

## Brief information about the project

Name of the project	AP19678245 “Photoinduced formation of complex molecular compounds in ice with a high content of organic substances under various astrophysical conditions”
Relevance	<p><b>The aim of the project</b> is to experimentally study the formation of complex organic compounds under the action of UV radiation in thin films obtained by condensation of organic substances from the gas phase under various astrophysical conditions. The objects of study are monohydric alcohols (CH<sub>3</sub>OH, C<sub>2</sub>H<sub>5</sub>OH, C<sub>3</sub>H<sub>7</sub>OH etc.), methane, ethane, carbon dioxide, and their mixtures with water in various concentrations.</p> <p><b>Scientific problems and challenges.</b> Astronomical studies of interstellar ice are focused on the icy components of the studied substances. For the various physical and chemical reactions taking place on the surface, the porous structure of ice offers a large surface area. The explanation of the ways for complex molecule formation, which continues to be found in the interstellar medium, is one of the main tasks of modern astrophysics and astrochemistry. Complex organic molecules of special astrobiological interest are usually found in the inner hot regions of protostellar shells. Various well-known models show that desorption by photochemistry in ice can explain this abundance. However, detailed quantitative data on ultraviolet (UV) radiation-induced complex ice chemistry and the exact pathways for the formation of most of the observed species are limited to a complete explanation.</p> <p>The proposed Project refers to the modern direction of science - the physics of cryocondensed media. An important feature of the planned research is the fact that it will use <b>approaches</b> developed earlier for UV irradiation of the solid phase substances to solve the problems posed.</p> <p><b>The results</b> of the project may contribute to the understanding of the physical foundations to explain the formation of complex molecular compounds. These data can also serve as a verification database for observational studies, ongoing astrophysical and astrochemical studies of the cold parts of the Universe. Research in this direction is pioneering and in Kazakhstan is carried out only in the laboratory of cryophysics of KazNU.</p>
Purpose	The aim of the project is to experimentally study the formation of complex organic compounds under the action of UV radiation in thin films obtained by condensation of organic substances from the gas phase under various astrophysical conditions.
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

	<p>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 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>Expected results</p> <p>1) Based on the results of the implementation of the scientific project, for the entire period of the project implementation, the following minimum results will be obtained:</p> <ul style="list-style-type: none"> <li>- at least 3 (three) articles and (or) reviews in peer-reviewed scientific publications in the scientific direction of the project, indexed in the Science Citation Index Expanded and included in the 1 (first), 2 (second) and (or) 3 (third) quartile according to impact factor in the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 50 (fifty);</li> <li>- at least 1 (one) article or review in a peer-reviewed foreign or domestic publication recommended by the CCIS;</li> <li>- either at least 2 (two) articles and (or) reviews in peer-reviewed scientific publications indexed in the Science Citation Index Expanded and included in the 1 (first) and (or) 2 (second) quartile by impact factor in the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 65 (sixty-five);</li> <li>- either at least 1 (one) article or review in a peer-reviewed scientific publication indexed in the Science Citation Index Expanded and included in the 1 (first) quartile in the Web</li> </ul>

	<p>of Science database or having a CiteScore percentile in the Scopus database of at least 95 (ninety-five) .</p> <p>2) publication of monographs, books and (or) chapters in books of foreign and (or) Kazakh publishing houses: not planned;</p> <p>3) obtaining patents in foreign patent bureaus (European, American, Japanese), in Kazakhstan or Eurasian patent bureau: not planned;</p> <p>4) development of scientific, technical, design documentation: not planned;</p> <p>5) dissemination of the results of the work among potential users, the scientific community and the general public: the results of the study will be published in articles in high-ranking journals;</p> <p>6) other measurable results in accordance with the requirements of the tender documentation and the specifics of the project. Additionally, the section specifies:</p> <p>The proposed Project refers to the modern direction of science - the physics of cryocondensed media. An important feature of the planned research is the fact that it will use approaches developed earlier for UV irradiation of the solid phase of the studied substances to solve the problems posed. The results that are planned to be obtained during the implementation of the project may contribute to the understanding of the physical foundations of the formation of complex molecular compounds. These data can also serve as a verification database for observational studies, ongoing astrophysical and astrochemical studies of the cold parts of the Universe. Research in this direction is pioneering and in Kazakhstan is carried out only in the laboratory of cryophysics of KazNU.</p>
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<p>List of publications with links to them</p>	<p>-</p>
<p>Patents</p>	<p>-</p>