

# Electrical characterization of low-dimensional structures by nanoprobe based approach

Stanislav Tiagulskiy<sup>1</sup>

Roman Yatskiv<sup>1</sup>, Hana Faitová<sup>1</sup>, Ondřej Černohorský<sup>1</sup>, Robert Hlaváč<sup>1</sup>, Jan Vaniš<sup>1</sup>, and Jan Grym<sup>1</sup>

<sup>1</sup> Institute of Photonics and Electronics of the Czech Academy of Science, Chaberska 1014/57, Prague, Czech Republic  
tiagulskiy@ufe.cz

Ongoing downscaling of electronic devices requires deep understanding of electronic properties of low-dimensional materials and nanostructures. Among the investigative approaches for electrical characterization of the nanostructures, the nanoprobe-based approach receives particular attention of the researches nowadays. The nanoprobe-based approach to contact the individual nanostructure is the most straightforward way to study their electronic properties, as far as it does not require wet lithographic process for the contact preposition, time-consuming transfers procedures, etc.

Recently, our research group develop advanced technique for in-situ electrical characterization of the individual nanostructures using the tips of the nanomanipulators mounted in the chamber of scanning electron microscope (SEM). Additionally, the SEM was equipped with the focused ion beam tool, employed to tune the properties of the nanoscale contacts. We successfully employ developed technique to study in detail the electronic properties of the single nanorod based ZnO/GaN [1, 2] heterostructures, GaN/AlGaN nanowire light emitting diodes [3], and graphene/ZnO nanorods junctions (Figure 1).

This work provides a useful reference for the in-situ electrical characterization of the low dimensional structures in the SEM with emphasis on the ion beam assisted approaches for better reliability of obtained experimental results.

## References

- [1] S. Tiagulskiy, R. Yatskiv, H. Faitova, S. Kucerova, D. Roesel, J. Vanis, J. Grym, J. Vesely, Highly Rectifying Heterojunctions Formed by Annealed ZnO Nanorods on GaN Substrates, (2020). <http://doi.org/10.3390/nano10030508>.
- [2] S. Tiagulskiy, R. Yatskiv, H. Faitova, S. Kucerova, J. Vanis, J. Grym, Electrical properties of nanoscale p-n heterojunctions formed between a single ZnO nanorod and GaN substrate, (2020). <http://doi.org/10.1016/j.mssp.2019.104808>.
- [3] A. Reszka, K.P. Korona, S. Tiagulskiy, H. Turski, U. Jahn, S. Kret, R. Bozek, M. Sobanska, Z.R. Zytkeiwicz, B.J. Kowalski, Influence of Growth Polarity Switching on the Optical and Electrical Properties of GaN/AlGaN Nanowire LEDs, (2021). <http://doi.org/10.3390/electronics10010045>.

## Figures

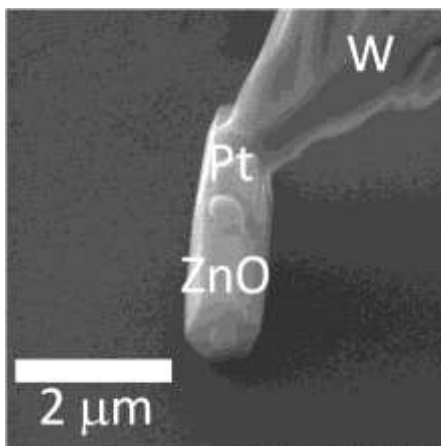


Figure 1. Tungsten nanoprobe in contact with ZnO (nanorod)/graphene structure.