European Mineralogical Conference
Vol. 1, EMC2012-205, 2012
European Mineralogical Conference 2012

Impact of temperature on Cotta sandstone

C. Franzen (1), D. Krause (2), H. Siedel (3), and B. Ullrich (3)

(1) Institut für Diagnostik und Konservierung an Denkmalen in Sachsen und Sachsen-Anhalt e. V., Dresden, Germany (franzen@idk-info.de), (2) Fachhochschule Hildesheim, Fachbereich Restaurierung / Hein Restauratorengesellschaft mbH, Dresden, Germany, (3) Institut für Geotechnik, Technische Universität Dresden, Germany

Fire impact on stone can be regularly observed as damage in historic building material. Also several monuments built from Cretaceous Cotta sandstone material, a quartz sandstone with minor clay components, did show and partially still does exhibit damage phenomena referred to fire attack. For a better understanding of such phenomena experiments have been conducted in seven different temperatures of 300°C, 400°C, 500°C, 600°C, 700°C, 800°C and 1250°C. First interesting and clearly visible result is that the steady-going development in staining changed unexpectedly towards the final temperature step. Pore size distribution by Hg-porosimetry does indicate an increase in pores larger than 10 μm getting significant at 1250°C. This is proven by data of capillary uptake. Compressive strength tends to increase, while USV testing including measurement of Young's modulus show clearly a decrease towards higher temperatures.
XRD idicates the breakdown of kaolinite as the main clay component at temperatures > 500 °C while in SEM the typical booklet structures stay present as pseudomorphoses. Compressive strengths in wet and dry state of heat-treated samples are significantly different at lower temperatures ($\leq$ 700 °C). At higher temperatures these differences disappear. An explanation for the wet and dry results in compressive strength are clay components which are mainly responsible for the strength reduction in wet state and are proven to be destructed in the material treated with elevated temperature.