# The transient layer in GaAs implanted with $Kr^+$ ions into GaAs: SE and RBS investigations


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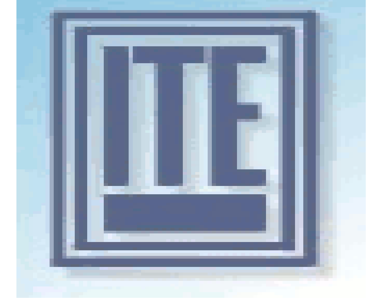



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## Sample and Ion implantation

(100) *semi-insulating GaAs single crystals implanted with* $Kr^+$ *ions* -

E = 250 keV, fluence $8.0\times10^{15}$ $cm^{-2}$

•E = 100 keV, fluence $2.0\times10^{15}$ $cm^{-2}$

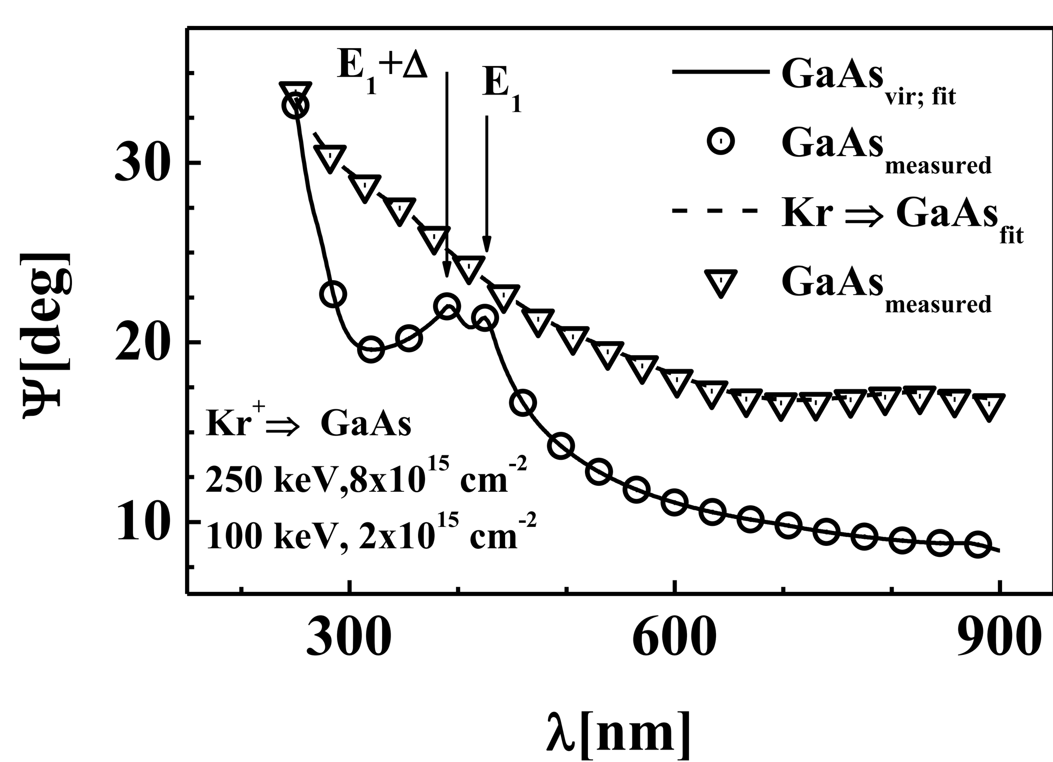
The current density of ion beam at a collector was 1.0 mA/$cm^2$

*UNIMAS ion implanter at Maria Curie-Skłodowska University*

## 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; $\Psi(\lambda)$ and $\Delta(\lambda)$ were measured at three incidence angles: 65°, 70° and 75° in the range of wavelength $\lambda$ = 250-900 nm (with the step of 1 nm).*

