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CEMENT AND CONCRETE RESEARCH

Editorial

Fall 1999 Materials Research Society Symposium on the Transport Properties and Microstructure of Cement-Based Materials

In cement-based materials (mainly concrete), the measurement of transport properties has importance in and of itself, since concrete is often used as a barrier. However, their main use is to help determine durability, since concrete degrades by the ingress of deleterious species (mainly water and chloride and sulfate ions). Concrete durability is an enormous problem, since a several-million-dollar concrete structure, for example, a building or bridge, is constructed carefully over a period of months or years and then is left out in the weather for a long period of time! No other valuable material is treated in this way. How long the structure lasts then depends on its microstructure, which, in turn, helps determine its transport properties, which determine the rate at which "bad stuff" gets into the material.

In the Materials Research Society Symposium on the Transport Properties and Microstructure of Cement-Based Materials, which was held at the Fall 1999 meeting in Boston, MA, there were a total of almost 40 talks, of which seven were invited. The organizers of the meeting were Drs. Sankar Bhattacharja, Edward Garboczi, Surendra P. Shah, Lars Olof Nilsson, and Tahar El-Korchi. Papers covering 15 of the talks are included in this issue, with five others being published in the RILEM journal Concrete Science and Engineering. The topics cover microstructural considerations — how the pore structure forms at different length scales, and experimental and theoretical studies of transport. Of course, the theoretical studies always included a strong computational aspect, because as far as we know, no transport equations of interest can be solved analytically for the cement paste or concrete microstructure.

The papers in this issue reflect how sophisticated materials science concepts and techniques are continuing to be applied to the study of the microstructure and properties of cement-based materials. Concrete is a complex, random, time-dependent material. The simple-minded application of high-tech materials science to the study of concrete will normally only reap failure. Numbers will be obtained, but their meaning will be very doubtful. Only careful application of materials science techniques, keeping in mind the particular complexities of concrete, will ultimately prove fruitful in materials science of concrete research. Another key factor is the simultaneous application, in close cooperation, of experimental and theoretical techniques. The theoretical efforts serve to guide and interpret the experimental measurements, and the experimental results serve to validate the theory. Physics has been approaching problems this way since at least the time of Newton, with great success. It is time concrete follows suit. The papers included in this issue show that these ideas are taking root in the concrete materials community and proving fruitful.

The 15 papers in this issue cover neutron scattering and fractal modeling applied to cement hydration and C-S-H structure, joint theoretical/experimental studies of ultra-high-performance cement-based materials, studies of basic cement paste and concrete microstructure affecting transport, applications of transport properties to concrete durability in pavement and fire situations, and a number of other topics. We hope you enjoy this issue of Cement and Concrete Research, which has been kind enough to serve as one of the publishers of the proceedings of this symposium. Finally, we would like to remind the reader that each of these 15 papers has gone through the usual Cement and Concrete Research review process, and was not simply accepted "as is."

Sankar Bhattacharja and Edward J. Garboczi
Guest Editors

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