POPULAR SCIENTIFIC SUMMARY IN ENGLISH

The main scientific goal of the project is to precisely explain the mechanisms behind graphene passivation with aluminium oxide. Graphene is a two-dimensional material whose unique properties were discovered in 2004 by K. Novoselov and A. Geim. It is characterized by outstanding electrical properties, which is why it has been the most intensively tested 2D material for several years. Due to its unique properties, graphene is used in the construction of, among others, transistors and sensors.

To protect graphene against external factors, a protective material must be provided in the construction of the devices. Aluminium oxide - Al_2O_3 - is a dielectric that has appropriate electrical properties, so it is often used as passivation for graphene-based devices. There are various methods known for obtaining Al_2O_3 on graphene, but only the method proposed in the project - Atomic Layer Deposition (ALD) allows to obtain Al_2O_3 on graphene in an extremely controllable way, without destroying the graphene underneath. The ALD method enables the application of individual atomic layers at relatively low temperature (300-500˚C), in a regular manner and over the entire surface.

Research conducted in various scientific centres and the Host Institution - Łukasiewicz Research Network - Institute of Microelectronics and Photonics, showed that electrical properties of Al_2O_3-covered graphene change with the use of various process parameters of aluminium oxide synthesis by the ALD method. In graphene-based devices, the ideal solution would be to obtain a device with specific graphene electrical properties, so the **goal of the project is to investigate the mechanism of Al_2O_3 graphene passivation in such a way that by proper dielectric layer design it is possible to control the electrical properties of graphene.**

During the project, it will be examined how the ALD process parameters (among others: oxide source, process time, temperature, substrate configuration) affect both the dielectric and structural properties of aluminium oxide and the electrical properties of graphene. During the project implementation, modern characterization methods will be used, available at Łukasiewicz-IMiF.

Based on the research and obtained experience, it will be possible to find the answer to the question of whether it is possible to control the process of graphene passivation in such a way as to obtain specific properties of graphene (concentration of charge carriers, mobility).