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FRACTURE OF CONCRETE REINFORCED WITH STEEL FIBERS IN NORMAL AND AGGRESSIVE ENVIRONMENT

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ABSTRACT

This study aims to determine and present the results of an experimental study of reinforced concrete with steel fibers at doses 20, 30 and 40kg/m³, using cement CP V - ARI, at ages 28 and 88 days after specimens molding. The specimens were exposed for 60 days in aggressive environment (in solution of water and 3% of sodium chloride), after 28 days. The bending toughness tests were performed in prismatic specimens of 150x150x500mm. We used the standards ASTM C1609/C1609M-10 and JSCE-FS4/1994. The factor values toughness specimens were different in harsh environments to those obtained in normal environment (in air).

Keywords: fracture, reinforced concrete, aggressive environment.

INTRODUCTION

A very important property is the material fracture toughness. Using this property it is possible to select materials, design parts and structures, and to evaluate security operating conditions of parts and structures with cracks (Hertzberg, 1996). The addition of fibers in concrete is primarily to minimize the appearance of cracks caused by the plastic shrinkage of concrete caused by temperature and heat of hydration of cement. The fibers when incorporated into the concrete are responsible for turning a brittle material to a pseudo-ductile material.

Two specimens were made of reinforced concrete (CP V - ARI cement) for each type of fiber (0.25% - 20kg/m^3, 0.38% - 30kg/m^3 and 0.50% - 40kg/m^3), according to ASTM C1609/C1609M-10 and JSCE-FS4/1994. These specimens were tested 28 days after confinement in a humid chamber and 60 days immersed in an aggressive environment (in aqueous solution 3% in weight of sodium chloride). Other specimens were tested 60 days in normal environment (in air) at room temperature (~ 25 ºC), for comparing with the aggressive environment ones.

RESULTS AND CONCLUSIONS

The test results of toughness in bending are shown in Fig. 1. When comparing to the 28 days in humid chamber, the toughness factor of normal and aggressive environment specimens showed regularity in their results, do not presented significant differences. The results showed that the contents of steel fibers contributed to improve toughness, but in terms of environment, normal and aggressive, there was significant change of behavior, for the several studied types of composites. This study also shows that the toughness factor is not influenced in normal environment (air) and aggressive (in aqueous solution 3% by weight of sodium

chloride) of polypropylene fibers in the levels of 0.25% - 20 kg/m^3, 0.38% - 30 kg/m^3 and 0,50% - 40 6kg/m^3.

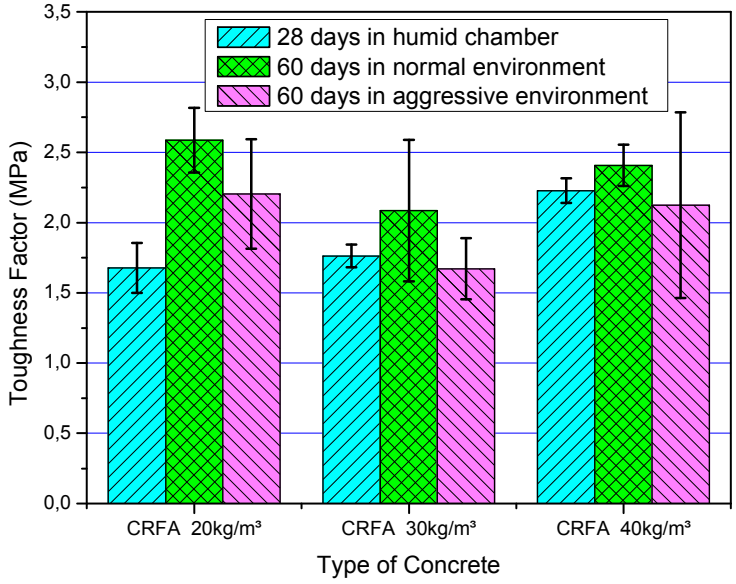

Fig. 1 - Toughness factor results for the Fibers Steel Reinforced Concrete (SFRC).

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REFERENCES

[1]-AMERICAN SOCIETY FOR TESTING AND MATERIALS. C1609/C1609M-10: Standard Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point-Loading). West Conshohocken, Pennsylvania, United States of America, 2010. 9p.

[2]-Hertzberg, R.W. Deformation and fracture mechanic of engineering materials. 4th Edition, John Wiley & Sons, 1996, p. 315-359.

[3]-JAPAN SOCIETY OF CIVIL ENGINEERS. Method of tests for flexural strength and flexural toughness of steel fiber reinforced concrete. JSCE-SF4. Concrete Library of JSCE. Part III-2 Method of tests for steel fiber reinforced concrete. N.3, p.58-61. June 1984.