MODIFICATION OF THERMAL BEHAVIOUR OF KAOLIN CLAYS BY ULTRASONIC TREATMENT

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The present study examines the effect of sonication on the thermal behaviour of kaolinite. Selected well ordered sedimentary kaolin clays from Lower Silesia (Poland) (Maria and Zofia) were chosen to describe this effect. Ultrasonic treatment of raw samples was performed in cycles of 1, 3, 9, 21 and 40 hours. Sonication process caused change of surface area value from 15 m^2/g (for raw samples) to 39 m^2/g (for 40 hours) for Maria and from 15 m^2/g to 34 m^2/g for Zofia. After final stage of applied processing no more size reduction was observed. The (001) reflections of all treated samples of kaolinite were used to obtain best mean particle diameters calculated by MudMaster program (Eberl et al., 2000). Thickness of domains of coherent scattering for both kaolinites changes suitably from 0.049 μm for raw sample till 0.045 μm for Maria and from 0.049 μm till 0.040 μm for Zofia after 40 hours of ultrasonic treatment. When sonication time increases, the original dehydroxylation effect shifts to lower temperatures (Fig. 1) and decreases in intensity. At the same time the exothermic effect, previous to the mullite formation, shifts to lower temperatures and broadens. Comparison of the HTXRD patterns (Fig. 2) of the untreated and the sonicated sample during 40h shows that (001) reflection of the treated sample decreases considerably stronger than the (001) reflection of untreated kaolinite. It disappears at 600°C indicating end of the dehydroxylation process. The conducted investigation of the surface area, the DTA-TG curves and the HTXRD patterns showed that the structure and the thermal behaviour of kaolinites were strongly affected by the ultrasound treatment.

Reference

EBERL, D. D., DRITS, V., ŚRODOŃ, J., NUESCH, R. (2000): MudMaster: a Program for Calculating Crystallite Size Distribution and Strain from the Shapes of X-ray Diffraction Peaks. Available from: ddeberl@usgs.gov.

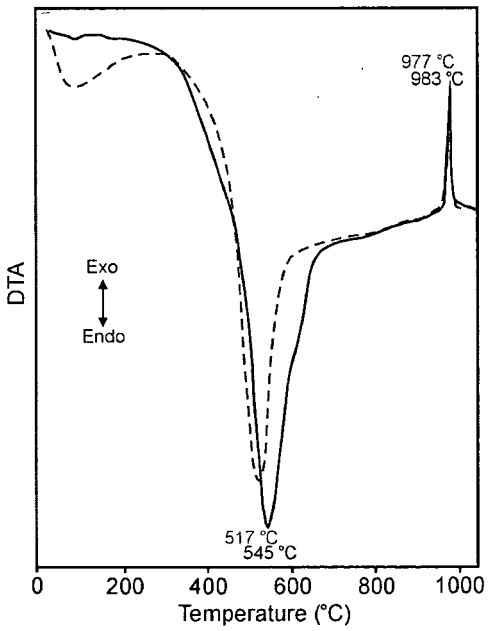

Fig. 1: DTA curves of the untreated Maria kaolinite (solid line), 40 hours sonicated (dashed line)

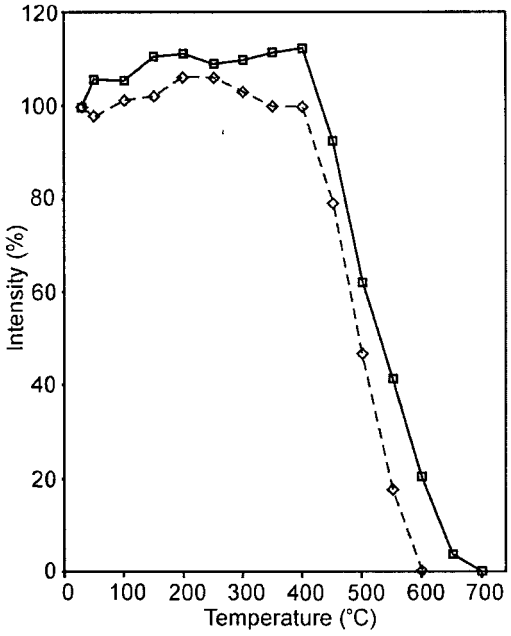

Fig. 2: Variation of the intensity of the basal reflection of the untreated Maria kaolinite (solid line), 40 hours sonicated (dashed line).