

The proposed project is to develop the method of characterization of semiconductors such as GaAs, AlGaAs or GaN used in the micro- and optoelectronics (lasers, LEDs, transistors etc.) based on the measurements in scanning electron microscope (SEM). Contrary to popular beliefs, the image created in the scanning electron microscope has very little in common with the images obtained by optical microscopes. This is actually a map of the intensity of a specified signal generated by the interaction of primary electrons with the material. Thanks to an appropriate choice of parameters of the microscope, one can get a wide variety of information on the intrinsic qualities of the material.

Low-energy scanning electron microscopy is a technique by the use of which one can also visualize the differences in the composition of the materials used in the optoelectronic industry. During the manufacturing process of lasers and sensors, it becomes crucial to assess whether individual layers (often with dimensions of nanometers) of materials in the structure have the proper thickness and composition. It is also important that the insulating regions in these devices can be visualized in an easy and relatively fast manner, without the need for sample preparation with wet chemical etching technique, as it is practiced nowadays.

The information that technologists receive from such images allow for a deeper understanding of the growth mechanisms and may be used for making improvement in the technological processes. With the images obtained in a scanning electron microscope directly on freshly cleaved cross-sections of the samples it is possible to gain information about the correctness of the process of growth of layers in a stack, their accurate measurement of width and quality assessment. All this can be done without exposition of people to harmful agents, such as highly toxic and dangerous substances usually used for etching of the samples. Furthermore, this technique significantly reduces the time and speeds up the process of characterization of layers, and therefore could improve the process of verification of the effects of growth in the production lines for optoelectronic devices.