

Small-angle neutron scattering and neutron transmission of hardened cement paste/硬化セメントペーストの中性子小角散乱と中性子透過率

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We have measured a small-angle neutron and X-ray scattering (SANS and SAXS) of cement paste to investigate a nanoscale structure of cement paste [1, 2]. Through the in-situ SAXS measurements of cement paste, in particular, we have focused on a fine nanostructure that emerged with time as a shoulder on the SAXS profiles at the high- q region of around 3 nm^{-1} . Based on a microstructure model of cement paste [3] and a previous SANS work [4], it is expected that the fine nanostructure consists of calcium silicate hydrate (C-S-H) gel and pore water, where C, S, and H stand for respectively CaO, SiO₂, and H₂O in a conventional notation of cement chemistry. The C-S-H is a major hydrate among the cement hydrates and relates closely with the compressive strength of hardened cement paste (HCP).

Recently, to obtain information of the elemental composition of the fine nanostructure, SANS measurements of HCP samples were conducted using a contrast variation method in BL15 TAIKAN of MLF at J-PARC. In addition, the neutron transmissions of the saturated and dried HCP samples were also measured because water contents including these samples were evaluated for subtracting the background due to incoherent scattering of hydrogen from the SANS profiles. In the data analysis for the water contents evaluation, the neutron transmissions which were calculated using the PHITS code were compared with the measured neutron transmissions, where the JENDL-5 ACE library (ACE-j50; neutron induced nuclear data and thermal scattering law data for hydrogen and deuterium in water) [5] was applied to the PHITS calculations. The data analysis of the neutron transmissions is presented together with the data of SANS measurements.

References

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