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APPLICATION OF THERMOSONOMETRY FOR THE STUDY OF FIRING IN CERAMICS

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ABSTRACTS

The termosonOmetry was used to follow the changes in the microstructure of the samples consisting from kaolin and admixture (calcite).

INTRODUCTION

In the last time the thermosonic method met a use in the research of various material, ceramics as well. The termosonometry represents a specific method of structural analysis based on generation of sound with thermal loading. The process of sound generation, i.e. the formation and the propagation of acoustic fonons, has been designated as the phenomen of acoustic emission AE. (1)(2). Starting from the New Ceramic Conception (3) the acoustic emission AE assists in determination of thermal effect on the arrangement of ceramic microstructure in firing.

MEASURING METHODS

The ceramic raw material mixture consisted of kaolin and carbonate. After a maturation of paste and gradual drying the specimens were subjected to measuring in the apparatus

For the illustation, results obtained from material mixtures are shown in Figs.

RESULTS AND DISCUSSION

The present results can be characterized as follows:

- Increased AE activity of specimens correlates with kaolin dehydroxylation, while in the specimens with a content of carbonates these bring about an increase in activity already from 250°C. The activity increases with the percentage of carbonates.
- The increase in AE activity during heating correlates with the increase of stress in the body as well. The specimen already shows very small activity.

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- The AE activity during cooling (interval 1000-500°C) has no significant differences in the character of activity at various specimens. The proportion of AE activity changed with the composition of specimen only. With gradual transition of the specimen from the pyroplastic to the solid state the internal stresses increase and thereby the level of AE activity keeps increasing as well.
- The share of AE released during cooling (to the ambient temperature) is higher than that released in the heating period. From that point of view the cooling is the more sensitive period.
- The total and average frequency can be understood as a measure of changes taking place in the body microstructure on heating, while the distribution of non-zero on frequency and of time intervals between non -zero frequencies are means for qualitative analysis of structural changes taking place on heating.

CONCLUSIONS

The thermosonometry can be the further method for the study of problem in ceramic firing. It completes the results of other methods and thereby it helps to the more precise determination of ceramic microstructure during firing.

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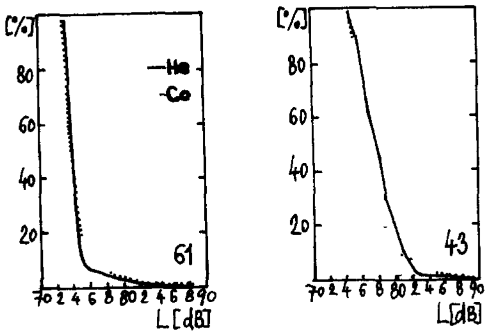

Fig.1 Cumulative probability of signal level: 61 - kaolin, 43 - kaolin and $CaCO_3$ 70:30

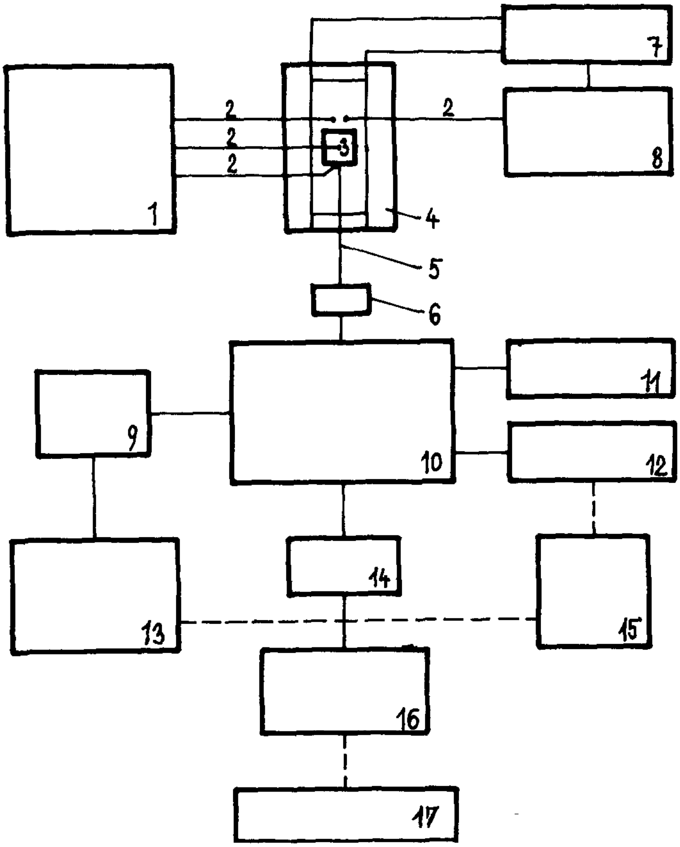

Fig.2
Block diagram of apparatus:
1 3point thermocouple recorder
2 thermocouple Pt
3 specimen
4 crussilite furnace
5 waveguide
6 transducer BK 4344
7 power unit Netzsch
8 temperature control Netzsch
9 noise level analyzer BK 4426
10 selective amplifier
11 level recorder BK 2305
12 taperecorder
13 X-Y recorder
14 universal counter BM 520
15 transient recorder Datalab
16 puncher
17 minicomputer ADT 4100

