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Im Forschungsverbund Berlin e. V.

IKZ

Information on the melt growth process through Lateral Photovoltage Scanning (LPS) measurements

Anke Lüdge, H. Riemann, M. Renner

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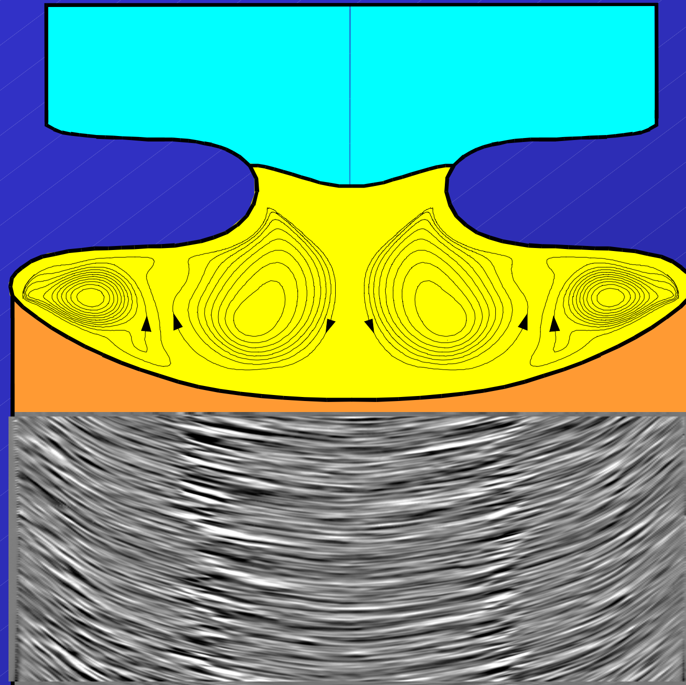
1. Introduction



The spatial distribution of electrically active impurities in semiconductor crystals is a compressed record of the crystal growth.

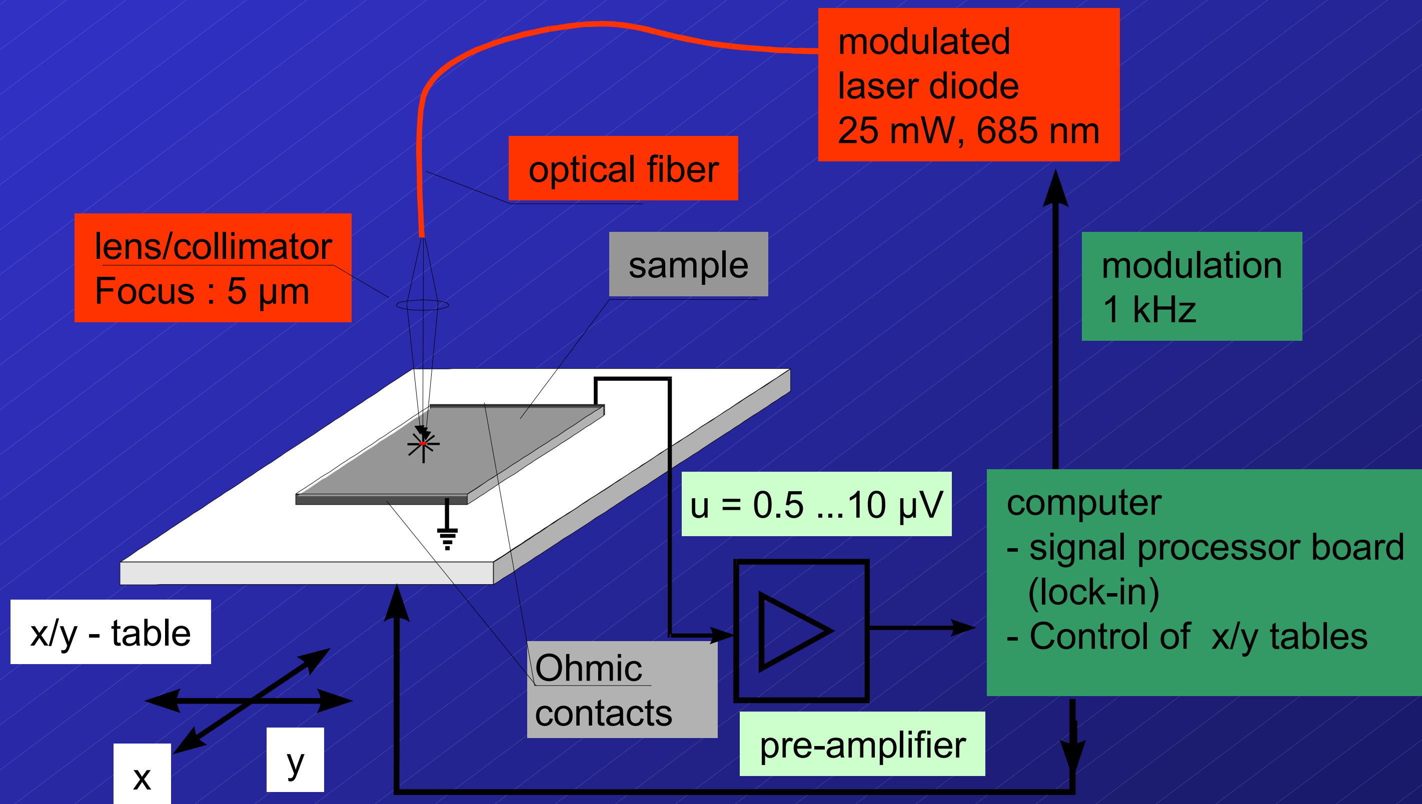
The measurement of the doping striations can be made by different methods:

