P03

Reflectivity of the *n*-type GaN with shallow surface gratings

Vytautas Janonis[1], Pawel Prystawko[2], Krzysztof Gibasiewicz[2], Jacek Kacperski[2], Irmantas Kašalynas[1]

[1]*Center for physical sciences and technology, CPST, Vilnius, Lithuania*

[2]*Institute of High Pressure Physics Polish Academy of Sciences, UNIPRESS, Warsaw, Poland*

vytautas.janonis@ftmc.lt

Periodic metal and dielectric gratings and micro/nano structures on the materials surface have been widely considered for sub-wavelength light manipulation and confinement of electromagnetic fields to achieve a large enhancement of linear and nonlinear optical properties[1]. Periodic irregularities on the surface of a polar semiconductor are used to provide coupling between the incoming light and Surface Phonon Polariton (SPhP) resonances. The SPP modes demonstrate higher quality factor as compared to the surface plasmon-polariton modes provided by the metal gratings and are promissing in the development of novel optical components.[2].

In this work periodic structures on the surface of *n*-type GaN semiconductor were investigated. The surface relief gratings with properly selected the grove depth, periodicity, and filling factor were used for the excitation of Surface Phonon Plasmon Polariton (PhPP) modes in *n*-GaN. Measured reflectivity spectra revealed the strong field confinement and coherent PhPP mode excitations.

The different periodicity gratings were produced on *n*-type GaN at UNIPRESS and the samples were investigated at CPST. The reflectivity spectra were calculated using the Rigorous Coupled Wave Analysis (RCWA) program. Results for the sample with shalow relief grating are shown in the **Fig.1.** Good agreement between the experimental and the theoretical data was found. And the field localization was observed only on the sample surface. Moreover, the resonance position in the reflectance spectrum was found to be dependent on the depth, width, and periodicity of the grooves [3].

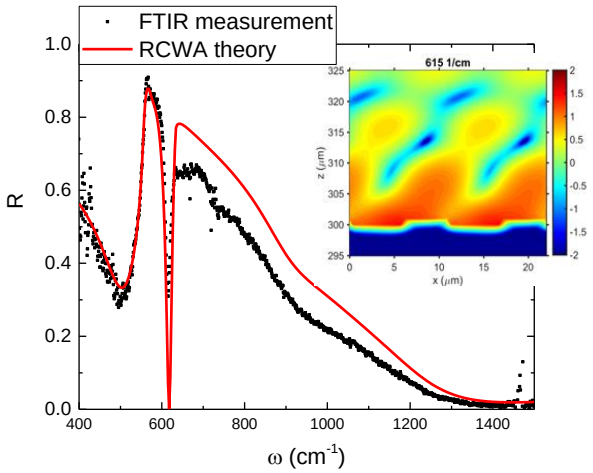

Fig. 1 Measured and calculated reflectivity spectra of *n*-GaN with the grating of 11 μm periodicity, 50 % filling factor, and 1 μm grove depth. Inset shows the magnetic field plot at the resonant frequency.

REFERNCES

[1] J. B. Khurgin, *Relative merits of phononics vs. plasmonics: the energy balance approach*, Nanophotonics 7(1), pp. 305–316 (2018).

[2] J. D. Caldwell, et. al., *LowLoss, Extreme Subdiffraction Photon Confinement via Silicon Carbide Localized Surface Phonon Polariton Resonators*, Nano Lett., vol. 13, pp. 3690–3697 (2013).

[3] V. Janonis, P. Prystawko, K. Gibasiewicz, J. Kacperski, I. Kašalynas, *Investigation of the reflectivity spectra of n-type GaN semiconductor with surface relief gratings*, Proc. of 44nd International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), Paris, France (2019).