### Příspěvky týmu VUT v mezinárodních impaktovaných časopisech v roce 2019 **s dedikací na projekt** **AMISPEC (TE01020233)**

### (supp\_mat\_liter\_vut\_dedikace\_2019.doc)

1. **/4: J. Mach, J. Piastek, J. Maniš, V. Čalkovský, T. Šamořil,** J. Damková, **M. Bartošík, S. Voborný, M. Konečný, T. Šikola:** *Low temperature selective growth of GaN single crystals on pre-patterned Si substrates*, APPLIED SURFACE SCIENCE 497 (2019), (**DEDIKACE PROJEKTU AMISPEC**)

Článek obsahuje výsledky PB4 z oblasti 3: Vytvoření technologického know-how a portfolia aplikací pro vyvinuté zařízení EBL (Vypracování a osvojení metod přípravy nanostruktur pomocí elektronové litografie - etapa II), časopis APPLIED SURFACE SCIENCE má Impact Factor 5,15 a v následujících oborech se nachází v 1. quartilech (Q1):

MATERIALS SCIENCE, COATINGS & FILMS: 1/20,**Q1**;

PHYSICS, CONDENSED MATTER: 16/68, **Q1**;

OPTICS: 7/94, **Q1**;

PHYSICS, APPLIED: 23/148, **Q1**;

CHEMISTRY, PHYSICAL: 35/148, **Q1.**

Abstrakt:

We report on a hybrid method for fabrication of arrays of GaN nanocrystals by low-temperature UHV selective growth on pre-patterned silicon substrates covered by native oxide. Patterning of the substrates was performed by using a gallium focused ion beam (FIB). To get GaN nanocrystals at specific positions, Ga droplets were created at FIB patterned sites by evaporation of Ga atoms at 280 degrees C substrate temperature first, and then modified by their post-nitridation using an ultra-low energy (50 eV) nitrogen ion-beam at a sample temperature of 200 degrees C. To get larger arrays of GaN nanocrystals (approximate to 150 nm and 200 nm in diameter), such a sequential process was repeated in several cycles at slightly modified operation conditions. The quality of the nanocrystals was checked by measurement of their photoluminescence properties which proved the occurrence of the peak of a band edge emission at around 367 nm (3.38 eV).

Poděkování:

This work was supported by the Technology Agency of the Czech Republic (grant No. **TE01020233**), H2020 Twinning programme (project SINNCE, 810626), Grant Agency of the Czech Republic (grant 1733767L), and MEYS CR (grant No. LQ1601-CEITEC 2020). We also acknowledge the support by the Grant Agency of the Czech Republic (grant No. 17-21413S).

1. **/4:** P. Bouchal, **P. Dvořák, J. Babocký,** Z. Bouchal, **F. Ligmajer, M. Hrtoň, V. Křápek,** A. Fassbender, S. Linden, R. Chmelík, **T. Šikola:** *High-Resolution Quantitative Phase Imaging of Plasmonic Metasurfaces with Sensitivity down to a Single Nanoantenna,*NANO LETTERS 19, (2019), (**DEDIKACE PROJEKTU AMISPEC**)

Článek obsahuje výsledky PB4 z oblasti 3: Vytvoření technologického know-how a portfolia aplikací pro vyvinuté zařízení EBL (Vypracování a osvojení metod přípravy nanostruktur pomocí elektronové litografie - etapa II), časopis NANO LETTERS má Impact Factor 13,96 a v následujících oborech se nachází v 1. quartilech (Q1):

CHEMISTRY, MULTIDISCIPLINARY 16/172, **Q1**

CHEMISTRY, PHYSICAL 10/148, **Q1**

MATERIALS SCIENCE, MULTIDISCIPLINARY 19/293, **Q1**

NANOSCIENCE & NANOTECHNOLOGY 10/94, **Q1**

PHYSICS, APPLIED 9/148, **Q1**

PHYSICS, CONDENSED MATTER 8/68, **Q1**

Abstrakt:

Optical metasurfaces have emerged as a new generation of building blocks for multifunctional optics. Design and realization of metasurface elements place ever increasing demands on accurate assessment of phase alterations introduced by complex nanoantenna arrays, a process referred to as quantitative phase imaging. Despite considerable effort, the widefield (nonscanning) phase imaging that would approach resolution limits of optical microscopy and indicate the response of a single nanoantenna still remains a challenge. Here, we report on a new strategy in incoherent holpgraphic imaging of metasurfaces, in which unprecedented spatial resolution and light sensitivity are achieved by taking full advantage of the polarization selective control of light through the geometric (Pancharatnam-Berry) phase. The measurement is carried out in an inherently stable common-path setup composed of a standard optical microscope and an add-on imaging module. Phase information is acquired from the mutual coherence function attainable in records created in broadband spatially incoherent light by the self-interference of scattered and leakage light coming from the metasurface. In calibration measurements, the phase was mapped with the precision and spatial background noise better than 0.01 and 0.05 rad, respectively. The imaging excels at the high spatial resolution that was demonstrated experimentally by the precise amplitude and phase restoration of vortex metalenses and a metasurface grating with 833 lines/mm. Thanks to superior light sensitivity of the method, we demonstrated for the first time to our knowledge the widefield measurement of the phase altered by a single nanoantenna while maintaining the precision well below 0.15 rad.