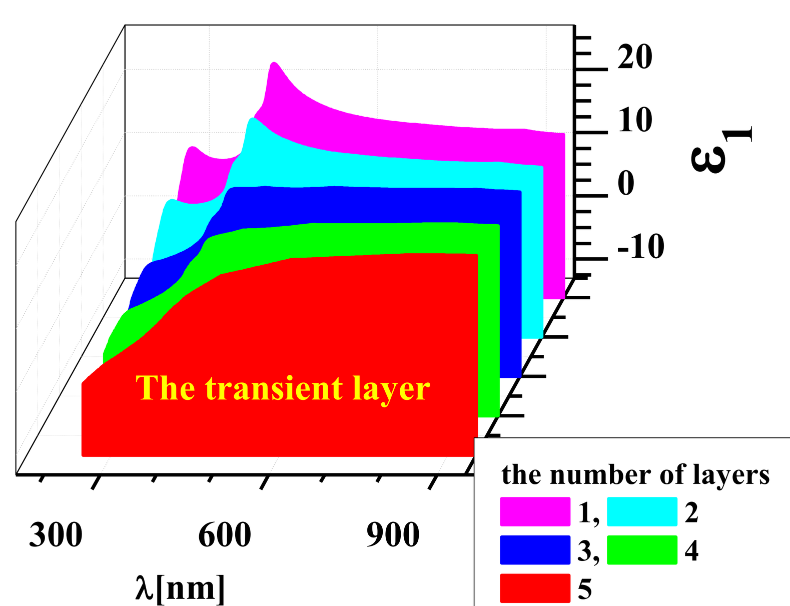
## SE investigation




Model:

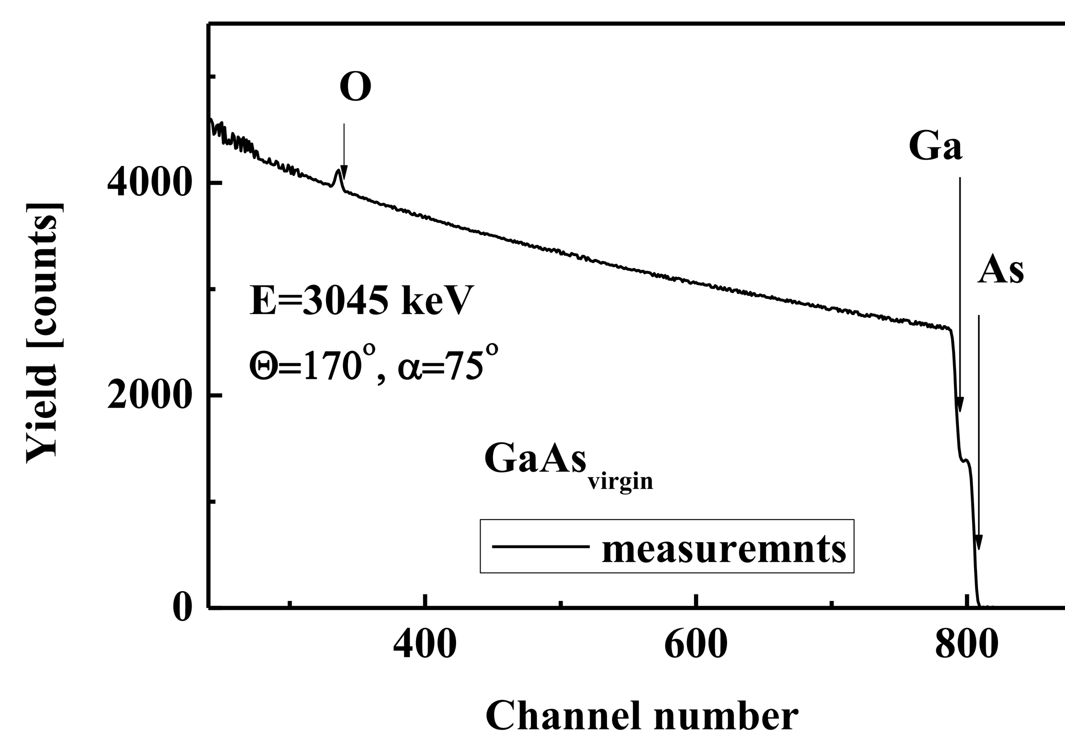
| Layer | Thickness |
|---|---|
| 7 oxides kr -gaas | 5 nm |
| 6 a-gaas 132 nm | 139 nm |
| 5 ema a-gaas/6% (gaas) | 21 nm |
| 4 ema a-gaas/28% (gaas) | 21 nm |
| 3 ema a-gaas/41% (gaas) | 21 nm |
| 2 ema a-gaas/78% (gaas) | 21 nm |
| 1 ema a-gaas/96% (gaas) | 21 nm |
| 0 gaas | 1 mm |