etching	not quantitative, weak contrast, only for highly doped samples
4 point	smaller resolution, but quantitative
SR	good resolution, slow,
LPS	good reproducibility, fast, half-quantitatively, area scan

The FZ Process : numerical model (calculated at EWH Hannover)

compared to LPS

2. The LPS Method

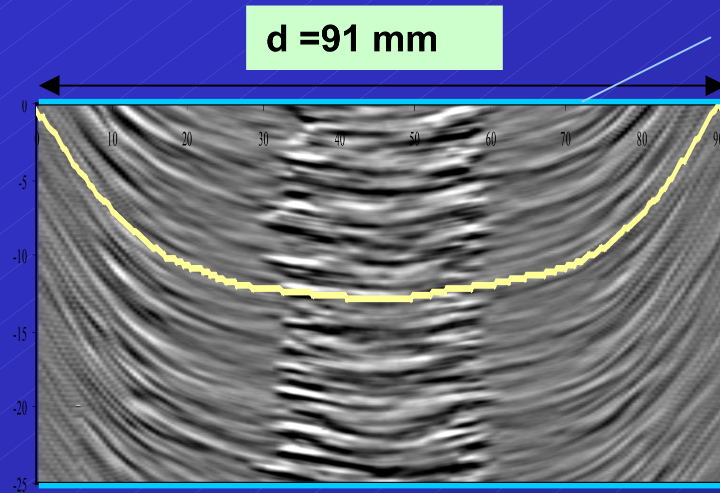


3. Crystallization interface and striations

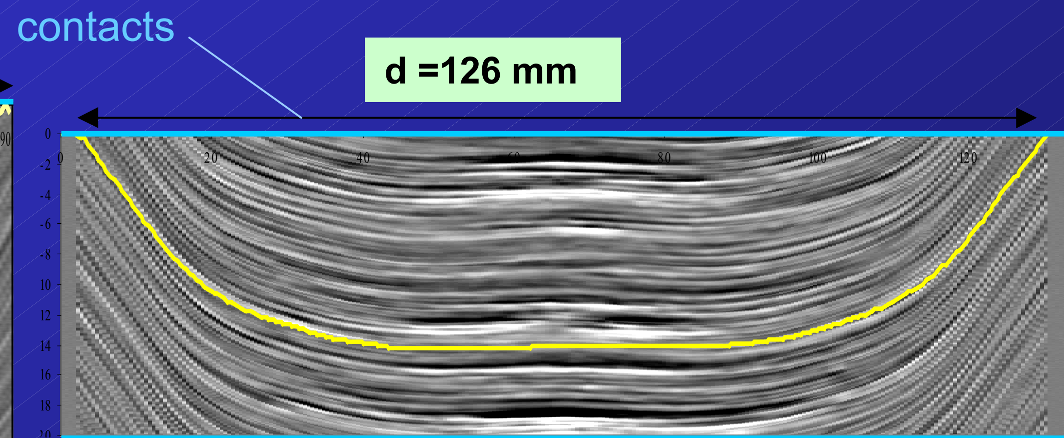
measurement of the interface in FZ Si single crystals

