

DEVELOPMENT OF MULTI-SCALE MODELLING FOR CEMENTITIOUS MATERIALS DAMAGED BY EXPANSION CRACK TO EVALUATE SIZE DEPENDENCY OF SULFATE ATTACK

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It is known that expansion crack due to external sulfate attack had signature cracking pattern corresponding to the diffusion of sulfate ion in liquid phase and transformation of solid phase based on chemical equilibrium of solid-liquid phase. Many researchers have observed that expansion crack tends to be localized at inner area and size dependency of expansion behavior was also observed [1]. The reason why size effect of expansion behavior due to sulfate attack was appeared cannot be clearly interpreted so far.

In this study, the analytical investigation using the analytical system [2] coupled with hydration model, diffusion-reaction model and crack propagation model were conducted in order to validate the size dependency of sulfate attack. This analytical system can reconstruct hydration process, transformation of liquid-solid phase and manifestation and propagation of expansion cracking behavior due to sulfate attack. Using this analysis, the transformation of solid phase and expansion crack of mortar specimens, which cross-section area were 10x10, 20x20 and 40x40 mm, were evaluated in order to clarify the size effect of sulfate attack precisely. As a result, this analytical system can evaluate the influence of expansion behavior due to the difference of cross-section area and visualize stress distribution and expansion cracking behavior in cross-section area. Furthermore, it can be said that the size dependency of expansion cracking behavior due to sulfate attack could be interpreted by the internal constraint due to remaining compressive stress.

REFERENCES

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