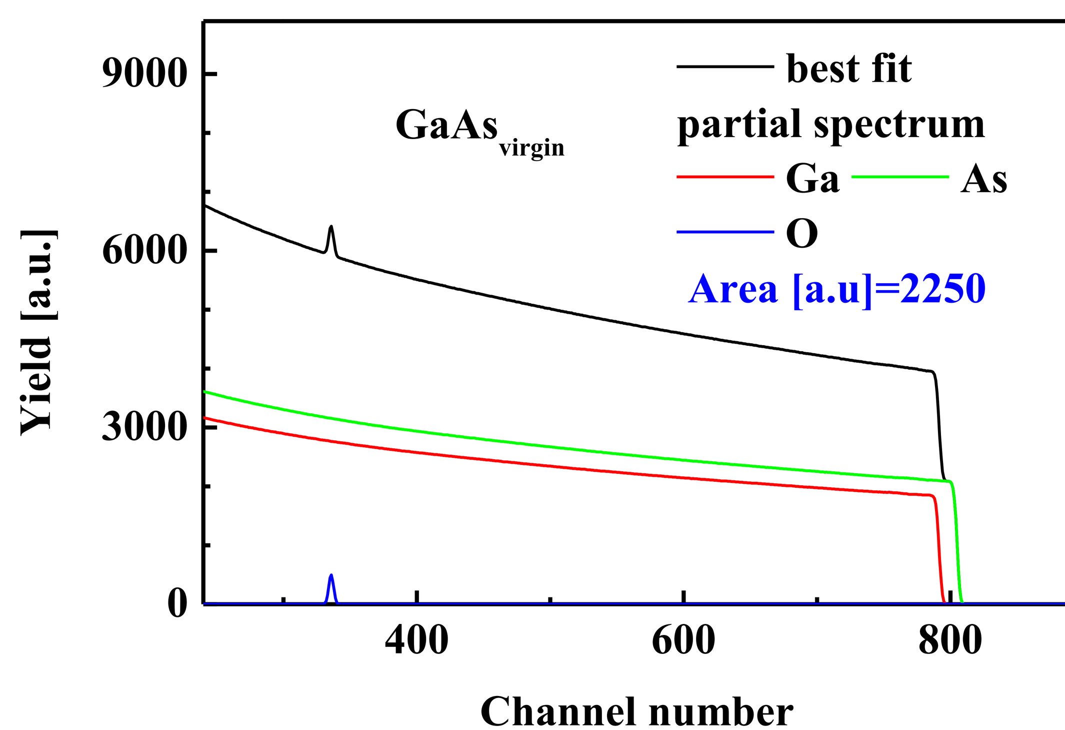
Dielectric function of the transient layer are Real part - $\varepsilon_1$ and Imag part - $\varepsilon_2$



