

Book reviews

Hydration and setting of cements

A. Nonat and J. C. Mutin (Editors)

Spon, London, 1992, ISBN 0 419 17760 4, £55, 418 pp

This book forms the Proceedings of the eponymous International RILEM Workshop held in Dijon, France in 1991. The workshop was organized to focus attention on the interactions between cement hydrates during and after their formation, and it brought together colloid and cement scientists. More than ten years ago when preparing a book on the rheology of fresh concrete, of which I was co-author, I became convinced that principles of colloid science were very helpful in considering the fresh properties of cement and concrete, since colloid behaviour is dominated by interactions at the surfaces of tiny particles. In fact, particle sizes in the fresh cement systems are too large (from 0.1×10^{-6} m upwards) to consider them to be true colloids, but when attention is directed to the formation, growth and cohesion of the tiny particles of cement hydrates (from 1×10^{-9} m upwards) then, in principle, colloid behaviour should dominate setting.

This book explores the application of this principle, but unfortunately consists merely of discrete contributions from cement scientists and colloid scientists, and only the editors succeed in bringing the two fields together. Their short introduction draws out the potential for interdisciplinary collaboration. They point out that although hydration is not setting, there cannot be setting without hydration, and that the coagulation of cement grains in paste is the initial process after which hydrates form in the contact zone and bridge the particles; this is a true colloid process.

The material in this book is divided into three parts. The first part contains twelve papers on the hydration of

cements, dealing with various aspects of the early hydration of calcium silicates, silicate anion structure and the hydration of other constituents. The second part, with fourteen papers, deals with hydration and setting, including particle interactions, rheology and strength development. The seven papers in the final part are concerned with hydration and microstructure. From the cement scientist's point of view nearly all the topics of major concern appear in these pages, ranging from techniques (solution chemistry, pore water extraction, silicate polymerization, solid-state nuclear magnetic resonance, electrochemical measurements, Mossbauer spectroscopy and microstructural analysis) through materials (Portland and aluminous cements, siliceous blending agents and admixtures) to properties (rheology, strength development and durability), and the papers are mostly by well-known authors.

The colloid science contribution in Part 2 is set in context by the paper by Nonat and Mutin, which amplifies their introductory statements already mentioned and refers to the origins and nature of interparticle forces. The measurement of these forces and their consequences in various colloid systems are discussed in the succeeding papers. Cement scientists may be reassured by the papers presented here that colloid science is not difficult, merely unfamiliar. The papers will repay careful study, aided by the editors' paper as a guidebook to this unfamiliar territory. Thus, while the editors may feel slight disappointment that the workshop itself succeeded only

in bringing the two groups of scientists together, without any joint work being reported, their book admirably shows areas for future collaboration and they are to be congratulated on that achievement.

Finally, the book owes its origin to the reputation of the reactivity of solids research group at the Université de Bourgogne, Dijon. This high standing is due to Pierre Barret's thirty year reign as Professor of General Chemistry. Accordingly, this book is dedicated to him, marking his retirement, and opens with a short and affectionate tribute to him.

The book reaches the high standard of presentation that one comes to expect from these publishers even though it is prepared from camera-ready copy supplied by the authors, and consequently the papers vary in typeface and some contain typographical errors. This high standard is attributable to the excellent and clear instructions for authors, to the quality of which I, as a contributor, can testify.

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9th international conference on alkali–aggregate reaction in concrete

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The two-volume proceedings of the 9th conference on alkali–aggregate reaction (AAR) contains 128 papers arranged in alphabetical order of the first named author. At the conference itself the papers were presented in the following sequence of sessions: reactive aggregates; undulatory extinction of quartz; testing aggregates by standard methods; testing concrete; evaluation of structural effects; damaged structures, evaluation, management, repair; chemistry and mechanisms of reaction; review of guidance and specification and regional reviews; and cement replacements and additives. Most of the papers discuss alkali–silica reaction (ASR) data rather than alkali–carbonate or other forms of reaction.

In the absence of a better way to organize the large amount of the material presented, the above structure serves its purpose well. Most of the papers are well prepared and documented. As one would expect, however, only a small fraction of the given data represents truly novel information. It is a pity that some of the papers were placed in the wrong sessions, i.e. do not discuss data relevant to the session topic. An example, is the session on the chemistry and mechanisms of reaction, in which several papers discuss only limited chemistry and do not present any mechanistic interpretations.

Among the most important topics covered in the conference papers is the issue of proper testing of potential aggregate reactivity and of the alkali–silica reaction in concrete. A variety of modified and novel techniques are proposed, few of them covering the whole range of

environments to which concrete is exposed. Nevertheless *in toto* the presented data will certainly advance the field and contribute to the development of better test methods.

Another interesting topic discussed at the conference at length is the issue of concurrent appearance of alkali–silica gel and ettringite in cracked concrete, mostly detectable in steam-cured concrete products. The majority view leans towards ASR being the primary or main culprit, although some propose that formation of secondary or delayed ettringite is the reason for crack development.

Inadequate attention was given to the topic of ASR in field versus laboratory concrete, to the interpretation of research data *vis-à-vis* concrete exposed to the environment. How much ASR gel and what degree of cracking of concrete, and under what structural and environmental conditions, should be considered deleterious? How can one transfer the extensive scientific knowledge available to practice? What are the mechanisms of stopping ASR in an already deteriorating structure? What are the economic/ecological implications of AAR and how should they be predicted in advance of construction? These and other topics will need to be discussed at length at the next conference on AAR.

Overall the Concrete Society and the organizers of the Conference should be complimented for a timely and quality publication of the presented papers.

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