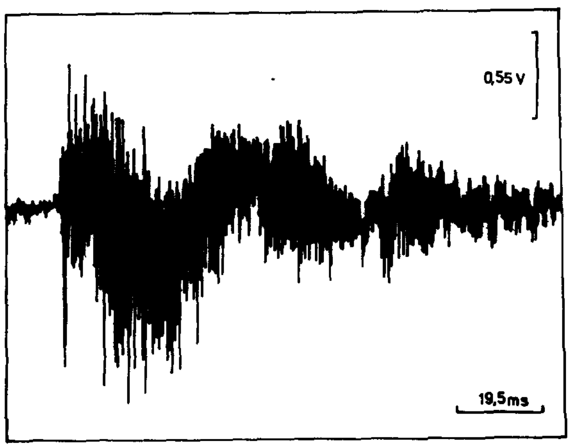

Fig.3
Activity of AE analyzed by Datalab

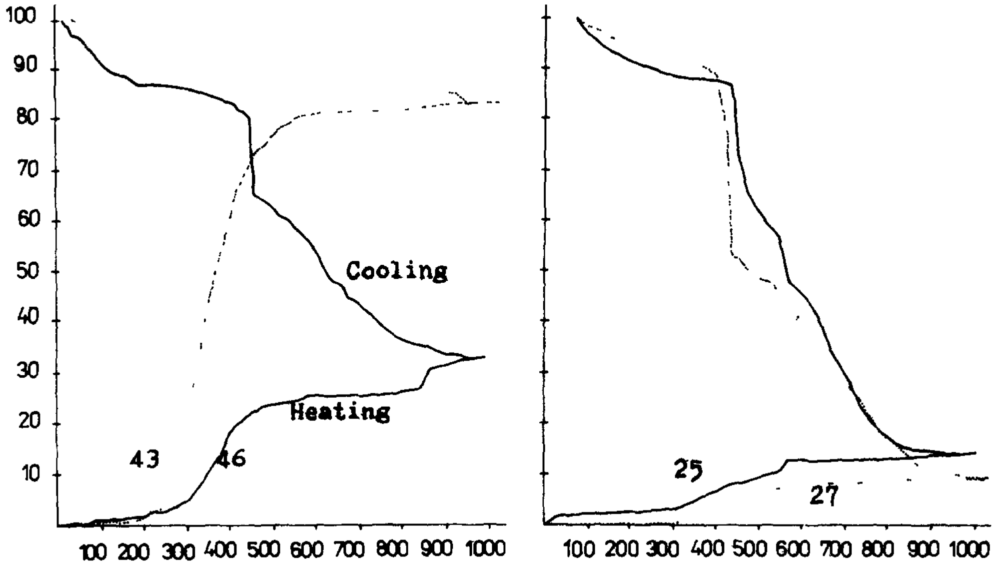

Fig.4 Relative cumulative count vs temperature: 43 - kaolin and $CaCO_3$ 70:30, 46 - kaolin and $CaCO_3$ 90:10, 25 - kaolin and dolomite 90:10, kaolin and dolomite 70:30

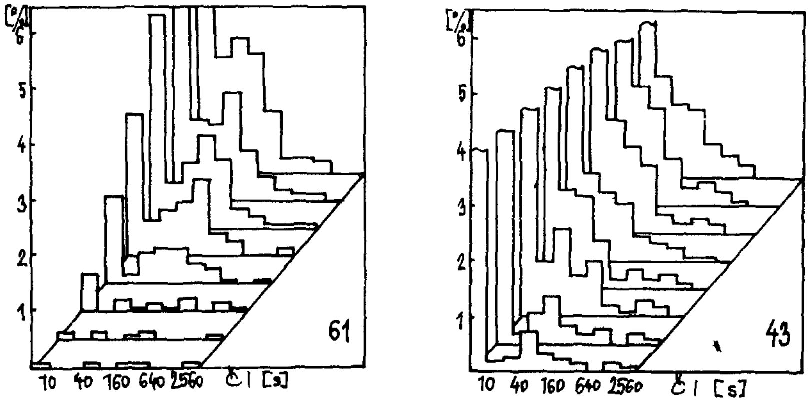

Fig. 5 Distribution of time intervals between counts on 8 levels: 61 - kaolin, 43 - kaolin and $CaCO_3$ 70:30