The dielectric function and chemical composition the near surface layer of implanted GaAs with In^+ ions

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Samples and Ion implantation nuclaer study

(100) semi-insulating GaAs single crystals implanted with In^+ *ions:*

E = 250 keV, fluence 2.7×10^{16} cm^{-2}

E = 100 keV, fluence 3.0×10^{15} cm^{-2}

The current density of ion beam at a collector was 1.0 mA/cm^2

UNIMAS ion implanter

Institute of Physics

Maria Curie-Skłodowska University

The irradiated samples were covered with protective layers of Si_3N_4 having a thicknesses of about 100 nm, before the thermal annealing. Then the samples were annealed isobarically in the flow of argon at 800 C. The annealing time was 2h.

RBS/NR -EG5 at room temperature

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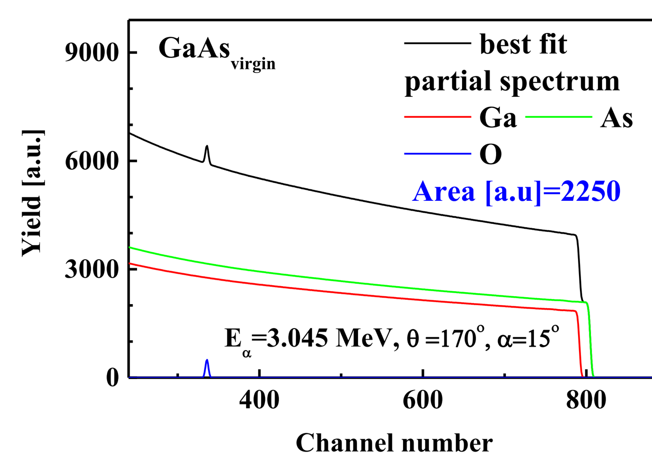
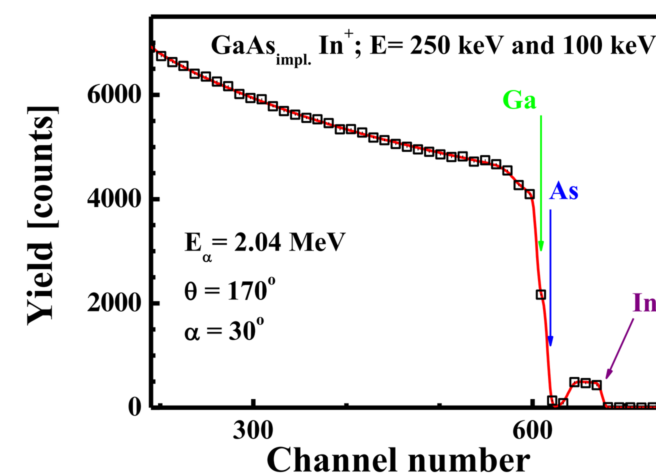
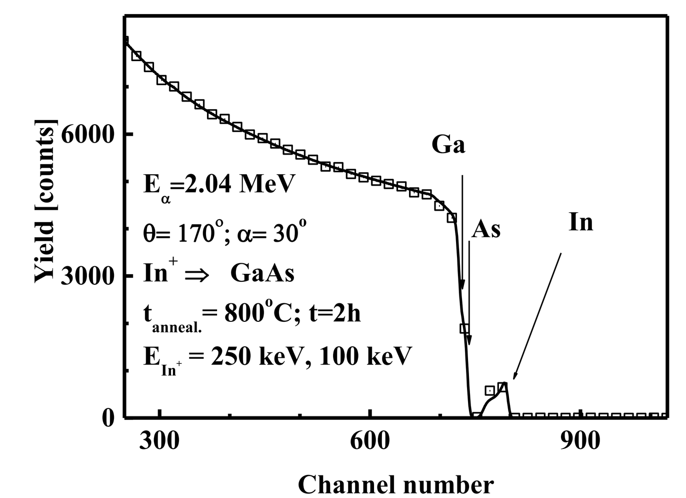
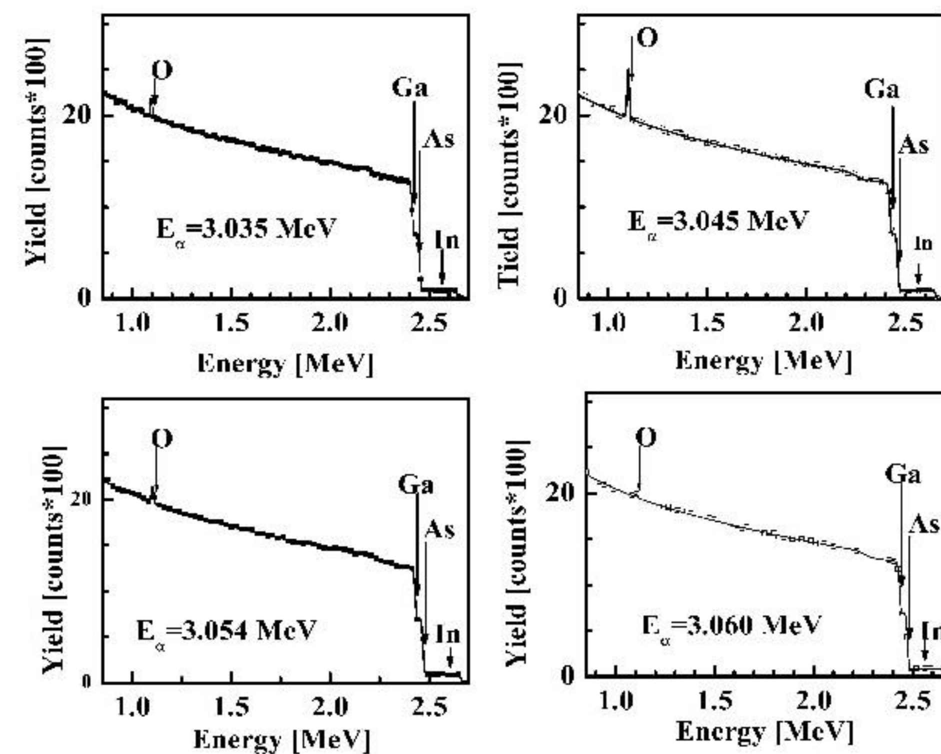
SIMNRA code - study of spectrum RBS/NR

