



Fellow: Ing. Marián Varga, PhD.

Title: TMD/diamond heterostructures: Fabrication, characterization and applications

Host organisation: Institute of Electrical Engineering SAS

Duration of the project: 1. 8. 2020 – 31. 7. 2024

Bio:

Dr. Marián Varga (1981) studied at the Faculty of Electrical Engineering and Information Technology STU in Bratislava, where in 2013 he defended his dissertation thesis entitled "Diamond in Nanotechnology" in the field of microelectronics with an award. During his doctoral studies, he participated in the education of students as a specialist supervisor of diploma theses, supervisor of team projects and practicing teacher of the Physical Electronics of Solids and Vacuum Electronics and Technique and Electronics. As part of the popularization of science, he participated in the organization / preparation of the events School of Vacuum Technology, the Researcher's Night and the JVC13 international conference.

He continued his scientific career as a postdoctoral student and later as an employee at the Institute of Physics of the Czech Academy of Sciences in Prague in the group of associate professor A. Kromka. Within the framework of basic and applied research, he primarily deals with the preparation, modification and characterization of diamond thin films with an overlap into interdisciplinary scientific fields such as photonics and biotechnology. The achieved results are regularly presented at national/international conferences and published in CC journals. Since the beginning of his scientific career, he has authored or co-authored 68 publications in peer-reviewed journals with more than 750 citations, 1 book chapter and 1 utility model.

He was the principal investigator of three bilateral and one Czech national project within the COST action MP1403. In recent years, he has successfully established and developed cooperation with several renowned institutes such as Uni Wien, KIST, Tescan and has completed several short-term scientific internships in South Korea, Sweden, Australia and Austria.

He is a member of the American Chemical Society (ACS) and the Slovak Vacuum Society (SVS). He is an expert reviewer of several renowned journals such as Nanoscale, ACS Applied Materials & Interfaces, Carbon, Applied Surface Science and others.

Currently, as a successful candidate of the MoRePro program with the topic "TMD / diamond heterostructures: Preparation, characterization and application", he works as a researcher at the Institute of Electrical Engineering of the Slovak Academy of Sciences in the Department of Microelectronics and Sensors.



Abstract:

The proposed project pursues a comprehensive experimental study of 2D&3D heterostructures represented by transition metal dichalcogenide (TMD) and diamond materials. Its main focus is on fabrication and characterization of TMD/diamond heterostructures in two different configurations, i.e. TMD on diamond and diamond on TMD. Morphological, chemical and opto-electronic properties and physical processes will be characterized by a variety of conventional and advanced analytical techniques. The results will be used for fundamental understanding of growth mechanisms, mutual interactions and properties of the prepared TMD/diamond heterostructures. Simultaneously, selected TMD/TMD heterostructures will be fabricated to compare the growth mechanism as well as the properties with TMD/diamond heterostructures. Moreover, the investigation of the TMD/diamond heterostructure properties tailored by internal (doping, induced stress, local defects) and external (electric and magnetic field, pressure and light excitation) modulations will be carried out. It is expected, that at the TMD/diamond interface and bulk, effects like metal vs. semiconductor transition phenomena, band-gap alignment, Fermi level shift or luminescence could be controlled.