Poděkování:

This work has been supported by the Grant Agency of the Czech Republic (GA17-33767L and GA18-01396S), Technological Agency of the Czech Republic (TE01020229 and TE01020233) and by MEYS CR (LM2015062 Czech-BioImaging, LM2015041 CEITEC Nano RI, 2016-2019). The research was partially carried out under the project H2020 Twinning project SINNCE (No. 810626) and CEITEC 2020 (LQ1601) with a financial support from the MEYS CR funder the National Sustainability Programme II. P.B. has been supported by scholarship awarded by the Czechoslovak Microscopy Society.

1. **/4: R. Holeňák**, T. Spusta, M. Potoček, D. Salamon, **T. Šikola**, **P. Bábor**: *3D localization of spinel (MgAl2O4) and sodium contamination in alumina by TOF-SIMS,* MATERIALS CHARACTERIZATION, (2018), (**DEDIKACE PROJEKTU AMISPEC**)

Článek obsahuje výsledky PB4 z oblasti 3: Vytvoření technologického know-how a portfolia aplikací pro vyvinuté zařízení EBL (Vypracování a osvojení metod přípravy nanostruktur pomocí elektronové litografie - etapa II), časopis MATERIALS CHARACTERIZATION má Impact Factor 3,46 a v následujících oborech se nachází v quartilech Q1 a Q2:

MATERIALS SCIENCE, CHARACTERIZATION & TESTING 4/33, **Q1**

METALLURGY & METALLURGICAL ENGINEERING 11/76, **Q1**

MATERIALS SCIENCE, MULTIDISCIPLINARY 94/293, **Q2**

Abstract

Phase and chemical compositions are crucial for properties of advanced ceramic materials. A study of the phase and chemical composition is nowadays limited to localized 2-dimensional methods and their sensitivity to local changes. Alumina as the most used ceramic material is often doped by MgO to prevent abnormal grain growth. The phase equilibrium of Al2O3 and MgO has been widely studied and discussed. However, the chemical composition of spinel (MgAl2O4) in three dimensions has never been described. Here we present a TOF-SIMS analysis of spinel in an alumina matrix, where chemical composition in 3D is demonstrated. The presented analytical method allows characterization of advanced ceramic materials in volume and study of grain formation and contamination in nanoscale.

The authors wish to express their gratitude to the authority of the Technology Agency of the Czech Republic, project TE02000162 and TE 01020233 for the financial support. This work has been also supported by the CEITEC Nano Research Infrastructure (ID LM2015041, MEYS CR, 2016-2019), and by ERD Fund-Project CEITEC Nano + (CZ.02.1.01/0.0/0.0/16\_013/0001728), CEITEC Brno University of Technology.

1. **/4:** T. Novák, P. Kostelník, **M. Konečný, J. Čechal, M. Kolíbal, T. Šikola:** *Temperature effect on Al predose and AlN nucleation affecting the buffer layer performance for the GaN-on-Si based high-voltage devices,*JAPANESE JOURNAL OF APPLIED PHYSICS 58, Special Issue: C, (2019), (DEDIKACE PROJEKTU AMISPEC)

Článek obsahuje výsledky PB4 z oblasti 3: Vytvoření technologického know-how a portfolia aplikací pro vyvinuté zařízení EBL (Vypracování a osvojení metod přípravy nanostruktur pomocí elektronové litografie - etapa II), časopis JAPANESE JOURNAL OF APPLIED PHYSICS má Impact Factor 1,27 a v oboru PHYSICS, APPLIED se nachází ve **3.** quartilu.

Abstrakt:

An AlN buffer layer allows epitaxial growth of GaN on silicon substrates. We have studied the early AlN nucleation stage performed at high and low process temperatures. We show that the temperature has a crucial effect on the chemical reactions on the Si substrate during the initial growth stage. We have observed that large clustered defects are formed at 1000 degrees C. These defects are responsible for degradation of the vertical leakage current (VLC) blocking capability of the buffer layer. Formation of the defects is prevented if the temperature is lowered to 800 degrees C, which is explained by a carbonization of the Si surface. Formation of the SiC interlayer leads to the stable AlN/Si( 111) interface during subsequent high-temperature growth of the buffer structure. We demonstrate that very low VLCs in superlattice-based buffer are achieved using the low-temperature nucleation process, which makes it suitable for fabrication of high voltage AlGaN/GaN high electron mobility transistor devices. (C) 2019 The Japan Society of Applied Physics

Poděkování:

The research was supported by the Ministry of Education, Youth and Sports of the Czech Republic LQ1601 (CEITEC 2020), and by the Technology Agency of the Czech Republic (grants no. TE01020233 and TH02010014). Part of the work was carried out with the support of CEITEC Nano Research Infrastructure (LM2015041, MEYS CR, 2016-2019).