Surface morphology study of AlGaN/GaN-HEMT using AFM and SEM

K.Nowak[1,2], R.Kuna[1], D.Majchrzak[1], W.Olszewski[1,3], D.Hommel[1,4], E.Piskorska-Hommel[1,4], D.Pucicki[1,2]

[1] *Łukasiewicz Research Network-PORT Polish Center for Technology Development, Stabłowicka 147, 54-066 Wrocław, Poland*
[2] *Faculty of Electronics, Photonics and Microsystems, Wrocław University of Science and Technology, Janiszewskiego 11/17, 50-372 Wrocław, Poland*
[3] *Institute of Experimental Physics, University of Wrocław, 50 - 204 Wrocław, Poland*
[4] *Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Okólna 2, 50 - 422 Wrocław, Poland*

AlGaN/GaN high electron mobility transistor (HEMT) technology has garnered significant attention in recent years due to its superior performance characteristics, particularly in high-power and high-frequency applications. The AlGaN/GaN-HEMT heterojunction structure allows the formation of a two-dimensional electron gas (2DEG) at the interface, resulting in exceptional electron mobility and high carrier density. Since the surface morphology impacts the technology and characteristics of the metal contact and deliver indirect knowledge about the buried interfaces, it's evaluation is pivotal in a final stage for further determination of the performance of these advanced semiconductor devices

The series of AlGaN/GaN-HEMT structures with different thickness of undoped GaN cap layer were grown on c-oriented 2" commercial sapphire substrates by metalorganic vapor phase epitaxy (MOVPE). The surface morphology of resulted structures was studied by scanning electron microscopy (SEM) and Ultra-High Vacuum atomic force microscopy (AFM). The findings reveals the high quality surface morphology characterized with relatively low surface roughness parameter (RMS). This work underscores the importance of advanced characterization techniques in AlGaN/GaN-HEMT technology and highlights the potential for further optimization in device design and fabrication.

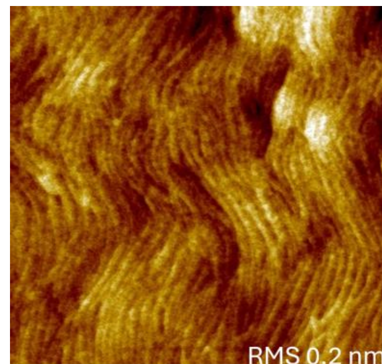

Figure 1. AFM 4x4 μm^2 image of AlGaN/GaN-HEMT structure grown by MOVPE.

Acknowledgements: This work was supported by the project: "High-performance AlGaN/GaN-HEMT transistors made with the hybrid MBE-MOVPE technology", number of agreement: 2/Ł-PORT/CŁ/2021, funded by The Łukasiewicz Centre.