

HSC018-03

Room: Exhibition hall 7 subroom 3

Time: May 23 15:50-16:00

Mechanism of short-term strength increase on mud brick by analogy from drying-induced deformation of rocks

Masahiko Osada^{1*}

¹Saitama University

It is entirely difficult to make large mud brick (adobe) with high strength and long-term durability, which had been made in ancient times; e.g. in the Arg-e-Bam world heritage of Iran. Two mechanisms are thought to contribute to harden mud bricks; one is a kind of compaction caused by suction pressure generated inside mud bricks during desaturation process (a short-term strength increase) and another one is a long-term strength increase accompanied with crystal growth (or chemical reaction). This paper describes, in terms of short-term strength increase, how we can make large mud bricks by analogy from drying-induced deformation experiments of sedimentary rocks which are being conducted in laboratory.

In general, the following two phenomena are observed during desaturation process. When muddy sediment is drying out, desiccation cracks are formed on its surface leading strength decrease as a whole. On the other hand, the parts between desiccation cracks become as hard as soft sedimentary rocks due to compaction. The drying-induced deformation experiments suggest that the magnitude of suction pressure is mainly controlled by the existence of nanopores. In that sense, mud brick becomes strong when the percentage of finer particles increases. However the cracking potential also increases due to high gradient of suction pressure. The experiment also suggests that the frequency of desiccation cracks is dependent on the spatial distribution of water content and the desiccation rate governed by the environments (temperature and humidity). The larger the size of mud brick, the higher the cracking potential.

Something is necessary to adjust these opposite effects and to keep the suction pressure between the center of a brick and its peripheral moderate in order to make large mud brick. Usually mud brick is made of sand and mud mixture with small portion of kinds of straw. We now pay attention to a role of straw not only in mechanical aspect but also in hydraulic one because the straw is working as drainage.

Keywords: adobe, strength increase, drying-induced deformation exp.