THERMAL EXPANSION OF ILLITIC CLAY RADOBICA

Igor Štubňa, Tomáš Húlan, Ján Ondruška, Anton Trník, SK

Abstract: Brick clay from a locality Radobica, Central Slovakia (39 % of quartz, 46 % of illite, 12.5 % of Na-feldspar, and 2.5 % of unidentified phase) was investigated for its possible reuse. The dilatometric measurements of clay were performed during heating as well as at room temperature on samples preheated at temperatures from 100 °C to 1100 °C. At the lowest temperatures, only a small expansion was observed. Dehydroxylation of illite (between 450 °C and 700 °C) was accompanied by the expansion. The sample has a relatively high amount of quartz that passes through the $\alpha \rightarrow \beta$ transition which exhibited itself as a steep expansion. Sintering and vitrification lead to the steep contraction. The course of the dilatometric curve of the fired sample is linear up to 500 °C with CLTE of 6.4×10^{-6} 1/K. After it, a regular thermal expansion continues. Partially fired samples showed that firing up to 500 °C almost did not influence the dimensions of the sample.

Keywords: ilitic clay, thermal expansion, sintering, ceramics

References

1. DasKshama, V. – Mohan, B.V. – Lalithambika, M. – Nair, C.G.R.: Sintering studies on plastic clays. *Ceramics International*, **18** (1992) 359-364
2. Hlaváč J.: *Základy technológie silikátov*. SNTL, Praha 1981 (in Czech)
3. Čičel B. - Novák I. - Horváth I.: *Mineralógia a kryštalochémia ílov*, VEDA, Bratislava 1981 (in Slovakian)
4. Kruglitsky, N.N. – Datsenko, B.M. – Moroz, B.I.: The influence of raw materials composition on the properties of fired clay products. *Ceramics International*, **18** (1984) 78-80
5. Caroll, D.C. – Kemp, T.F. – Bastow, T.J. – Smith, M.E.: Solid-state NMR characterization of the thermal transformation of a Hungarian white illite. *Solid State Nuclear Magnetic Resonance*, **28** (2005) 31-45
6. Húlan, T. – Trník, A. – Štubňa, I. – Bačík, P. – Kaljuvee, T. – Vozár, L.: Development of Young's modulus of illitic clay during heating up to 1100 °C. *Materials Science – Medziagotyra*, **21** (2015) 429-434
7. Gualtieri, A.F. - Ferrari, S., Kinetics of illite dehydroxylation. *Physics and Chemistry of Minerals* **33** (2006) 490 – 501.
8. Kováč, J. – Trník, A. – Medveď, I. - Vozár, L.: Influence of calcite in a ceramic body on its thermophysical properties. *Journal of Thermal Analysis and Calorimetry*, **114** (2013) 963-970

9. Venturelli, C. - Paganelli, M.: Sintering behaviour of clays for the production of ceramics. *Ceramic Forum International Ber. DKG*, **84** (2007) No.5, E1-E3
10. Ferrari, S. – Gualtieri, A.F.: The use of illitic clays in the production of stoneware tile ceramics. *Applied Clay Science*, **32** (2006) 73-81
11. Jankula, M. – Húlan, T. – Štubňa, I. - Ondruška, J. – Podoba, R. – Šín, P. – Bačík, P. –Trník, A.: The influence of heat on elastic properties of illitic clay Radobica. *Journal of the Ceramic Society of Japan*, **123** (2015) 874-879
12. Húlan, T. - Kaljuvee, T. - Štubňa, I. -Trník, A.: Investigation of elastic and inelastic properties of Estonian clay from a locality in Kunda during thermal treatment. *Journal of Thermal Analysis and Calorimetry,* **124** (2016) 1153–1159
13. Jankula, M. – Šín, P. – Podoba, R. – Ondruška, J.: Typical problems in push-rod dilatometry analysis. *Epitoanyag*, **65** (2013) 11-14
14. https://www.netzsch-thermal-analysis.com/en/materials-applications/building-materials/brick-clay-thermal-expansion/, accessed on June 22, 2021
15. P. Kidger – C. Dickinson: Clay brick vs concrete: Movement of masonry. *Technical note N.20*, The Clay Brick Association of Southern Africa, 2016
16. Húlan, T. – Štubňa, I. – Shiskin, A. – Ozolins, J. – Bačík, P. – Fridrichová, J.: Development of Young's modulus of natural illitic clay during heating and cooling stage of firing. *Clay Minerals*, **54** (2019) 229-233

Contact address

RNDr. Tomáš Húlan, PhD.

Department of Physics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra

Tr. A. Hlinku 1, 94901 Nitra, Slovakia

e-mail: thulan@ukf.sk