
BOOK REVIEW

Fly Ash in Cement and Concrete

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REFERENCE: Helmuth, R., *Fly Ash in Cement and Concrete*, Portland Cement Association, Skokie, IL, 1987, 216 pp, paperback, ISBN 0-89312-085-5.

This book provides for the first time a complete and thorough review which compiles in one volume of about 200 pages the present state of knowledge of fly ash in all its widely different forms. The reader is first introduced to coals by type and is made aware of the influence of differences in coal type and in the ash combustion, collection, and beneficiation processes on the final characteristics of the ash produced. Then follows an informative and well-illustrated discourse on the chemical composition, phase structure, particle morphology, and physical properties of fly ashes. Much of this material provides a background knowledge of the ash itself and will be unfamiliar to or unavailable to readers of journals and books on concrete, the content of which is usually confined to the effects of fly ash in concrete.

Having provided a background emphasizing the widely diverse characteristics of available fly ashes, the book goes on to deal with the effects of ashes in freshly mixed and hardened cement pastes, mortars, and concretes. A detailed and comprehensive description of what is known about the reactions which take place between the ash and lime and between the ash and the constituents of cement is presented. The main thrust is to identify the parameters which fundamentally determine the rate and degree of pozzolanic reactivity of a given ash in terms of its physical and chemical characteristics and to point out the apparent inadequacies of some of the methodology currently used to assess reactivity, in particular that em-

bodied in ASTM Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete (C 311) and Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete (C 618). This section of the book is the largest and most comprehensive in its depth and breadth of coverage and will not be readily assimilated in total on first reading by readers without a sound knowledge of the microstructure and chemistry of the setting and hydration processes in concretes with or without fly ash. While the emphasis is on the importance of rate and degree of pozzolanic reactivity in relation to strength development at both early and later ages, a subsequent chapter deals in considerable depth with the possible effects of different ashes on sulphate resistance and control of deleterious alkali-aggregate reactions. Soundness, frost resistance, and permeability considerations are also addressed but to a lesser extent. The final chapter is an informative summary of what the author has gleaned from his comprehensive review of the literature. He identifies what is known about the many factors influencing the pozzolanic reactivity of a given ash while at the same time highlighting what is not yet known and needs further study.

The book is well organized and well illustrated, but, as a consequence of concisely reviewing a great deal of research, the text assumes considerable reader background in the fundamentals of the chemistry and microstructure of cement paste and fly ash and the related experimental techniques for determining them. Consequently, the book will be of most value to specialists in concrete technology, notably researchers, teachers, and the more knowledgeable of concrete producers. Those with only a rudimentary knowledge of concrete technology may have difficulty getting full value from this advanced level text.