RBS/NR investigation

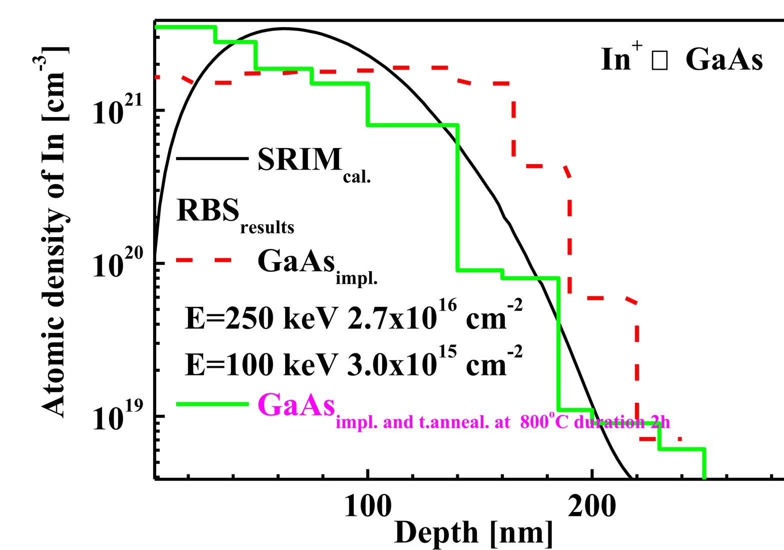








Depth profiles of In

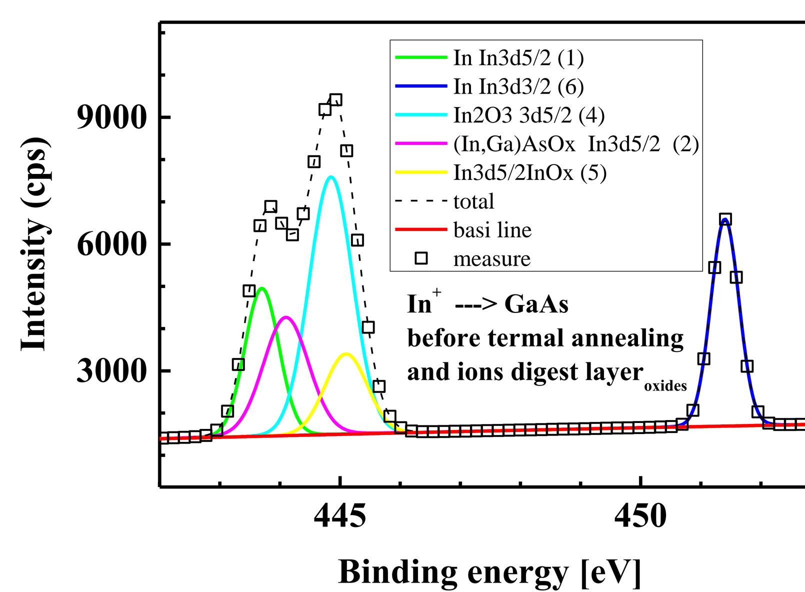


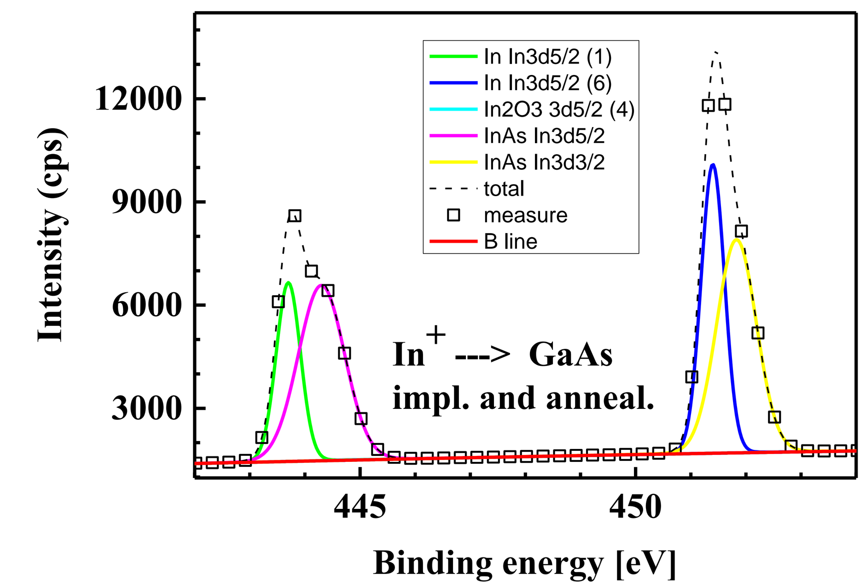
