

According to the commonly accepted definition, nanocomposites are multicomponent materials in which at least one phase has nanoscale morphology with dimensions less than 100 nm. These materials attract much attention in drug delivery, optics, electrics, magnetism, ceramics, and catalysis. Additionally, they are of particular interest for the application as electrolytes in batteries and fuel cells. This is because they are less flammable and leak-free compared with conventional liquid single-component electrolytes and therefore much safer. Nevertheless, before their commercial use, there is a need to develop and systematize knowledge about the thermodynamic and dynamic properties of these substances, especially under high-pressure conditions.

This project is devoted to a thorough understanding of the thermodynamics and dynamics of ionic nanocomposites. To realize this goal, we will perform unique studies of phase transition and transport properties of many ionic nanocomposites in an extensive range of temperatures and for the first time at high pressure (up to 0.5 GPa). This type of research allows us to create a universal picture of transport properties of ionic nanocomposites in the entire thermodynamic space and, consequently, offer new ideas for the design of advanced amorphous nanocomposites with exceptionally efficient ion transport. This, in turn, will bring an essential breakthrough in the field of material sciences.