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Book reviews

Cement and Concrete—Trends and Challenges. Materials Science of Concrete, Special Volume

Edited by Andrew J. Boyd, Sidney Mindess, and Jan Skalny, American Ceramic Society, OH, USA, 2002

The 2001 Anna Maria workshop assembled 41 participants with 15 presenting papers on Anna Maria Island, FL, to debate the current situation for cement and concrete and the needs for new developments, in particular, via research.

Only a few on the list of attendants have sufficient seniority to have worked in the past World War II époque of strong general commitments to concrete as the indispensable building material for socioeconomic progress: in North America for the beginning creation of the modern welfare society; in Europe, USSR, and Japan for rebuilding the devastated and worn-down countries. The industries, engineering professions, universities, and a flood of science-oriented researchers enjoyed high political and general public support and responded by making tremendously increasing production capacity of cement and concrete possible along with remarkable, innovative improvements of cement and concrete technology, new structural design conceptions, and corresponding architectural functionalism.

The book deals with the different situation today. Building and construction is low on the priority lists of public and private financial resource funds. The required concrete performance qualities for modern buildings and structures are taken for granted by the users (and failures are punished by excessive litigation costs—and strain on the time and minds of researchers). Five papers deal with general and strategic issues, two describe recent cement and concrete R&D programs, two discuss U.S. Departments of Transportation's (DOT) modest needs for new concrete research, and two introduce the reader to the circumstances for concrete research and practice in past, socialistic East European countries. One paper describes the environmental issues for the cement industry in the United States. A remarkable current trend in exploratory research appears in three papers on new, advanced methodology for investigation of the submicrostructure of cement paste and concrete.

The book provides a picture of a meeting of dedicated colleagues in an atmosphere of shared concern for the current crisis in their interdependent professions, and in search of ways and means for joint efforts towards renewed progressivity. Obviously, the attendants are not in professional or demographic terms representing the global trend of the trade and the social importance of concrete today. But

this is balanced by the thoughtfulness of the presentations and their wealth of facts and observations.

The repeatedly occurring deterioration in field concrete is mentioned as a contrast to a century of intensive durability oriented cement and concrete research, testing development, consistent specification updating, etc. to illustrate the “gap between research and practice”. The later decades’ growing “critical mass” problem for university—and other research institutes due to reduced funding is referred to as one reason. The loss of young talented scientists to research for new high-technology industries, such as IT, biotechnology, etc., is evidently an important interrelated cause.

The importance of the cement industry for the concrete development stems from its global production, now approaching 2000 million metric tons annually, in plants reaching daily production of 10,000 metric tons. The achievements of this number-one world commodity supplier are due to consistent, long-term investments in materials and machinery R&D, rationalization of product distribution, intensive marketing, and international corporation governance with massive capital accumulations. The papers by R&D directors in two international cement corporations suggest that the increasing competition, now also from some developing countries, and environmental concerns are turning the R&D efforts towards supplementary cementitious products, chemical admixtures and product–conglomerate creations, and to less altruistic support than in the past to external, scientific research. Construction companies and engineering design firms are referred to as weak concrete research supporters. Their commercial organization structure and limited profitability make them satisfied by reliance on regulations and standard specifications with testing methods, such as run by ASTM, RILEM, and national systems. The two American DOT views reveal that the existing complexity of options for specifying concrete properties suitable for different circumstances and declining DOT expertise force them to license concrete research to cooperating partners and to aim at short-term achievable quality improvements. For pavements with asphalt as alternative to concrete, the materials cost is a decisive parameter.

The workshops’ reward-qualifying paper by B. Möser and J. Stark on examinations of cement paste by different modes of ESEM-FEG electron microscopy offers new basic insight in the hydration of clinker minerals and cement. The 27 excellent images of submicroscopic morphologies and corresponding microanalyses of paste samples reveal a complexity of the cement hydration process—even in laboratory model samples—which makes it inconceivable to

explain it as linear reactivity. The paper shows also, together with the two other submicroscopic studies, that it is now possible to investigate concrete from the field-, through the microscopic-, to the nanosize dimension levels. These achievements open a new pathway for long-term studies of the basic nature of cement paste. They will be of no less intellectual challenge and importance for further development of concrete technology than the pioneering work by T.C. Powers and colleagues at the Portland Cement Association in the 1940s. Two university professors, from Poland and Slovakia, tell a story of concrete research undertaken under extremely restrained financial and manpower resources, though still required to match strong, national demands after the many years of socialistic stagnation. (Inadvertently, they make complaints from our researchers in Western countries appear a bit overstated.) The contributions are also, albeit implicit, an appeal for more contact with the scientific and engineering communities in the CIS countries, because their need for concrete progress is as obvious as the ineffective use of their many talented scientists and engineers. Incidentally, this leads to a further debate issue, namely, that not only for millions of the people in East Europe and the CIS regions, but even more for most of the close to 6 billion in the LDC countries, concrete is for decades ahead the indispensable building material for the creation of acceptable life conditions for ordinary people.

This makes the contribution by C. Drakov of Florida University, during the second day of concluding discussions, remarkable. He suggested development of residential concrete house design and production for resistance to hurricanes. He could have added—also for prevention of the disasters caused by tornadoes, the central U.S. states river floods, and the forest fires and earthquakes in the western states.

A U.S. concrete R&D conglomerate—concrete technology, structural and architectural design, and environment, economy, sociology, and management expertise—for development of a family house resistant to the destructive nature's forces ought to be a very attractive "new deal" concept for all who work for effective use of concrete. It could also, in a global context, be a formidable offer to people in many developing countries, and a way to involve the new research in other continents than North America and Europe.

Altogether, the book, with its papers, concluding discussions, and suggested forthcoming cooperative activity for a progressive *Research Manifesto*, is valuable reading for all with sincere interest in concrete progress.

The only editorial matter to criticize is that three papers merely consist of reproductions of overheads from the verbal presentations. This is not acceptable for the many more readers than the 41 who attended the meeting.

Gunnar M. Idorn
Tovesvej 14B, DK 2850 Naerum, Denmark
E-mail address: gunnar.idorn@get2net.dk
Tel.: +45-4580-0856

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Dauerhaftigkeit von Beton (Durability of Concrete)

By Jochen Stark and Bernd Wicht, Birkhauser Verlag, Basel, Switzerland, 2001; 340 pages, 221 figures, 42 tables (in German)

This book deals comprehensively with concrete durability, a subject of increasing interest to concrete technologists. The areas covered include: manufacturing of durable concrete, carbonation, neutralization of concrete surface by sulfur dioxide and oxide of nitrogen present in air, effect of chlorides, sulfate attack including delayed ettringite formation, frost resistance, concrete corrosion due to microbiological factors and alkali-silica reaction. In the individual sections, the mechanism how the damage develops, how the damaged concrete looks, how the damage is to be prevented and the possibilities of repairing the damaged concrete are discussed. Also discussed is the effect of individual factors not only on plain concrete but also on embedded steel. Each chapter is adequately covered with pertinent references. A very positive factor are the numerous tables, illustrations and color photographs which may help the reader to follow the text, which is written in German. The book may serve as a valuable source of information to everyone interested in concrete durability.

Ivan Odler
Institute of Nonmetallic Materials,
Technical University Clausthal,
38678 Clausthal-Zellerfeld, Germany
E-mail address: ivanodler@aol.com

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