The thickness of the impl. layers:

$d_{b.\ anneal.} = 164.0 \pm 5.0$ nm

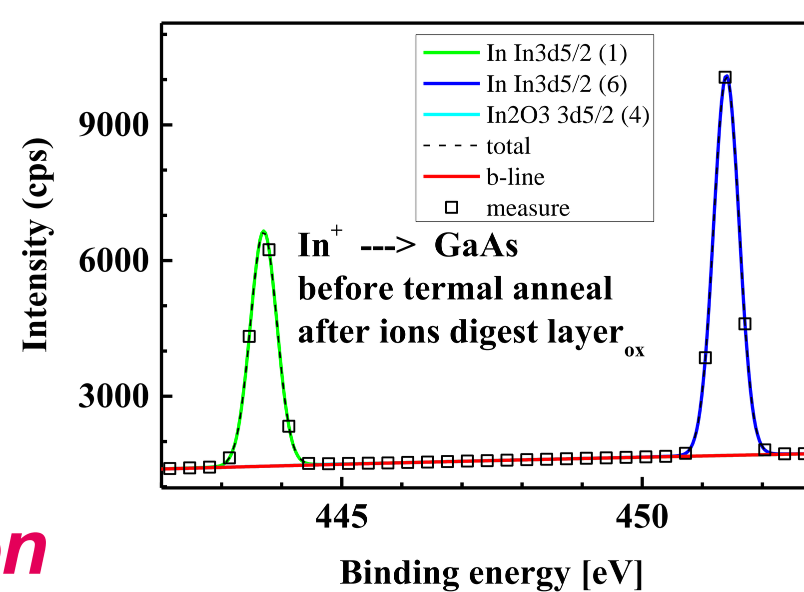
$d_{a.\ 2h,\ 800^oC} = 112.0 \pm 5.0$ nm

