## PREFACE

Cement-concrete is one of the most widely used building materials primarily because it is obtainable from relatively cheap and abundantly available raw materials. Apart from this, its simple preparation, ease of handling and application in large quantities, early attainment of strength, good adhesion to steel, excellent finish and manoeuverability, all make it indispensable in modern construction technology. However, it has very low tensile and flexural strength. Moreover, its resistance to chemical/freeze-thaw attack is poor, and it is particularly vulnerable to the attack of sulfate ions. Incorporation of organic polymers into concrete has given rise to an entirely new class of material i.e. "Concrete-Polymer Composites", which possesses strength and durability properties several fold greater than those of the ordinary concrete. Polymer-impregnated concrete (PIC) is one such composite which is prepared by impregnation of a liquid monomer into precast concrete and its in-situ polymerization.

In last 30 years tremendous technological progress has been made in the field of PIC. As a result, it has been possible now to produce PIC with tailor made properties. Some of the typical applications of PIC are in highway and bridge decking, water desalination plants, precast housing, underground support in mining, underwater and marine structures etc.

However, the role of the polymer in bringing about the phenomenal improvement in properties of concrete is not yet

conclusively established. Very little is known about the actual state of the polymer inside cement-matrix. The exact mechanism through which the impregnated polymer interacts with the substrate is still ambiguous and much speculations prevail in this regard.

Studies made in the present investigation are a modest attempt to have better insight into the role of cement-polymer interaction in PICs cured by gamma irradiation and its variation with the nature of the imbibed polymer. The main emphasis has been put on the correlation of strength and durability properties of PIC with the characteristics of the polymer (viz. molecular weight, degradation, crosslinking by gamma radiation, polarity etc.) and its fracture morphology at the cement-polymer interface.

The thesis consists of four chapters.

Chapter-1 deals with the general introduction, process technology of PIC, review of the reported work and scope and objective of the present investigation.

In Chapter-2 experimental procedures adopted in this investigation have been described. Chapter-3 embodies the results and discussions thereof in ten subsections.

Better properties of PICs compared to ordinary concrete are generally attributed to reduced porosity of the matrix phase in the former. It has also been suggested that the impregnated polymer improves the bonding between matrix and

aggregate phases. However, we have found that the above two factors, though important, are not the exclusive ones. In order to account for the observed mechanical and durability behavior of different PICs several other factors such as molecular weight of the imbibed polymer, its polarity, texture and kind of interaction with the cement phase, etc. need to be taken into consideration.

Quite admittedly the present study is far from comprehensive with regard to the elucidation of the exact mechanism through which the polymer in PIC reinforces the cement-matrix mechanically and immunizes it from chemical attack. Nevertheless, it is hoped that the attempts will contribute towards better understanding of concrete-polymer composite materials, in general, and would stimulate further interest among the researchers in this direction.

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