The use of copmosite heating storage materials based on $Zn(NO_3)_2 \cdot 6H_2O$ for space heating and domestic hot water supply in the Arctic region of the Russian Federation

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Subtitle

The use of promising heating storage materials based on crystalline hydrates of zinc nitrate is an effective direction for the development of energy-intensive and resource-saving technologies, the development of which is provided for in the state program of the Russian Federation “Socio-economic development of the Arctic zone of the Russian Federation” No. 366. This is currently especially true in the northern regions, where the development of cheap and effective technologies that are available to the consumer is necessary. The use of energy storage systems will reduce the economic burden on the consumer by reducing heat losses arising from the system supply of thermal energy regardless of the required volumes of its use, as a result of which part of the thermal energy is lost instead of being accumulated and used later.

Salt hydrates are affordable and safe compounds for use as thermo-accumulating materials and are able to accumulate heat for a long time, as evidenced by high enthalpy values. In this case, crystalline hydrates are phase-change materials (PCM) [1,2], due to which they have a clear advantage over sensible heat TAMs, whose enthalpy is lower in the medium temperature range that interests us [3].

In our work, we propose several composite mixtures based on $Zn(NO_3)_2 \cdot 6H_2O$ salt hydrate, the results of the study of which established their thermal stability in the medium temperature range, so that they can be used in a warm floor system for a long time [4,5]. Table 1 presents these

mixtures in the temperature range from 30 to 40 °C. The measurements were carried out using the T-history method to ensure the reliability of the results under natural cooling conditions with a mass of a few grams of the sample. According to the results of the study, all mixtures had low supercooling.

Table 1. Characteristics of composites based $Zn(NO_3)_2 \cdot 6H_2O$

	T, °C	**supercooling**
Mixture 1	~29	2.7
Mixture 2	~36	3.81
Mixture 3	~36	4.44
Mixture 4	~29	3.63

Reducing supercooling is especially relevant for thermal energy storage systems, which can also be used as space heating and domestic hot water systems. PCM with different temperature ranges of melting / crystallization will allow more rational use of the available heat and control the processes of heating water for various needs. The given experimental characteristics show that the composites studied in the work can be used as PCM in the initial temperature range, which is especially important when rationalizing the heat energy consumption in secondary household problems.

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