Editorial

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Nowadays, cement industries are obligated to save energy and resources, to minimise CO₂ emissions, to obtain soundness and high durability, and to realise the sustainable society.

The world suffers very severe disasters such as huge earthquakes, tsunamis and floods. Cement and concrete will be used increasingly in these circumstances – and their social properties include not only the development of new constructions but the maintenance of sustainable structures in a recycling-orientated society. Therefore, their soundness and high durability become ever more important.

Currently, we can achieve a century's durability, but we need to know the important factors to achieve longer-term durability. A discussion regarding thermodynamics will be very useful but not the only one we need to have. A kinetic discussion is also important, as is the development of new materials – and new materials need new technology to evaluate them. Moreover, the practical phenomena are not the same as ideal and experimental materials. New discussions will be necessary due to the discovery of phenomena from the point of view not only of existing theory but new ideas.

For example, Islam and Kishi (2014), found a phenomenon in which the concentration distribution and penetration depth of Cl[−] and water did not change during the 1.5–8.75 years they measured them with concrete cores from practical revetment concrete. This means that the immigration of Cl[−] into concrete did not follow the diffusion law. The mechanism of the phenomenon is not yet understood clearly and exactly, but it was experimentally confirmed. If this phenomenon occurs generally, the design of cover concrete will be changed.

Advances in computer science are also very important for long-term estimation and for subjects on which we are unable to experiment.

In this situation, *Advances in Cement Research* offers a field of discussion and communication for new approaches, and new proposals of materials and evaluation methods. Indeed, this issue contains four papers concerned with them.

The first paper by Galan and Glasser (2015) is concerned with the state of chloride in cement, its reaction with concrete and its reaction with the embedded steel bar and diffusion process. It compactly and precisely summarises and reviews up-to-date knowledge of chloride. The problems with Cl[−] are not avoidable. The aluminous component is useful for immobilisation, but is not for the stability of concrete.

For the fixation of various ions, Cho (1997) has divided the mass transfer resistance for many ion species into three classes. Ions that have a very high solubility, such as Na⁺, Cr⁶⁺ and alkali-activated-slag cement with fine structure in pore size, are greatly affected. For the ions that react to form a hydrate with hardened components (e.g. Cl[−], CO₃^{2−} and SO₄^{2−}, etc.), ordinary Portland cement with aluminate phases is sufficient; and for the amphoteric ions, such as Pb²⁺, a carbonated body with low pH pore solution is greatly affected.

The second paper by Wang *et al.* (2015) is concerned with kinetic modelling. The authors measured the hydration ratio by using nanoindentation modulus. They used a modified Tomosawa equation. In this subject there are two problems. One is how to determine the hydration ratio. In cements there are many phases with different kinetics. They attempted to use nanoindentation modulus, and they calculated successfully porosity, diffusion coefficients and other coefficients. The other problem is that the kinetics for all clinker phases are treated as the same component in the Tomosawa equation. However, nowadays, the cement composition contains many additives, such as slag and fly ash, and the high utilisation of waste materials changes its composition. Therefore, the basic understanding is very important.

The third paper by Rakhimova and Rakhimov (2015) is concerned with the utilisation of waste materials such as waste concrete powder. Construction waste increases year on year. Utilisation of these materials is difficult because they are contaminated with many materials, such as clay and aggregates. However, the utilisation techniques are very important to establish the recycling-orientated society.

The fourth paper by Zhai and Yang (2015) evaluates the degree of mixing uniformity by using dielectric properties. How to evaluate the homogeneity of mixtures is very important in the process control. Unfortunately, it is not clear whether the sensitivity of dielectric property is sufficient, so further discussion will be requested.

Advances in Cement Research welcomes reports on new attempts, and new proposals, and we hope that it activates many discussions among readers.

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