Use of Carbon rod as Reinforcement in Concrete Technology

Bhavita S. Dave, Jaykumar M. Soni

Abstract— **The fast growing world moving towards MICRO SCIENCE. With this concept, technology has also developed on micro scale. Civil Engineering is a vast field which is concerned with the construction mainly of CONCRETE. In recent trends, concrete technology has achieved significant role in micro science. The research represents the use of micro material "CARBON ROD" in concrete technology and to examine the role of carbon rod with addition to REINFORCEMENT. Carbon films are uniformly amorphous and highly transparent to electrons because carbon has a low atomic weight. Due to their strongly interconnected three-dimensional network structure, carbon films have remarkable mechanical stability. In this research carbon rods, along with steel bars in concrete were used as reinforcement combinations i.e. steel-steel, steel-carbon, and carbon-carbon and the flexural properties of carbon rod were examined. It was observed that the use of equal number of steel bars and carbon rods shows subsequent amount of strength result compared to use of only steel bars. The flexural strength of the carbon rod without any steel bars did not show much increment.**

Key words: micro science, carbon rod, flexural strength

I. INTRODUCTION

Concrete is the second most consumed substance on earth; on average, each person uses nearly three tones a year. Through time, different materials have been added to concrete in order to improve or alter its properties. The addition of fibers, such as steel, glass, polymeric materials, carbon, cellulose, and nylon to fresh concrete in order to improve specific characteristic(s) such as compressive strength, toughness, flexural strength, flexural toughness, and/or abrasion, has received more attention from researchers and the concrete industry lately.

Reinforced Concrete is one of the common building materials in the world. Many structures, such as buildings, bridges, and highways, use reinforced concrete as its main construction materials. Concrete lacks tensile strength, thus, steel is the common tensile reinforcement use in reinforced concrete. Even though steel performance in reinforce concrete is superb, it does have some set back. Steel tent to deteriorate, rapidly, especially when expose to extreme coastal weather and sea water.

Carbon fibers have low density, high thermal conductivity, good chemical stability and excellent abrasion resistance, and can be used to reduce or eliminate cracking and shrinkage. These fibers increase some structural properties such as tensile and flexural strengths, flexural toughness and impact resistance. Carbon fibers also increase freeze-thaw durability and dry shrinkage. However, the addition of carbon fibers decreases the electrical resistance.

Researches done, highlighted that the addition of carbon fibers causes a significant increase in splitting tensile strength relative to normal plain concrete. From the research, it can be seen that the percentage of splitting tensile strength increase by about 45% of normal strength with 0.5% fiber volume fraction.

This research is to investigate an alternative non-metal reinforcement for concrete structure, namely using carbon rod. In this study, the purpose of using carbon rod is to enhance the tensile strength of reinforced concrete, replacing steel, totally. The main advantage of using carbon rod as reinforcement is to avoid rusting and corrosion of reinforcement.

The main objective of this study is to design beam reinforced with carbon rod. Then to study the performance and behavior of carbon rod reinforced concrete compared with steel reinforced concrete. This study involved design and experimental works on carbon rod reinforced concrete, compared to traditional steel reinforced concrete.

II. METHODOLOGY

In this research, the main material to be used as the concrete reinforcement was carbon rod. There were three types of concrete samples fabricated. Samples of carbon rod along with steel reinforced

concrete and carbon rod reinforced concrete without cover were prepared. Another sample of conventional steel reinforced concrete was prepared as control sample. Cubes were prepared for concrete mix to ensure the concrete grade. Table I shows the type of samples used for this research.

TABLE I: TYPES OF SAMPLES

Type	Sample	Beam mold
1	Conventional Steel reinforced concrete	3
2	Carbon rod with Steel reinforced concrete	3
3	Carbon rod reinforced concrete	3

For the samples Type 2 & 3, the technique of the reinforcement was similar to the steel reinforcement. Carbon rods were circular in shape ribbed over the entire length, like the round steel bars, as shown on Figure 1.

Fig. 1.Carbon Rod

There was no concrete cover for the reinforcement. The size of beam mold for all samples was 700 mm (length) x 150 mm (width) x 150 mm (thick).

Fig. 2 Casting of Beam Molds

Figure 2 shows the casting of beam mold, placing of reinforcement and concreting at Geoengineering Services, Vadodara.

III. RESULT AND DISCUSSION

The steel bars used for this research was of 18 mm diameter mild steel round bars and carbon rod of 18 mm diameter.

The tested strength for Type 2 and Type 3 samples seemed to be lower than the conventional steel reinforced concrete value.

TABLE II: FLEXURAL STRENGTH OF BEAM

Type	Sample	Weight of Reinforcements (KG)	Test Result (KN)	Flexural Strength (Kg/cm^2)
1	Conventional Steel reinforced concrete	5.38	5100	105.78
2	Carbon rod with Steel reinforced concrete	3.54	4100	85.03
3	Carbon rod reinforced concrete	1.74	3800	78.82

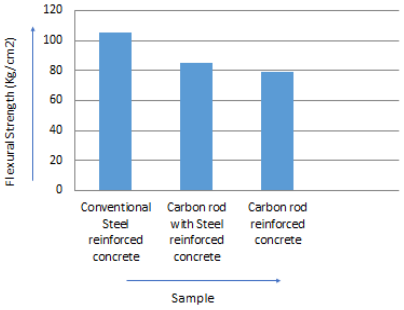

Fig. 3 Comparison chart of flexural strength

Figure 3 shows the experimental results obtained. The experimental results were compared as tabulated on Table II.

IV. CONCLUSION

Overall, from this study some conclusions can be made:

1. It was observed that the use of carbon rod with steel reinforced concrete showed subsequent amount of strength result compared to conventional steel reinforced concrete.
2. The use of carbon rod with steel bars as reinforcement for concrete can perform intended function to strengthen the concrete in tension zone.
3. The flexural strength of the carbon rod reinforced concrete did not show much increment.
4. India is a country, which has large overturn of carbon content as a waste. Use of carbon rod can be useful to minimize carbon waste as well.

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