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Book reviews

Concrete at High Temperatures—Material Properties and Mathematical Models; Z.P. Bazant and M.F. Kaplan; Longman, London, 1996, 412 pages

Concrete at High Temperatures is the ninth volume of the Concrete Design and Construction Series edited by F.K. Kong and R.H. Evans. This book, the first of its kind, consists of two parts. The first part (195 pages) was written mostly by the late Professor Kaplan and addresses the material properties and behavior of concrete, focusing mainly on heat-induced effects. The second part (173 pages) was written by Professor Bazant and centers on mathematical modeling. The importance of this book is based on the assumption that most textbooks on concrete deal with the effect of normal environmental exposure, usually below 50°C; but certain engineering aspects (e.g., the fire resistance of concrete structures or the use of concrete structures for nuclear power generation plants) require materials to withstand much higher thermal loads. Some kinds of refractory concretes must resist temperatures up to 2000°C. The topic is thus timely and important for concrete experts.

The first part begins with the usual generalities on the composition and structure of hardened Portland cement paste, but the following chapters deal directly with heat-induced effects, such as changes in chemical composition, pore water, physical structure, thermal expansion, strength, and deformation. As real refractory concrete cannot be made on a Portland cement basis, special chapters deal with high-alumina or barium-alumina cements, non-hydraulic binders, and refractory aggregates. Chapters on mix design and the physical, thermal, and mechanical properties of refractory concretes close the first part of the book.

The second part of the book, addressing the mathematical modeling of concrete at high temperatures, contains principles and models with examples for moisture diffusion, pore pressures, creep, shrinkage, cracking failure and nonlinear triaxial stress–strain relations. All these phenomena are important for concrete to be used at high temperatures. Special emphasis is given to nuclear applications, where concrete must withstand, besides high temperature, the effects of various radiations and (in case of metal-cooled reactors) the chemical effects of liquid sodium.

An unusually high number of references is cited in the book; selected bibliographies serve the purpose of supplying further reading after each chapter. *Concrete at High Temperatures—Material Properties and Mathematical Models* will definitely serve as a useful guide for all concrete practitioners, especially those who deal with the high-temperature application of concrete.

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Strength and Related Properties of Concrete – A Quantitative Approach; Sándor Popovics; John Wiley & Sons, New York, 1998, 536 pages

This excellent book is a direct continuation of the former volume written by the author, the well known *Fundamentals of Portland Cement Concrete—A Quantitative Approach*, which displays a rigid adherence to its chosen topic, in this case the most important property of concrete—strength. Similarly to the former volume, *Strength and Related Properties of Concrete—A Quantitative Approach* is also numerically oriented, as shown by the subtitle. This numerical orientation means that the author uses the best formulae presently available for the calculation of properties, or for proportioning to reach the desired properties, regardless of whether these formulae are theoretical, empirical, or in-between. This means that not only engineering aspects are covered, but also fundamental principles. It is stressed, however, that the validity of formulae is examined experimentally in most cases.

The book is divided into six chapters on compressive strength, other concrete strengths, strength development, structure of hardened cement paste and concrete, composition/strength interrelations, and elastic deformations of concrete. Although the table of contents gives only the principal headings and no subheadings, finding of a desired item is made easy by the detailed index. The author emphasizes the importance of testing procedure and discusses in detail the artifacts that may be induced by choosing an inadequate an apparatus or system.

The extensive use of formulae is important from the point of view of computerization. To this reviewer's knowledge, this is the first book on concrete technology that is fully computer-oriented—note the 3.5″ floppy disk, containing software developed by the author, "Proportioning for Concrete Strength in the 21st Century" (Prop 21). Prop 21 helps the user calculate all practical proportioning tasks.

This user-friendly software can be used all over the world, as units (American, SI, or metric), cement sort, etc. can be used arbitrarily.

Another benefit of the book is an exact and full list of references—over 1200 in all. The reviewer made some random tests to check accuracy; none of the references proved to be inexact. Each reference gives not only the usual data but titles and, in case of non-English publications, the original title in addition to the English translation.

The book is highly recommended for all practitioners and researchers in the field of concrete. It will also be a good guide for students in civil engineering.

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***Cement and Concrete;* M.S.J. Gani; Chapman & Hall, London, 1997, 212 pages**

This concise booklet gives an introduction to cement and concrete science, engineering, and manufacture for students and practitioners. Unlike other books on this topic, *Cement and Concrete* is concentrated to describe morphologies and material properties rather than concrete proportioning or cement chemistry.

Some important chapters of the book include: Cement production; Cement hydration; Mortar, Concrete; High-performance, reinforced, prestressed and fiber-reinforced concrete; Durability, deterioration, fire resistance and protection of concrete; and Special cements and concrete. One chapter discusses the history of cements, mortars, and concretes, beginning with the Neolithic and ending with the most recent achievements. The author and I share the opinion that the heroes of cement and concrete science and engineering in the 18th and especially in the 19th century did extraordinary work, definitely commensurable with efforts of our times.

Although the book itself is short, its coverage is extended, incorporating all aspects of hydraulic binders. Almost all up-to-date materials, such as glass, carbon or polymer fibers, blocking of pores by polymers, MDF cements, expansive cements, sulfur concrete, and even dental cements are incorporated. To help students, self-test questions are given at the end of each chapter.

Although the book was written in Australia, it can be used internationally as adequate references are given to ASTM, ACI, and European Standards, in addition to Australian ones.

The book is a welcome addition to all concerned with cement, concrete, and mortar. The beginner can use it without any other help; for those who wish a deeper insight into the rather complex world of cement and concrete, the detailed list of references will provide further reading material.

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