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SOME APPLICATIONS OF THE DECREPITATION TECHNIQUE AND THERMOSONIMETRY IN RESEARCH ON MINERALS AND BUILDING MATERIALS

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ABSTRACT

A status report is given showing the application of thermosonimetry in Czechoslovakia.

DECREPITATION TECHNIQUE IN THE STUDY OF MINERALS

The decrepitation technique, devised by Scott [1], was further developed in Czechoslovakia and used in the study of minerals. Special apparatus for decrepitation technique was developed by Konta et al. [2]. Figure 1 shows the decrepitograph of feldspar, with acoustic effects in the temperature range between 270 and 343°C [2].

The decrepitation technique was applied by Mýl and Kvapil [3,4] in the study of phosphates. The changes in the crystal lattice, the dehydration of minerals and other effects have been studied by this technique and the results compared with the results of DTA. In Fig. 2 the results of application of the decrepitation technique to sodium hydrogen phosphate are shown [3]. In the study of synthetic quartz, characteristic acoustic effects were observed during heating at a constant rate [4]. Using this technique, other synthetic minerals, e.g., corundum and rubine, have also been studied during heating

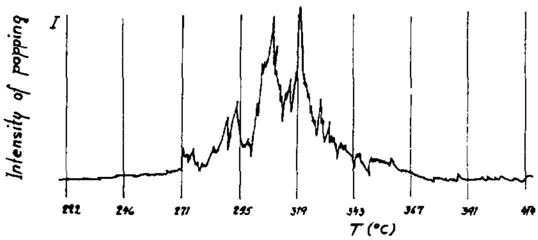

Fig. 1. Decrepitograph of feldspar.

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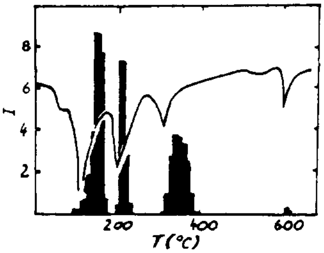

Fig. 2. Thermosonimetric curve and DTA curve of sodium-hydrogen phosphate. Heating rates: for TS, 25 °C min^{-1}; for DTA, 10 °C min^{-1}.

at temperatures up to 1600 °C and the annealing of the stress in synthetic minerals has been examined [5].

THERMOSONIMETRIC STUDY OF THE MICROSTRUCTURAL CHANGES IN CERAMICS DURING FIRING

The study of raw materials for ceramics was carried out under conditions of non-isothermal heating and cooling in air by Lach and co-workers [6–8]. It was found that the thermosonic activity of kaolin significantly increases when calcite, dolomite, silica, feldspar, etc., are added. The thermosonic effects correspond to dehydroxylation of kaolin, but in the presence of calcite and dolomite the increase in the thermosonic emission starts at 250 °C. Figure 3 shows examples of TS curves of kaolin containing (a) calcite and (b) dolomite.

The thermosonic emission activity is higher during cooling of the samples than during heating; also, the thermosonic activity is lower with samples that are well homogenized than with poorly homogenized mixtures.

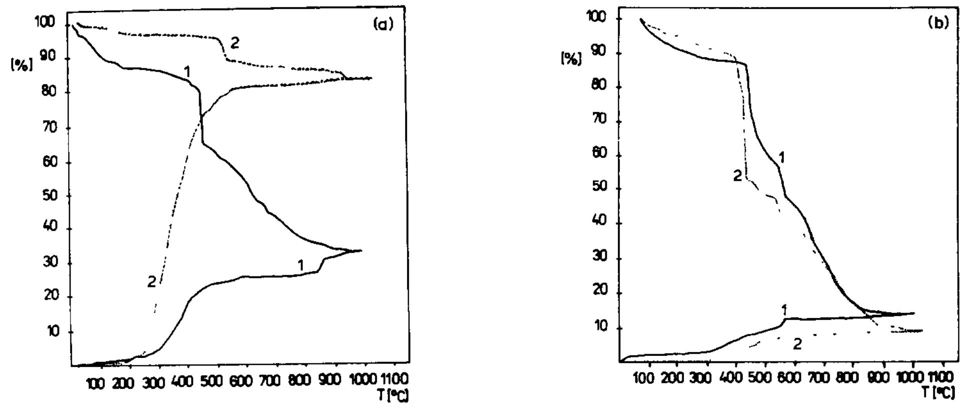

Fig. 3. Thermosonimetric integral curves obtained during heating and subsequent cooling of kaolin in mixtures with (a) calcite and (b) dolomite. 1, Mixtures of the composition 9:1; 2, mixtures of composition 7:3.

THERMOSONIMETRIC STUDY OF THE FROST RESISTANCE OF BUILDING MATERIALS

The frost resistance of building materials was studied during cooling of samples from room temperature to liquid nitrogen temperature [9]. When cooling dry samples the acoustic emission was measured and the emission activity was found to increase proportionally to the increase in the pore volume. When cooling samples soaked in water, the acoustic emission patterns were of different character to those for dry samples. The emission patterns of soaked samples had substantially smaller amplitudes than those of dry samples.

On the basis of experiments, a method for the evaluation of the frost resistance of porous building materials was suggested. Thermosonimetry can be applied as a rapid method for evaluating the frost resistance, providing data on the quality of building materials for application under conditions of extreme temperature.

Thermosonimetry makes it possible to establish the changes that take place in the microstructure of ceramics during firing.

From the temperature dependence of thermosonic emission the temperature ranges in which damage to the ceramic body takes place can be estimated, and the extent of the damage can be estimated from the TS spectra.

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