The aim of the project is to identify the optimal crystallographic orientation of germanium substrates for the growth of high-quality graphene which is characterized by a high mobility of carriers and a uniformity of thickness and a continuity of the layer. In order to achieve and verify the preconceived tasks, physicochemical properties obtained layers, as well as the formation of layers of graphene as a function of the crystallographic orientation of germanium substrates on which the graphene is produced will be examined. The Applicant will focus on understanding and describing the kinetic processes occurring on the surface of the germanium. Also, there will be defined structural, electrical, morphological and optical properties of the obtained layers and their dependance on the orientation of monocrystalline Ge substrate. In addition, the Applicant will seek to grow the second layer of graphene on an existing first layer so that a continuous and homogeneous bi-layer is formed. Mono and bi-layers will be grown using the chemical vapor deposition method.

The Project will be divided into three main tasks:

- Graphene growth on different crystal oriented germanium substrates,
- Growth of bi-layers of graphene,
- Evaluations of graphene layers as a function of crystal orientations of germanium substrates.

During the realization of the Project through the use of a number of complementary research methods, the physical and chemical properties of graphene on various germanium substrates will be examined. The research will investigate both surface of the graphene/germanium samples, as well as their structure.

Ge substrates present an alternative to the currently used surfaces in the graphene growing process, such as Cu and SiC. Germanium substrates are interesting because of the possibility of their direct use in silicon technology, and what is more, they can provide graphene layers that are uncontaminated with metals. In addition, according to the Applicant’s preliminary findings and observations, it seems to be possible to grow two layers of graphene, thus opening the possibility for graphene to be used in the future in a wider range of products, such as electronic and photovoltaic devices.