

KISHI LAB.

Physical properties of concrete and durability of concrete structure



Department of Human and Social Systems

Concrete Engineering and Recycling

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We research on (1) physical property, performance assessment, deterioration mechanism of cementitious materials, (2) development and practical application of new material and (3) quality inspection / maintenance of concrete structure.

A new maintenance frame combining water penetration and neutralization



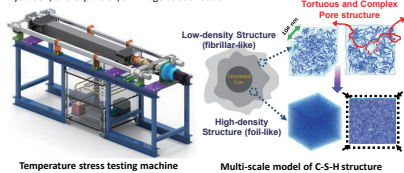
Although the neutralization of concrete is not a sufficient condition for the initiation of rebar corrosion, it has been revealed that it serves as a necessary engineering condition contributing to corrosion, especially when combined with exposure to (acid) rain.

Development of a prediction model for degradation (corrosion cracks and spalling) by calculating the rate and amount of rebar corrosion considering water penetration and the degree of neutralization.

Evaluation on multi-scale shrinkage performance of cementitious materials

Evaluation of the cracking performance of OPC and expansive concrete

Proposal of a multi-scale model to predict macroscopic stress and deformation by elucidating the microscopic stress-deformation mechanism in response to temperature history and by linking the pore structure, moisture movement, densification due to hydration, and expansion/shrinkage at each scale.



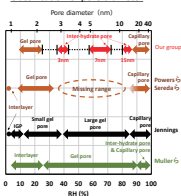
Investigation of nano-scale pore structure using isotherm

Pore structure analysis



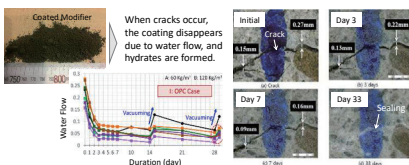
Experimental results were obtained that suggest a new classification of pore diameter, with representative pore diameter of 3 nm, 7 nm, and 15 nm.

Classification of pore diameter

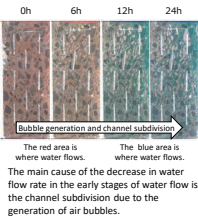


Self-healing process of self-healing concrete

- 1st generation : Crack closure due to hydration of un-hydrated cement
- 2nd generation : Crack sealing by precipitates caused by modifiers
- 3rd generation : Enhancement of sealing performance by improving modifiers

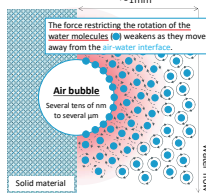


Water flow reduction due to the existence of air-water interface



Why do even microscopic bubbles contribute to a decrease in water flow?

It was pointed out that water molecules with restricted rotation are arranged at the air-water interface, possibly having a braking effect on the water flow near the air bubbles. ~1mm



Study on the regularity of flow based on velocity curve in coaxial cylinders

Observation of flow / Viscosity measurement

