The 7th International Conference of Asian Concrete Federation
"SUSTAINABLE CONCRETE FOR NOW AND THE FUTURE"
30 Oct – 02 Nov, 2016, Hanoi, Vietnam
www.acf2016.vn

EFFECT OF THE MOISTURE MOVEMENT ON THE SPALLING OF HPC UNDER HIGHTEMPERTURE

T.Koyama[1], S.Bae[2], M. Tamura[3] and M.Kanematsu[1]

[1] *Department of Architecture, Tokyo University of Science, Noda,Chiba Japan*
[2] *Division of Architectural Engineering, Hanyang University, Seoul, Korea*
[3] *Department of Architecture, The University of Tokyo, Tokyo, Japan*

High-performance concrete (HPC) is vulnerable to the fire exposure, resulting in the explosive spalling of HPC surface at the early stage of fire. Physico-chemical process of the spalling is assumed to be due to the moisture pressure accumulated inside the pore structures of HPC paste matrix. In the present study, 2-dimensional moisture movement in HPC subjected to heating was quantitatively assessed in order to elucidate the effect of moisture content of HPC and polypropylene fibers (PP) on the spalling behavior of HPC. Thermal Neutron Radiography Facility (TNRF) was used to visualize and quantify the hydraulic behavior of HPC under high temperatures. For the TNRF experiment, two types of concrete specimens (100×100×20 $mm^{3,}$ water-to-binder ratio=18 %) with/without PP were prepared and moisture content of each specimens were adjusted.

Two-dimensional distribution of differential moisture content of paste in the specimen per unit volume during heating was estimated by examining the correlation between the change of water content of specimens with predetermined relationship between specific water contents and the intensity of transmitted neutron. The moisture clog in HPC was observed at the boundary of dried areas, moving up to the top with the temperature elevation. Furthermore, the presence of the moisture condensed areas was also observed around the coarse aggregates. Interfacial transition zones around the coarse aggregates are assumed to provide the space that the condensed moisture can pass through. On the other hand, when adding PP fiber to HPC, the boundary of fully dried areas moved up faster compared with HPC. This is because the polypropylene fiber melted and created a connected porosity from 200 °C allowing the increased permeability of moisture. Explosive spalling was observed in plain HPC specimen two times at 86 and 97 seconds after heating whereas it did not occur in PP-added HPC.

Smallmountain14@gmail.com: 7115620@ed.tus.ac.jp, +81 80 1142 4375