

Establishing Methods to Design Materials for Polymer-Modified Cement Waterproofing Coating

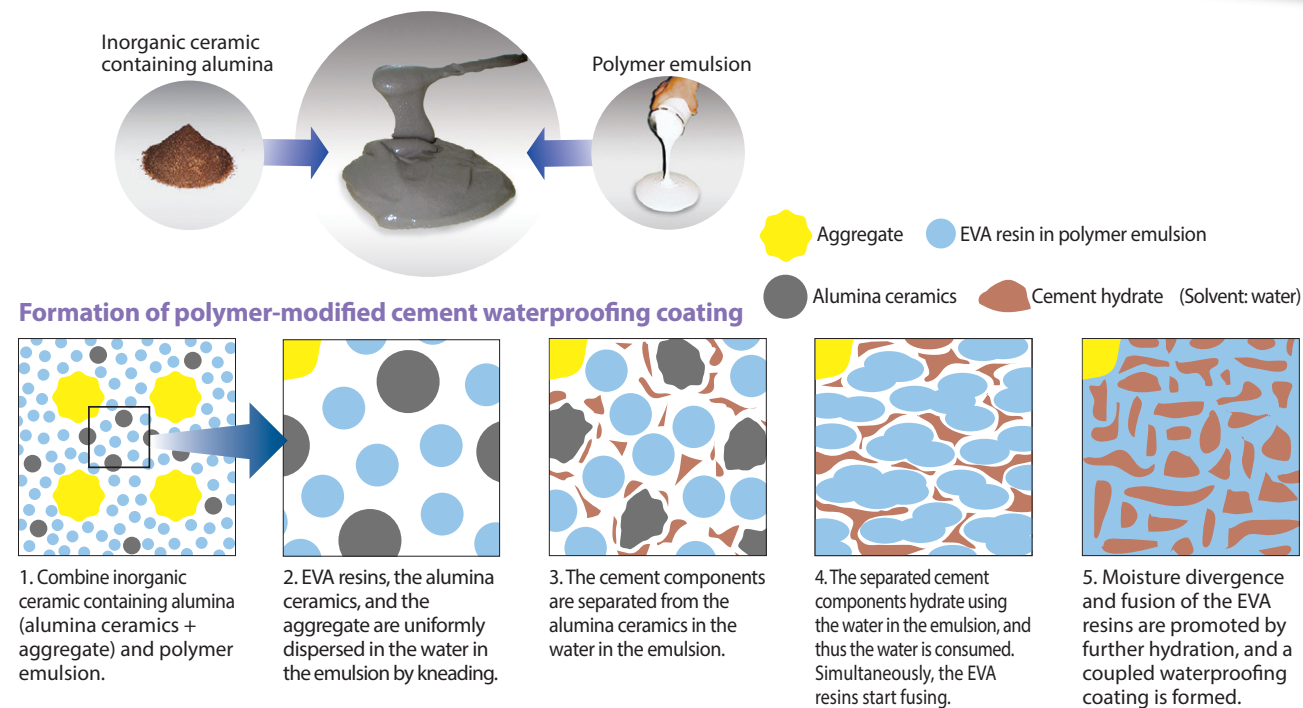
Pursuit of hydration and hardening processes

Achievements

- Observing the **cement hydration in polymer-modified cement waterproofing coating materials*** over time to clarify the process of cement hydrate production
- Realizing precise design method for materials suitable for each temperature and humidity in a construction environment to improve the reliability of products
- Adoption of the products in major facilities in Japan and overseas because of their improved performance and reliability (Examples of adoption: Roppongi Hills, Shanghai World Financial Center, Tokyo Urban Planning Group's Nerima Tunnel, etc.)

R&D facility: Ozeki Chemical Industry Co., Ltd.

***Polymer-modified cement waterproofing coating material:** A kind of waterproofing material used in construction and engineering work. When a polymer emulsion and cement admixture powder are mixed and kneaded at a construction site and applied to a base, the cement is hydrated to form a waterproofing coating. Polymer-modified cement waterproofing coatings are widely used as reliable and safe waterproofing materials because they combine the flexibility of polymers and the toughness and adhesiveness of cement and because they do not require the use of an organic solvent or open flame.



X-ray diffraction/
scattering

Role of SPring-8

Background

Polymer-modified cement waterproofing coating materials must have characteristics that are suitable for a wide range of environments because they are used under various conditions, such as high temperature and high humidity. In order to obtain materials with desirable properties under all conditions, it is essential to understand the process of cement hydration in detail and design materials so that the properties of the final coating can be predicted.

However, molecular-level microscopic measurement is needed to clarify the hydration process. Such measurement was difficult with general-purpose X-ray devices.

Results

We traced the entire hydration process in polymer-modified cement using high-brilliance X-ray diffraction in SPring-8, and examined when and how multiple cement hydrates are produced. In addition, we collected data using materials with the same combination ratio of cement and polymer emulsion by varying the temperature and humidity to quantitatively clarify the behavior of the materials, including changes in the reaction rate.

From these results, we made it possible to design materials that form a waterproofing coating even in a closed underground environment with a humidity of 100% by effectively using the water in the polymer emulsion to hydrate the cement.

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Progress of cement hydration measured in SPring-8 (at room temperature)

