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SUMMARY

FYCRETE-GLASS FIBRES REINFORCE PLASTICS TO STRENGTHEN CONCRETE STRUCTURES [1/]

by

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For over a thousand years, organic fiber elements have been used to reinforce materials for building structures. The tensile strength of these fiber elements was not high enough to allow its use in materials for building modern structures.

Glass in fibrous form exhibits high strength in tension, but this strength is destroyed when the exposed glass fibers are mixed in concrete. The glass deteriorates when in the alkaline solution resulting from the hydration of the cement. If glass fiber multistrands are impregnated and coated with a strong thermosetting resin, they

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constitute reinforcing elements which, when cut in small lengths and dispersed at random in a concrete matrix, result in a new material for structures called FYCRETE.

The mechanical properties of FYCRETE are based on the crack arrest theory. If straight elements of a material possessing high strength in tension are placed close to a void in a concrete mass, they tend to arrest the extension of the cracks originating at the boundaries of the void, where the concrete is subjected to a tensile force. The result is a material having high strength both in tension and compression.

FYBRITES, the glass fiber reinforcing elements are obtained through a production process where the glass multistrands are impregnated and coated with a thermosetting resin, then cured and cut to the desired lengths. These are added to a mixer containing concrete, and after mixing, the new material, FYCRETE, is obtained.

The new material shows mechanical properties different from those of its components. Extensive testing lead to the following results:

1- The stress-strain relationship of the FYBRITES is linear

2- The protection of the glass fibers by impregnation and coating with the thermosetting resin is quite effective

3- The compressive strength of FYCRETE is higher than that of the concrete component

4- The tensile strength of FYCRETE is many times that of the concrete component

5- Within limits, both the tensile and compressive strengths of FYCRETE vary linearly with the quantity of glass it contains

6- Shear and creep in FYCRETE compare quite favorably with those in conventionally reinforced concrete.

7- Temperature differentials in the order of 500°F do not affect the mechanical properties of FYCRETE.

A comparative cost analysis revealed that for structural members performing equal functions, a saving of 40 - 60 percent is realized by using FYCRETE instead of concrete conventionally reinforced.

From the test results and observations, FYCRETE finds an adequate application in jointless highway and airport pavements, sewer and drainage pipes, precast piles, bridges, water and oil tanks, thin shell dams, stadiums, precast structural elements, prestressed concrete, and structures in corrosive media (marine structures, acid containers etc...)

Extensive research is at present underway aiming at investigating the behavior of FYCRETE when subjected to high temperature

(800$^{+\circ}$F) and shock waves. The results may lead to the use to advantage of this material in the construction of buildings and bomb shelters.

It is estimated that with the continuous increase in the cost of steel and labor, the use of FYCRETE may lead to further economy in the cost of structures. The saving in time of constructions, the eventual resistance to shockwaves, as well as the elimination of joints in pavements may make FYCRETE of particular importance for military applications.

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