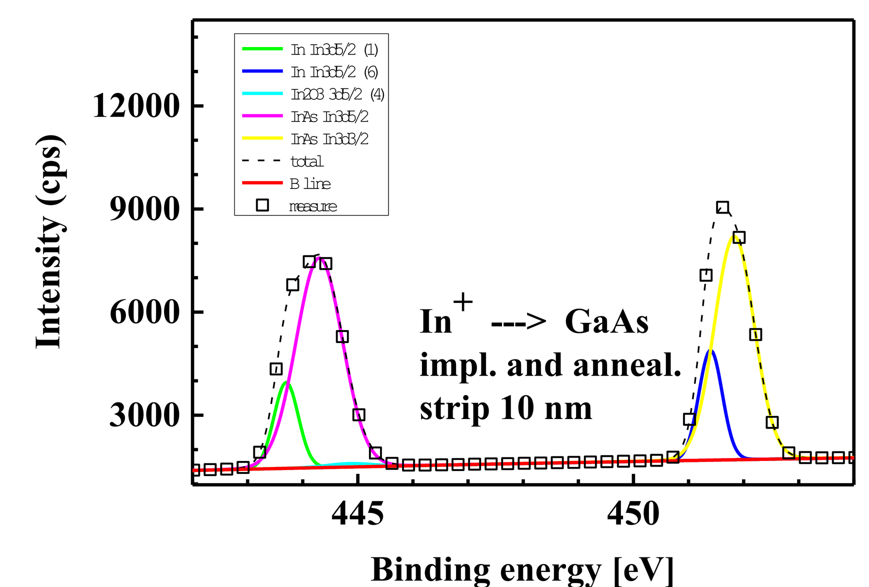
XPS investigation





X-ray photoelectron spectroscopy (XPS) was performed using a Thermo Scientific K Alpha spectrometer equipped with a monochromatic Al Ka radiation source ($E_{Al,\ Ka}$=1486.6 eV). **JINR DUBNA**
The analyzer was operated in CAE mode with a pass energy of 20 eV.

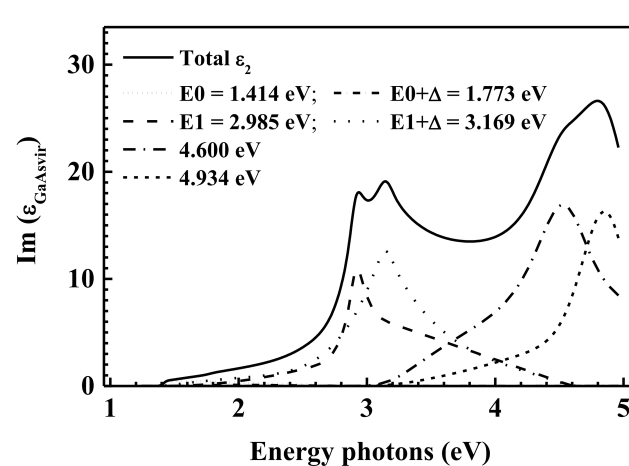




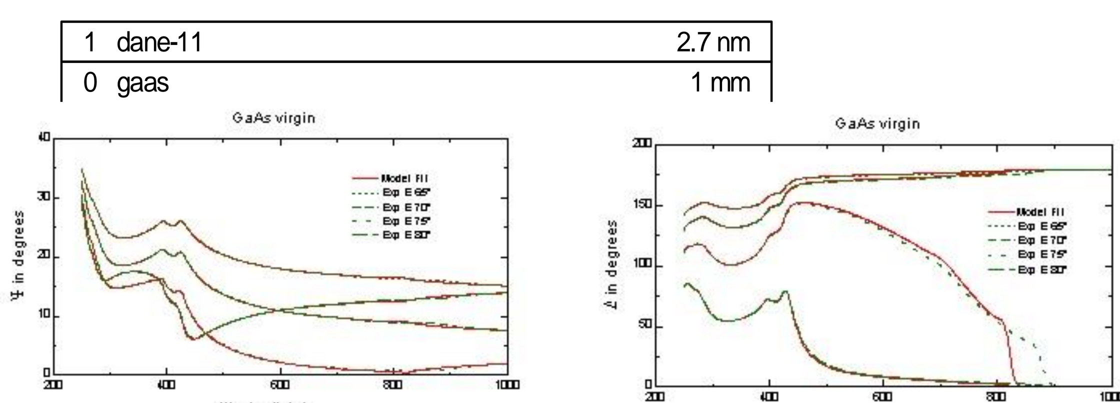
Ellipsometric investigation

Ellipsometric measurements SE - were performed at room temperature; variable angle spectroscopic ellipsometer (VASE) of J. A. Woollam working in the configuration of a rotating analyzer; Y(λ) and D(λ) were measured at three incidence angles: 65°, 70°, 75° and 80° in the range of wavelength l = 250-900 nm (with the step of 1 nm).

