Polymer-Modified Hydraulic-Cement Mixtures

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Foreword

This publication, *Polymer-Modified Hydraulic-Cement Mixtures*, contains papers presented at the symposium on Polymer-Modified Hydraulic-Cement Mixtures and Mortars, held in Louisville, KY on 16 June, 1992. The symposium was sponsored by ASTM Committee C-9 on Concrete and Concrete Aggregates and its Subcommittee C04.44 on Polymer-Modified Concrete and Mortars. Louis A. Kuhlmann of The Dow Chemical Company in Midland, MI and D. Gerry Walters of Reichold Chemicals, Inc. in Research Triangle Park, NC, presided as symposium co-chairmen and are editors of the resulting publication.

Contents

Overview

Polymer-modifiers used for portland cement are organic polymers dispersed in water and formulated for use in portland cement. Although polymer-modifiers have been in use for over 30 years, there has been a lack of standards and specifications to guide the specifier and customer in their proper use. This has been changing recently. In 1991, the American Concrete Institute (ACI) published the first three chapters of a state-of-the-art report on polymer-modified concrete that dealt primarily with styrene-butadiene copolymer (S-B) latexes. In 1992, ACI published a specification on the use of these latexes as modifiers to concrete for the construction of overlays. In addition, ASTM Subcommittee C09.44 (formerly C09.03.19) is preparing a specification for the latexes and redispersible powders. All of these developments are major steps forward in the effort to improve the quality and proper use of these materials.

To further assist this effort of educating the industry about these materials, a Symposium on Polymer-Modified Hydraulic-Cement Mixtures and Mortars was held in Louisville, KY on 16 June, 1992. At this symposium, technical papers on a variety of aspects of polymer-modifiers were presented.

This Special Technical Publication (STP) contains nine of the papers that were presented, plus two others that could not be included on the program. The papers presented here cover a wide range of topics, from general information on the latexes and redispersible powders, to their application and properties in mortar and concrete.

The book begins with an update on the status of current activities at ASTM with these materials. This update includes a specification for the latexes and redispersible powders for modifying mortar and concrete, as well as suggested modifications to current test methods to make them compatible for the polymer-modifiers. In addition, there is a review of a new test method for measuring adhesion that is being introduced into ASTM. Several papers address the effect of polymer variables, such as polymer type, particle size, and glass transition temperature, as well as polymer levels on the properties of portland cement mortar. Applications of polymer-modified mortar are discussed in the next papers. These include: ceramic tile in flooring applications, mortar coatings for concrete to reduce alkali-silica reaction, and properties for patching.

Redispersible powders, dry products made from latexes and used in single component systems, are increasing in use. Reduction of shipping costs and simplicity of use at the job site are two of the primary reasons for this increase. Properties of mortar modified with powders made from ethylene vinyl acetate and acrylic polymers are described in detail in two of the papers.

One paper addresses a unique polymer-modified system that incorporates an emulsified epoxy resin without a hardener, to produce a modified-mortar. Test results compare favorably to mortar made with a hardener.

Several papers on concrete made with styrene-butadiene latex as a polymer-modifier complete the book. The first, an investigation of the failure mechanism of this modified concrete, indicates that the cured polymer controls the initiation and growth of microcracks. Impact resistance, durability, and toughness are shown to be improved by the addition of the polymer-modifier. Another paper reviews the application of polymer-modified concrete as an overlay on bridge decks with cathodic protection. Data on the performance of these installations indicate that the two systems are compatible and performing well. A review of

the use of this type of latex during the past 20 years as an overlay on bridge and parking garage decks follows. Typical properties of this concrete are given. Mix design guidelines and construction procedures, as well as typical problems that can occur and measures to avoid them are included. Case histories of several projects are highlighted. The final paper is a report on the 20-year performance of bridge deck overlays made with this modified concrete. Data on bond, corrosion potential, and permeability are some of the field measurements reported, supporting the fact that the overlays are still in service.

Louis A. Kuhlmann

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