The world of nanomaterials still holds many secrets. 2D layers from oxide materials are considered valuable materials primarily in microelectronics, optoelectronics, sensors, supercapacitors and solar collectors, moreover materials in the form of thin layers show properties that are differing from those of bulk materials. Until now, nanometric materials have been mainly obtained using techniques that require specialized and expensive equipment, primarily using vapor deposition (physical vapor deposition PVD or chemical vapor deposition CVD).

In order to lower the temperature of the production of nanosystems, a method that can be used without complicated equipment was proposed in the project. When oxygen is available a few nanometers thick oxide layers forms easily on non-toxic gallium-based alloys. It is possible to transfer this layer onto various types of substrates - like ceramic substrates such as glass, silicon oxide or other type of substrates more often used in electronics and sensors, e.g. silicon or flexible, transparent materials like polymers.

The aim of the research will be to use of various two-component alloys based on gallium with additions of such elements as aluminum, tin, zinc to obtain nanometric layers on conductive and non-conductive substrates. We plan to examine the quality of the obtained layers by means of atomic force microscopy, which will allow the determination of the thickness and morphology of the obtained materials, optical and scanning electron microscopy will be used to describe the quality, continuity and morphology of layers and transmission electron microscopy with EDS will be used to examine the chemical composition of the material. In addition, the XPS technique will be employed in order to determine the chemical composition of the layers. In the project, the influence of temperature and chemical composition of the initial alloy on the obtained layers will be studied as there is no information on this topic in the literature. The layers will be analysed using UV-VIS spectroscopy in order to assess their level of transparency. For promising systems, attempts will be made to create conductive connections and to measure the electrical conductivity.

Optimizing the technique of producing nanolayers at room temperature will prove beneficial, especially for the field of electronics and the still developing field of nanotechnology. There is limited data in the literature on the production of layers using liquid alloys, but many of the described techniques require heating the system to temperatures above room temperature, and so far the influence of factors such as temperature or composition of the chemical alloys have not been analyzed. The improvement of the quality of the obtained layers in terms of morphology, chemical and phase composition as well as electrical properties seems promising from the point of view of possible application.