

**Brief information about the project**

Name of the project	Investigation of thermophysical properties and structural-phase states of organic substances at low temperatures (80-300 K)
Relevance	In the message to the people of Kazakhstan "Kazakhstan's way-2050: a single goal, a single interest, a single future" the President of the country noted: Development of new knowledge and technologies is the main way to increase the potential of the country. The development of new knowledge and technologies is the main way to increase the country's potential. Deep knowledge of the laws of nature and their use for human needs in technology and, in particular, in various technological processes related to the processing of raw materials – natural products, semi-finished and finished products, medicine in the field of transplantology, is a turning point of scientific and technological progress. Knowledge of the properties of various materials, petroleum products and natural products that are stored, processed and used in practice requires the rational use of fundamental scientific achievements. The development of modification and intensification of heat treatment processes is based on the basic principles of modern technology: from the knowledge and analysis of the thermophysical properties of organic materials as an object of processing to the choice of methods and optimal process modes, and on this basis, to the rational creation of apparatus design. Of practical importance is the formulation of the problem of determining the analytical form of the function that connects the effective coefficients of generalized conductivity of heterogeneous systems with the conductivity coefficient of their individual components and their volume concentrations. To achieve the set goal of the project, it is important to set a task for determining the main thermophysical characteristics of the objects under study.
Purpose	The aim of the project is to obtain new data on the thermophysical properties of organic substances, as well as to study thermally stimulated structural-phase transformations at low temperatures of samples. The objects of research are fullerenes, alkanes ( $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$ , $\text{H}_3\text{C}-\text{CH}(\text{CH}_3)-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$ ), organic substances of natural origin.
Objectives	To obtain new data on the thermophysical properties of organic substances, as well as to study thermally stimulated structural-phase transformations at low temperatures, the following tasks are planned: 1. Modernization of the measuring cell for the "diffuse reflection" prefix of the FSM 2203 spectrometer with the possibility of combining studies of a single FTIR sample and Raman spectroscopy in the low-temperature range from 80 K to 300 K. 2. Modernization of a low-temperature measuring cell for determining the thermal

	<p>conductivity coefficient of liquid and powdered samples in a wide temperature range (80K - 300K). 3. Conduct IR and RAMAN spectrometric studies of solid, liquid and powdered hydrocarbons in the frequency range of characteristic oscillations. Based on the obtained IR spectra, information will be obtained on the effect of temperature on the position and amplitude of the absorption bands corresponding to the characteristic vibrational modes of the molecules of the substances under study. 4. To investigate thermally stimulated structural-phase transformations of hydrocarbons at low temperatures. Using the spectrometric method of observation, the temperature intervals of the existence of various structural states of the samples will be determined. 5. To investigate isothermal relaxation processes and temperature values of structural transformations of hydrocarbon products at low temperatures using the obtained IR spectra. To investigate the role of functional groups of a molecule in the process of thermally stimulated transformation on the thermophysical properties of organic substances. 6. To determine the influence of the structure of the simplest organic molecules on the value of the glass transition temperature.</p>
<p>Expected and achieved results</p>	<p>The result of the project is to obtain new fundamental data on the properties of organic materials at low temperatures. The results of the study will be published in articles in rating journals, and will also be reported at major scientific conferences. A master's thesis and at least two bachelor's theses will be prepared. At least 4 jobs will be created for highly qualified young professionals; Application of scientific results: The implementation of this project with the involvement of young scientists and students will contribute to the formation of a social environment involving talented young people with a penchant for technical sciences and high-tech technologies. This circumstance has a long-term strategic effect, the results of which will manifest themselves and affect the level of the scientific and technological state of the country. Training of specialists in the field of cryogenic technologies and materials science; The results will have a certain impact on the development of low temperature physics and cryogenic technologies of the Republics of Kazakhstan.</p>
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List of publications with links to them	-
Patents	-



Liquid nitrogen production plant ZIF 1002



"Dry ice"