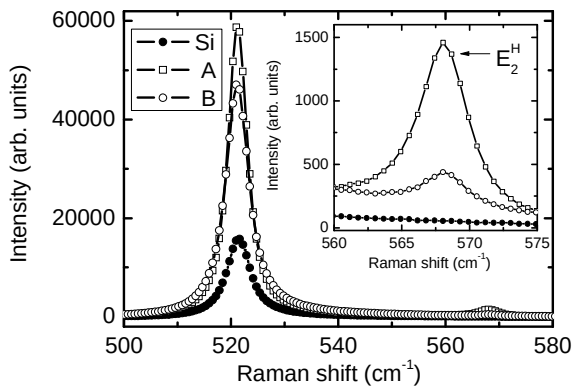
The growth and micro-Raman characterization of GaN nanorods

P. Kamyczek[1], Z. R. Zytkiewicz[2], E. Placzek-Popko[1], E. Zielony[1], M. Sobanska[2], A. Reszka[2], K. Klosek[2]

[1]*Institute of Physics, Wroclaw University of Technology, Wybrzeze Wyspianskiego 27, 50-370 Wroclaw, Poland*
[2]*Institute of Physics, Polish Academy of Sciences, Al. Lotnikow 32/46, 02-668 Warsaw, Poland*

Micro-Raman spectroscopy was used to study strain in GaN nanorods grown by plasma-assisted molecular beam epitaxy on Si(111) substrates. The growth comprised of a substrate deoxidation, exposure to a nitrogen flux and self-organized growth of nanorods under nitrogen-rich conditions, without catalyst. The morphology of the samples was characterized by high resolution scanning electron microscopy. The GaN nanorods were ~350 nm long with diameter of ~25nm, homogenously distributed, oriented along c-axis, perpendicularly to the substrate. Two types of nanorods grown at Ga source temperature T_{Ga} ~820°C and 800°C were studied. The nanorods in the sample A exhibit partial coalescence whereas in the sample B an ensemble of separated nanorods was formed. Micro-Raman spectroscopy was carried out with the use of Jobin–Yvon's T64000 system equipped with a CCD camera. 514.5 nm line of Ar^{2+} laser was used as an excitation source. Raman spectra show Si related signal at ~521cm^{-1} and E^{2high} GaN mode at 568cm^{-1}. The intensity of the mode is, as expected, higher for the sample A. Comparison of the Raman signals with bulk Si and GaN let us conclude that substrate and nanorods are strain free. A slight red-shift of the E^{2high} mode for higher laser powers (568 cm^{-1} at 4mW down to 567.4 cm^{-1} at 90mW) is associated with local increase of temperature upon laser illumination. The temperature of the samples was estimated using Stokes'/anti-Stokes' intensity ratio of the Si related signal**.**



[1] P. Kamyczek, Z. R. Zytkiewicz, E. Placzek-Popko, E. Zielony, M. Sobanska, A. Reszka, K. Klosek, *The growth and micro-Raman characterization of GaN nanorods* – accepted for publication in *Sensor Letters*.