High temperature and heat insulated calcium silicate materials

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Currently heat – resistant materials, with an operating temperature of 500 °C, are limited on the construction and heat-and-power insulation product market. Vermiculite slabs, mineral wool products and perlite plates can be referred to domestic materials. However, all of them have essential drawbacks. As an alternative there are Danish plates of the company "Skamol" which possess high characteristics. Production of such plates isn't presented in Russia so far and the cost of the imported materials is very high. Thereby, the purpose of our study is to research the production possibility of heat-resistant calcium silicate materials on the basis of local raw materials.

We began the research of industrial samples with the phase composition determination based on the X-ray diffraction analysis method (XRD). Decryption of X-ray diffraction pattern data allows us to draw a conclusion that these materials are mainly composed of calcium silicate hydrate named xonotlite. In addition, the Skamol sample was researched by the method of Differential scanning calorimetry (DSC). There is a thermogram of the Skamol sample in Fig. 1. The wollastonite crystallization process is presented in terms of an insignificant exo-e fect under 805 °C. [1]

The hypothesis of technology development was made according to the results of the conducted researches: the researched material can be obtained by means of water suspension autoclave processing prepared by intergrinding of silicic rock and lime.

To obtain suspension of a proper consistency, some compositions with different amount of water were prepared. The received compound was dispersed in a planetary laboratory ball mill under the different modes. Fiber in the amount of 2 % of mass was introduced into a part of slurry dry, then poured in metal forms (sizes of 10 • 10 • 2.5 cm) and subjected to hydrothermal processing according to the modes: 16 atm. 6 h., 12 atm. 6.

The most appropriate samples were researched by XRD and DSC methods and also calcinated under 1000 °C. The samples withstood calcinating without structure destruction. Results of comparative X-ray diffraction patterns of the synthesized sample under 16 atm. and the sample of Skamol are provided in Fig. 2. Crystalline perfection of the received sample is noted to

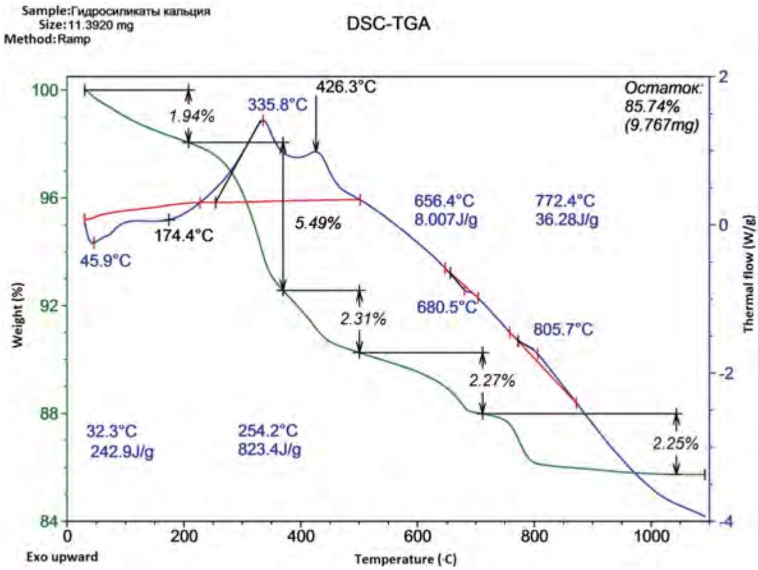

Fig. 1. *Differential scanning calorimetry results of Skamol Super-Isol sample*

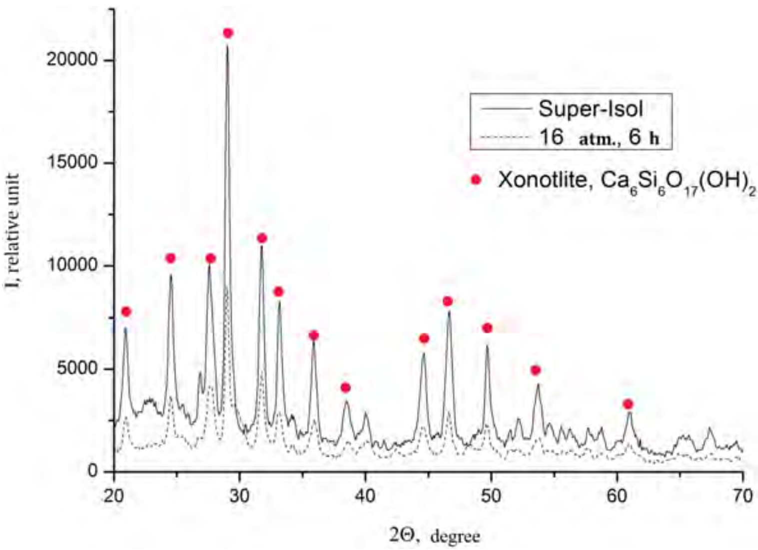

Fig. 2. *XRD results of the synthesized sample under 16 atm. and Super-Isol*

be worse, but all the main peaks are shown on the X-ray diffraction pattern.

On comparison thermograms there is an exo-effect enhancement in the range of 800–850 °C indicating the incomplete xonotlite formation process under existing conditions that leads to wollastonite crystallization from synthesized components [2].

Based on the data we conclude that calcium silicate product synthesis should be carried out under 16 atm. with intensive grinding of raw materials. The received samples are characterized with higher density, respectively, with durability and heat conductivity. Upon heating up to 1000 °C the sizes and strength of the samples remain unchangeable.

Heat – resistant calcium silicate material obtaining based on local raw materials was studied. The samples, with significantly better characteristics than the materials produced in Russia, were received. Further technology development will allow us to produce ultralight materials with high structural characteristics.

References

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Development the logical algorithm for optimal gasoline blending

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Gasoline yield increases from year to year, while contemporary requirements on gasoline quality became more and more strict. The economic benefits of gasoline blending optimization are sufficient, but the task is challenging, due to factors such as:

- large number of involved feedstock streams,
- changes in the feedstock composition even for the same refiner ,
- non-linear nature of blending octane number,
- planning and scheduling difficulties

Such a difficult optimization problem requires highly specialized algorithms to be solved. In practice, applying mathematical models which consider observed problems is an effective solving method.