

Basalt Fiber Reinforced 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.

Keywords: Basalt fiber, cubes, beam, concrete, flexural capacity.

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.

Basalt fiber has good hardness and thermal properties. Basalt fibers have been successfully used for foundation such as slabs on ground concrete.[4-6]

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.

Basalt has a fine-grained mineral texture due to the molten rock cooling too quickly for large mineral crystals to grow, although it is often porphyritic, containing the larger crystals formed prior to the extrusion that brought the lava to the surface, embedded in a finer-grained matrix.



Figure 1.1: Basalt fiber

3. Properties of Basalt Fiber

a) 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/cm³

Coefficient of friction:- The coefficient of friction may be between 0.42 to 0.50[1].

b) 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[1].

c) 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 and carbony preventing rapid overheating and improving brake life. Offer three times the thermal efficiency of asbestos with no Mental and heat hazards. Basalt fiber is the best solution for asbestos replacement. Basalt fiber is non- combustible and explosion proof. After exposition less than 400 °C the basalt fibers loss on their initial strength, while the E-glass loss more 50%[1].

d) 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%[1].

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 Result and Observation

This paper presents an experimental investigation that was carried out to evaluate the performance characteristics of basalt fiber reinforced concrete beams. 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 moment capacity of basalt fiber reinforced concrete beams, and their calculated ultimate moment capacities according to IS 516:1959 methods of tests for strength of concrete. The chemical tests are also carried on the basalt fiber to check their strength and stability with effect on their physical properties[3].

Test Result

Table 1: Flexural Strength of Specimen after 14 days IN N/mm²

Specimen no.	% of basalt fiber	Flexural strength (14) days N/mm ²	Average strength in N/mm ²
1	1 %	3.2	
2	1 %	3.28	3.12
3	1 %	2.90	
Specimen no.	% of basalt fiber	Flexural strength (14) days	Average strength in N/mm ²
1	2%	4.44	
2	2%	4.62	4.80
3	2%	5.3	

Table 2: Flexural Strength of Specimen after 14 Days IN N/mm²

Specimen no.	% of basalt fiber	Flexural strength (28) days	Average strength in N/mm ²
1	1 %	3.75	
2	1 %	3.55	3.5

Specimen no.	% of basalt fiber	Flexural strength (28) days	Average strength in N/mm ²
1	2%	5.70	
2	2%	5.80	5.90
3	2%	6.0	

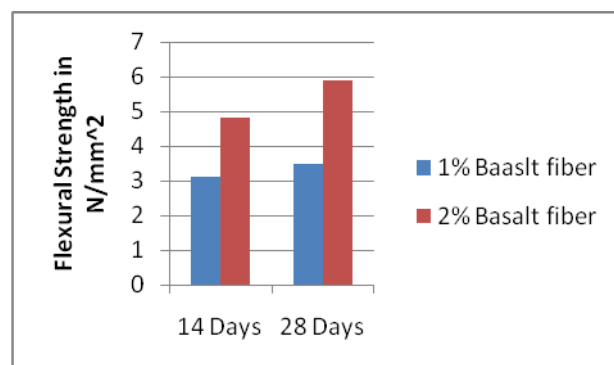
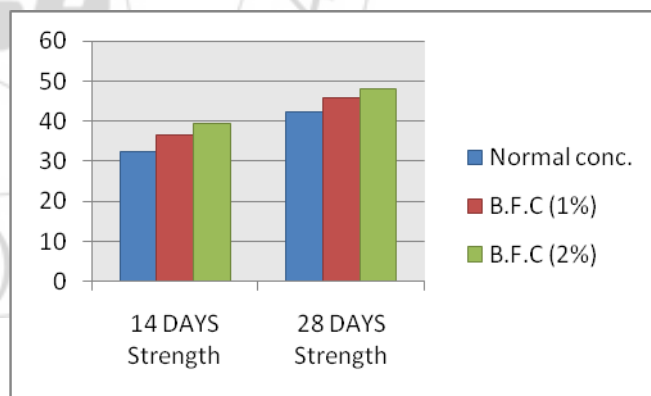


Table 3: Compressive Strength of Concrete After 14 Days And 28 Days (M25 Grade)

Sr No	Type Of Conc.	14 Days Avg. Strength Mpa	28 Days Avg. Strength Mpa
1	Normal conc.	32.44	42.44
2	B.F.C (1%)	36.44	45.99
3	B.F.C (2%)	39.49	48.14

Table 4: Compressive Strength Taken On Concrete With Basalt Fiber Immeresd In Various Chemical.

SR NO	Type Of Conc.	14 Day Avg. Strength Mpa	28 Day Avg. Strength Mpa
1	Na2so4	33.78	42.04
2	HCL	34.72	42.24
3	NaOH	37.08	43.25



6. Discussion

1. As seen from Table 1, the 14 days average flexural strength is maximum when 2% fiber is used. About 40% to 50% increase in strength is observed.
2. As seen from Table 3, the 28 days average compressive strength is maximum when 2% fibers are used. About 83% & 92% increase in compressive strength than the design strength, when the basalt fibers are introduce in concrete.
3. 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.
4. The basalt fibers are add 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.

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