contacts

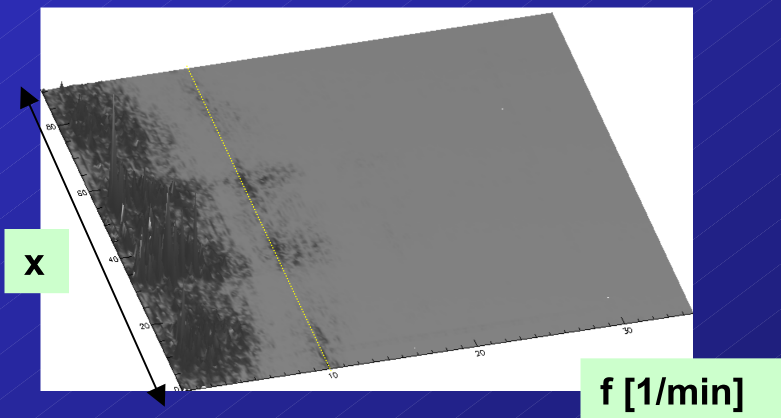
d =91 mm



d =126 mm

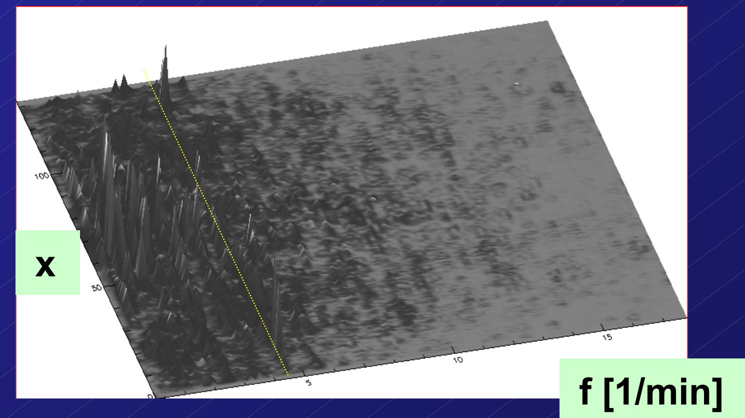


power spectrum



lower rotation rate : 10 U/min

power spectrum

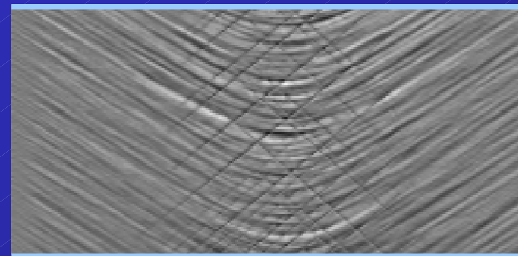


lower rotation rate : 4.8 U/min

3. Crystallization interface and striations germanium silicon crystals

45 mm x 15 mm

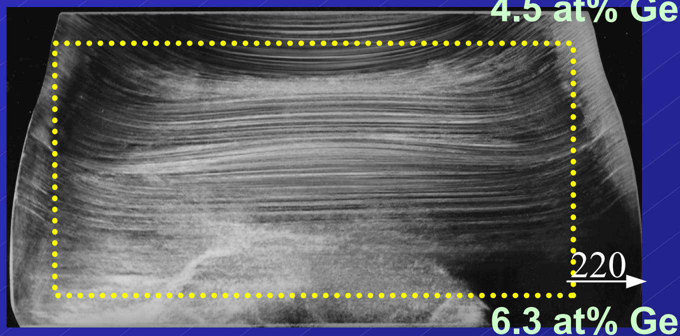
45 mm x 15 mm



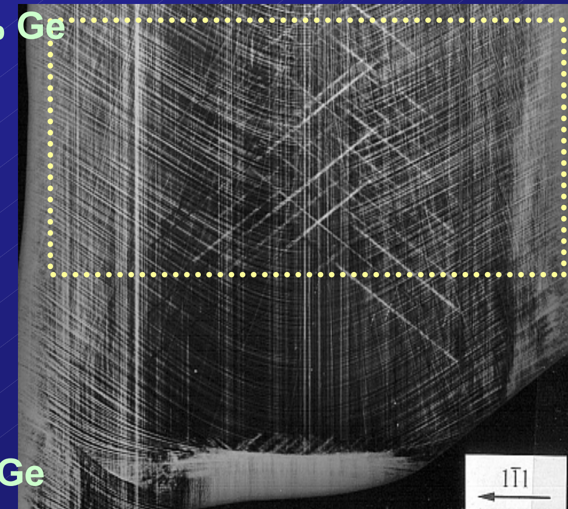
45 mm x 22 mm

X-ray topography

<100> growth direction



56 mm x 20 mm with **g** = (220) and MoKa_{α} radiation

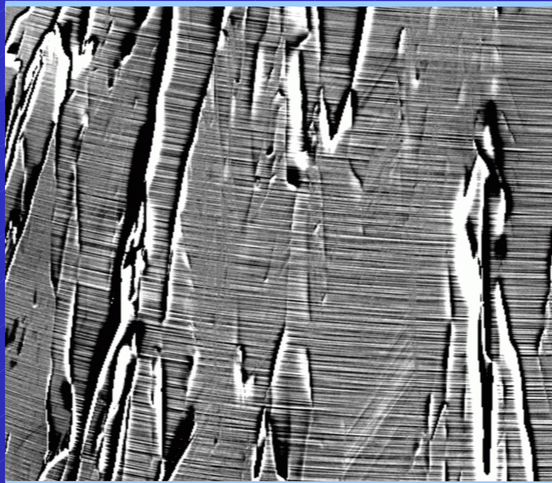


50 mm x 50 mm with **g** = ($\overline{1}\overline{1}1$) and MoK$a_{\alpha}$ radiation

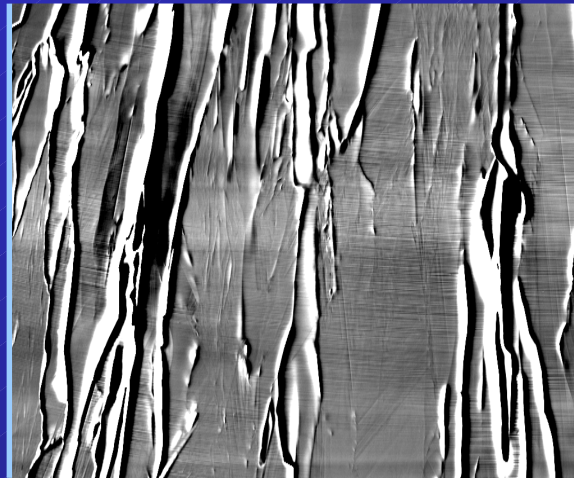
4. Measurement of the phase boundary in poly silicon

Directionally solidified block silicon for PV applications

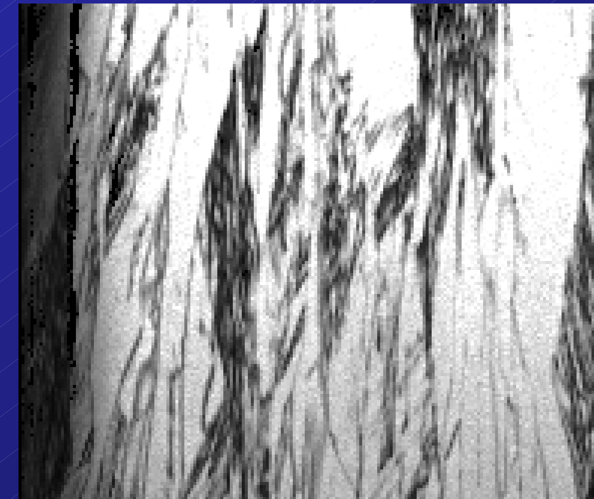
LPS plot 90 x 90 mm², contacts across the growth direction



LPS plot , contacts parallel to the growth direction



life time plot



- determination of the phase boundary not possible until now
- phase boundary visible clearly when contacts across the growth direction
- contrasts at grain boundaries by space charge field and recombination

5. Summary and outlook

- the LPS method allows to determine the solid-liquid interface of silicon, germanium and SiGe crystals, also for high dislocation densities and polycrystalline silicon
- the flow pattern of the crystal growth can be visualized
- if the mean resistivity value is known, the specific resistivity can be calculated by integrating the LPS curve - comparison to doping profiles
- dislocations and grain boundaries generate changes of the LPS signal but do not affect the determination of the phase boundary

The method can be carried out measuring the magnetic field of the current dipole with SQUID sensors. This is investigated in a project with PTB Berlin and the University Freiberg.

Acknowledgement:

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Contactless and touchless measurement using SQUID sensors