No	% of basalt fiber	Split Tensile strength at (28) days Mpa
1	0	4.565
2	0.25	5.70
3	0.50	5.64
4	0.75	5.21



Graph 2: Split tensile test

Table 3: Flexure Strength of Specimen after 28 days in Mpa

Specimen No	% of basalt fiber	Split Tensile strength at (28) days Mpa
1	0	4.3
2	0.25	6.3
3	0.50	5.8
4	0.75	5.16



Graph 3: Flexural test

6. DISCUSSION

1. As seen from tables, the 28 days average compressive, flexural, split tensile strength is maximum when 2% fiber is used. About 20% to 30% increase in strength is observed.

2. One should take care of basalt fiber during mixing with concrete. It should be not allowed to mix more than 1.5 minute, otherwise it will segregate.

3. The basalt fibers are added in the concrete before adding of water, otherwise it will stick at surface.

7. CONCLUSION

Based on the above mentioned tests it is concluded that basalt fibers of great interest for the building industry. The benefit of using fiber is that it is non-corrosive. The strength is very good. The heat resistance power is very good which is extremely important for every building.

8. REFRENCES

- ✓ IS 456-2000, "Code of practice for Plain and reinforced Concrete", Bureau of Indian Standards, New Delhi, India, 1999.
- ✓ IS 516(1959), "Indian standard methods of tests for strength of concrete", Bureau of Indian Standards, New Delhi, India.
- ✓ IS 10262-2009, "Recommended Guidelines for Concrete Mix Designs", Bureau of Indian Standards, New Delhi, India.
- ✓ Matthys S.,2005 "Axial load behaviors of large scale columns confined with fibre-Reinforced polymer composite" ACI Structural journal , Volume 102 page no.258
- ✓ Patnaik A.K., and Puli, R.K., "Preliminary Studies on the use of Basalt FRP for Strengthening Reinforced Concrete Beams", ICFRC International Conference: Edited by V.S. Parameswaran, January, Chennai, India, 2004, pp. 375-385.
- ✓ Sheldon G. L., "Forming Fibres from Basalt Rock", Platinum Metals Rev., 1977, 21, (1).
- ✓ Vladimir Brik, V. Ramakrishnan and Neeraj Tolmare, "Performance Evaluation of 3-D Basalt Fibre Reinforced Concrete & Basalt Rod Reinforced Concrete", IDEA Program Final Report, Contract No. NCHRP-45, November 1998.