Compressive and Tensile Properties of Fiber Reinforced Polymer Concrete

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ABSTRACT

The mechanical behavior of fiber reinforced polyester polymer concrete was studied in terms of strength, failure strain and modulus in compression and tension. Glass fibers and PAN based carbon fibers were used. In this investigation 6% (w/w) carbon fibers required 20% (w/w) of polymer and 6% (w/w) glass fibers required 18% (w/w) of polymer for the best performance of carbon fiber reinforced polymer concrete and glass fiber reinforced polymer concrete from both a strength and workability point of view. Although the addition of fibers in polymer concrete matrix increased the failure strain in compression, for carbon fiber reinforced polymer concrete the strength and modulus reduced. In tension, the addition of carbon and glass fibers increased the mechanical properties in terms of failure strain, strength and modulus. A Correlation has been made between strength and modulus for carbon fiber reinforced polymer concrete.

1. INTRODUCTION

Polymer Concrete (PC) is a mixture of aggregate and monomer, which hardens through polymerization of monomer. Due to its rapid setting, high strength properties and ability to withstand corrosive environment, PC is increasingly being used as an alternate to cement concrete in many applications. In order to minimize material cost, it is imperative to use the least possible amount of polymer in PC formulations to achieve desired properties depending on their applications. Earlier studies have reported further enhancement of the mechanical properties such as strength, stiffness and toughness of polymer concrete using fiber reinforcements. Steel, glass and carbon are the most popular fibers for matrix reinforcement. Ohama and Nishimuru studied the effect of steel fibers in a PC system and noted an increase in compressive, flexural and impact strengths. Similarly, Vipulanandan et al in 1992 reported that glass fibers increased the mechanical properties of a PC system.

2. OBJECTIVE

The purpose of the study is to investigate the effect of adding glass and carbon fibers in a PC matrix on the compressive and tensile properties of the polyester PC.

3. MATERIALS AND TESTING PROGRAM

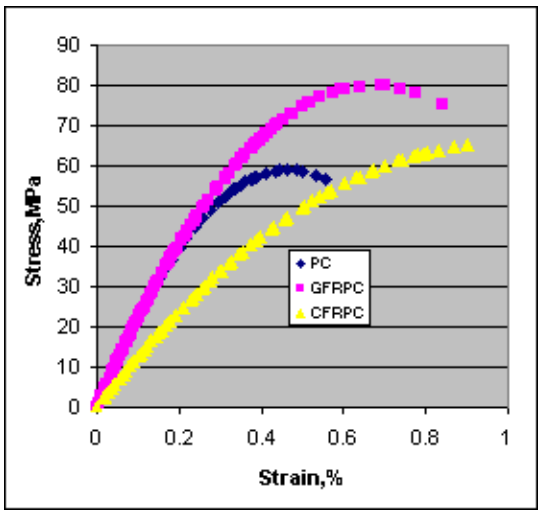
Based on workability, polymer content for GFRPC and CFRPC were determined to be 18% and 20% respectively. Fiber content for both the matrices was varied up to 6%. CIGMAT standards (CIGMAT PC1-01, CIGMAT PC2-01, CIGMAT PC3-01) were followed for specimen preparations, compression test and tension test. Destructive tests were performed in displacement-controlled mode.

4. TEST RESULTS AND CONCLUSIONS

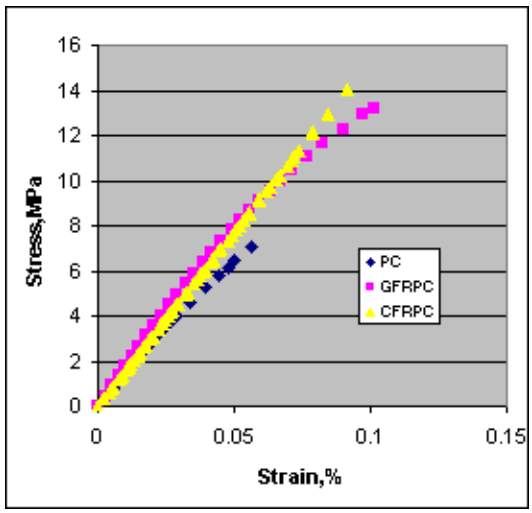
Based on the experimental study the following conclusions can be drawn:

- Adding 6% glass fibers required 18% polymer in the GFRPC system for good workability. Glass fibers increased the failure strain, peak strength and modulus in compression and tension.
- Adding 6% PAN based carbon fibers required 20% polymer to develop a workable CFRPC. The addition of carbon fibers increased the failure strain, but strength and modulus decreased. In tension, it increased the

tensile strain, modulus and strength. Carbon fibers also increased the failure strain in compression, but reduced the strength and modulus.



Compression Test



Tension Test

5. ACKNOWLEDGEMENT

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6. REFERENCES

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If you have any questions, please contact **Dr. C.Vipulanandan**