SE investigation



1	dane-11	2.7 nm
0	gaas	1 mm



2	cauchy	7.0927 nm
1	ema a-gaas/1.4% gaas	164 nm
0	gaas-virgin	1 mm

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1	ema a-gaas/1.4% gaas	164 nm
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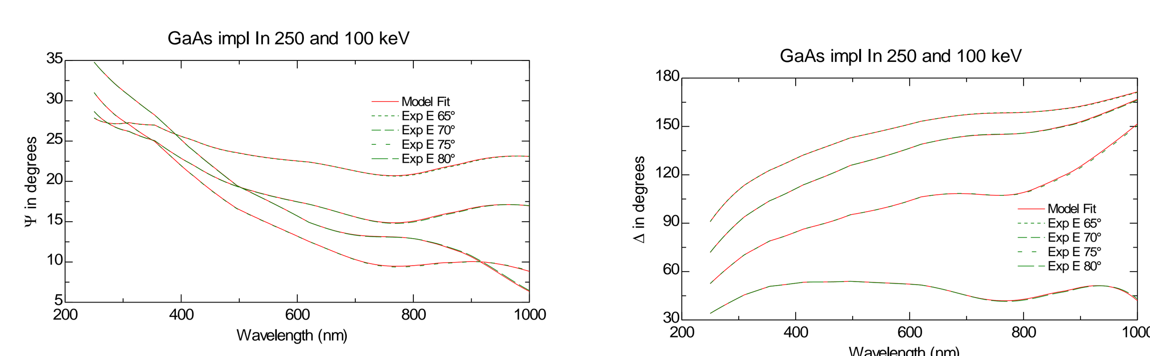
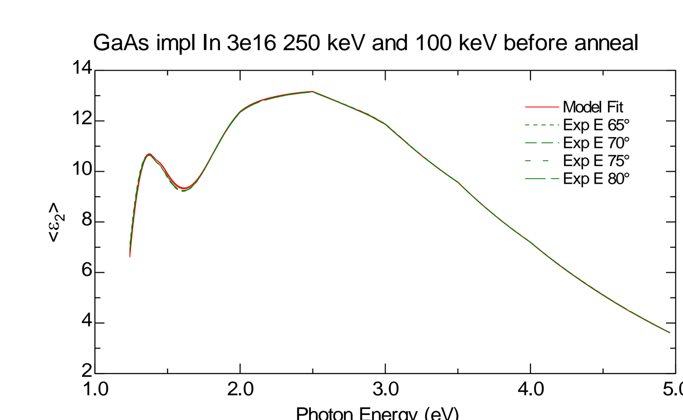
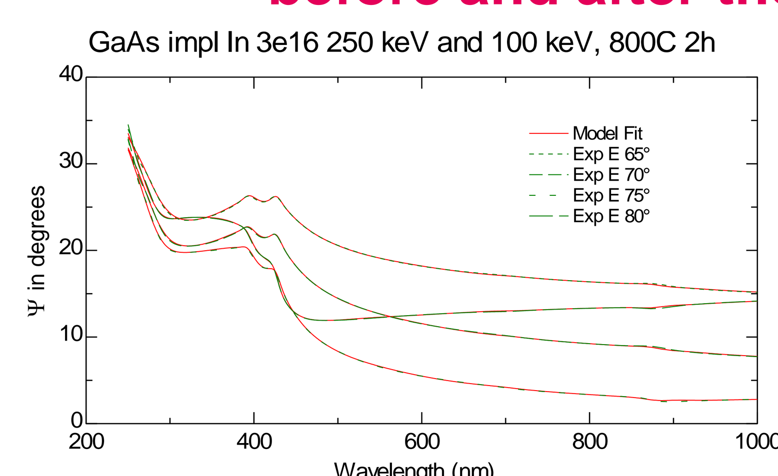




Dielectric function ε_2 of the implanted layer before and after thermal anneal.



2	cauchy	5.0927 nm
1	gaas_p	112 nm
0	gaas-virgin	1 mm