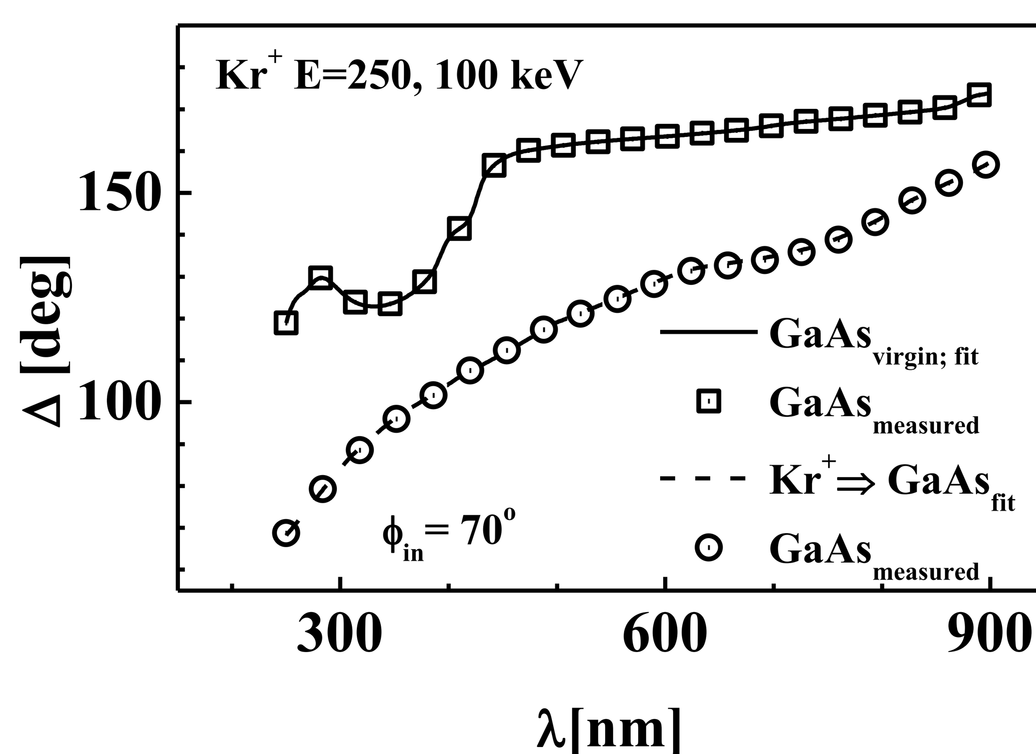

The transient layer
the number of layers
λ[nm]
$\varepsilon_2$

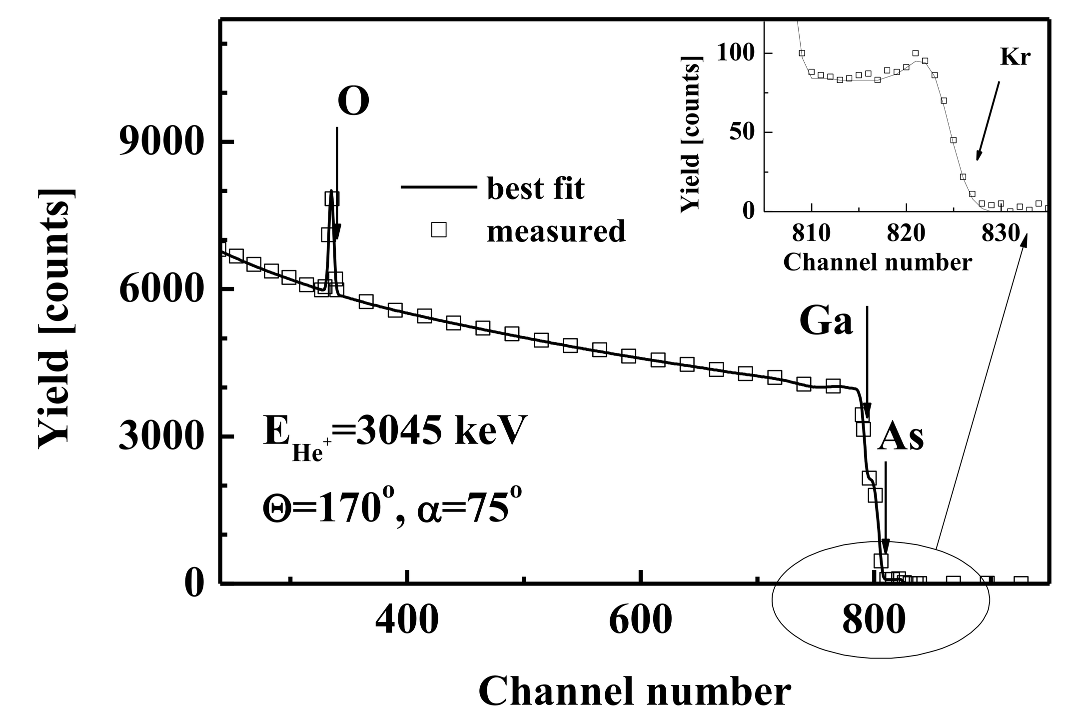
## RBS investigation

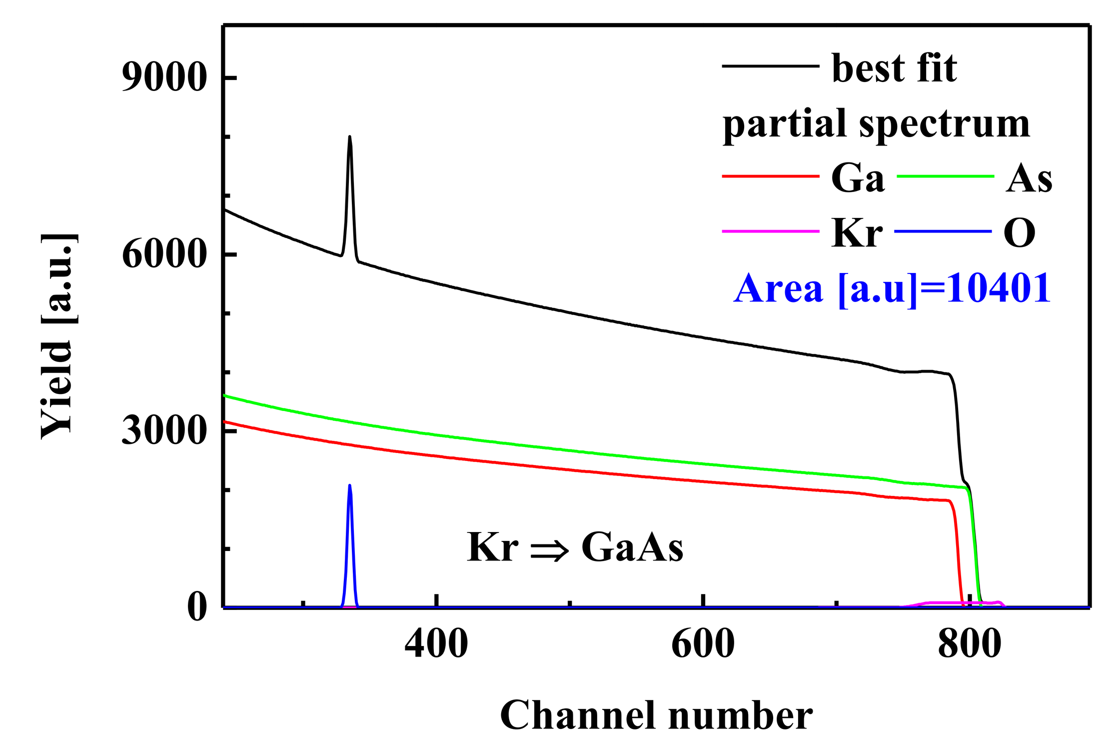


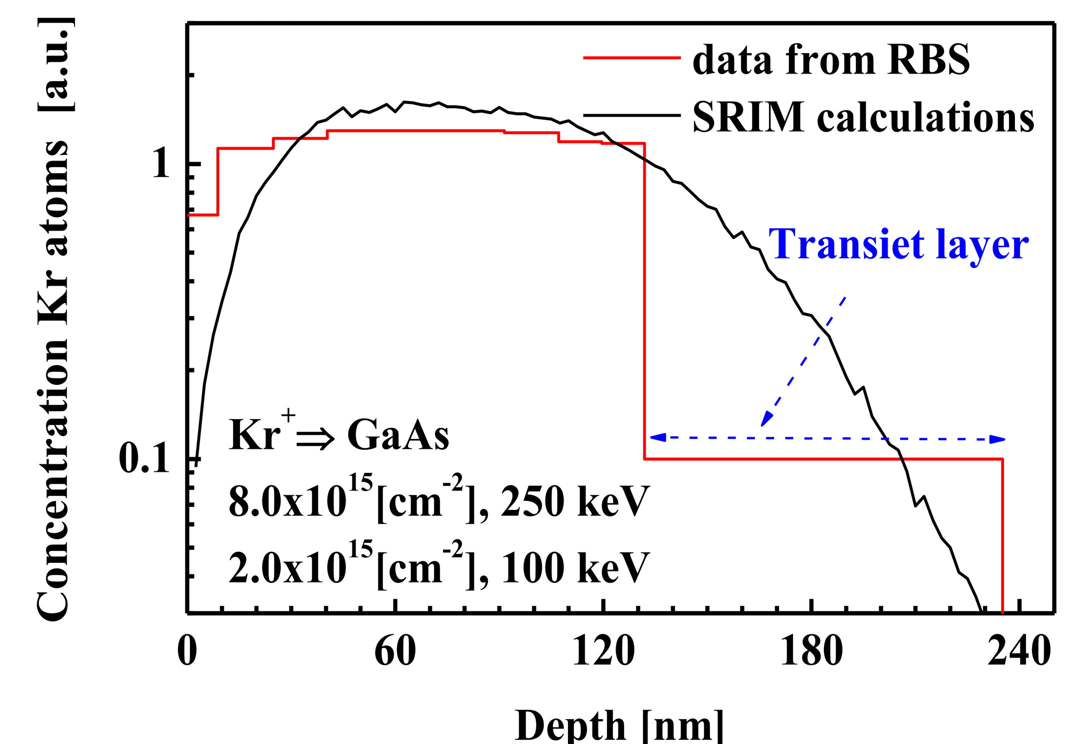




The thickness of the thransient layer 103.1± 4.5 nm – RBS
105.0 ± 3.5 nm SE





Summary

1.Dual ion implantation has provided a quasi rectangular distribution of Kr atoms in GaAs (results form SRIM and RBS are in a good agreement).

2 The process of ion implantation damaged the crystallographic structure of GaAs in the near surface layer.

3. The thickness of the native oxide layer increases after Kr irradiation

4. The thickness of the transient layer between the substrate and the disorder layer can be described with gradient of the dielectric function. It has been obtained with the effective medium approximation (EMA) theory.

5. These results are confirmed by two methods: RBS and SE.

6. The irradiated surfaces easer covered with the native oxides.