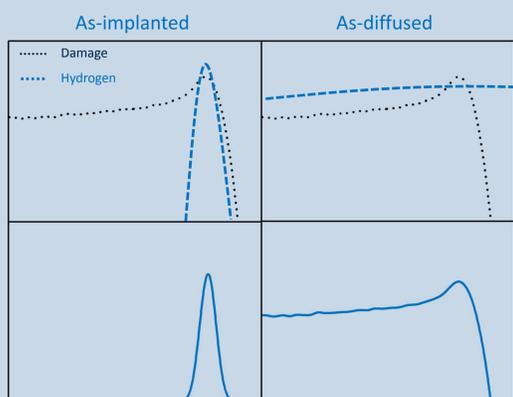


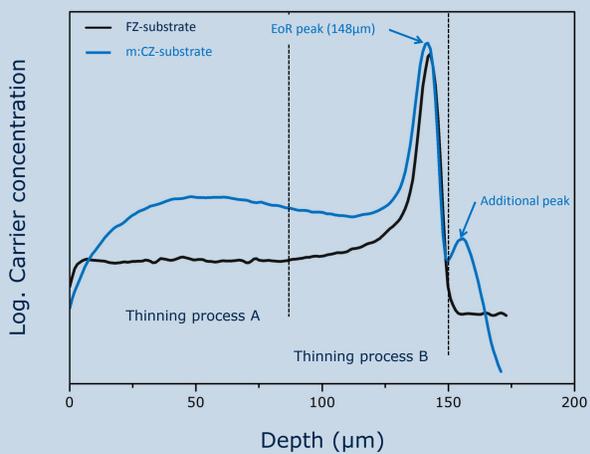
## M. Jelinek, J. G. Laven, S. Kirnstoetter, W. Schustereder, H.-J. Schulze, M. Rommel, L. Frey A DLTS Study of Hydrogen Doped Czochralski-grown Silicon

### Proton Implantation

#### Proton Doping

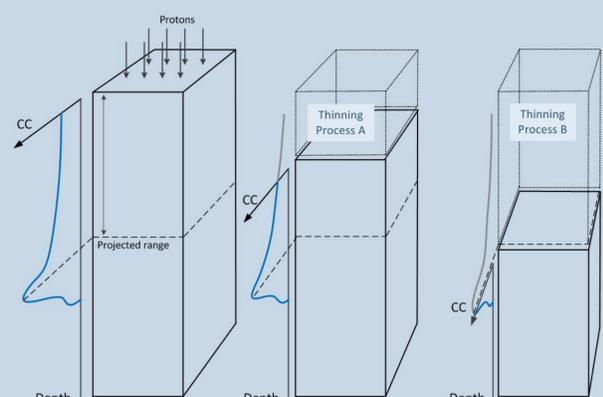


#### Spreading resistance profiles in FZ and m:CZ material

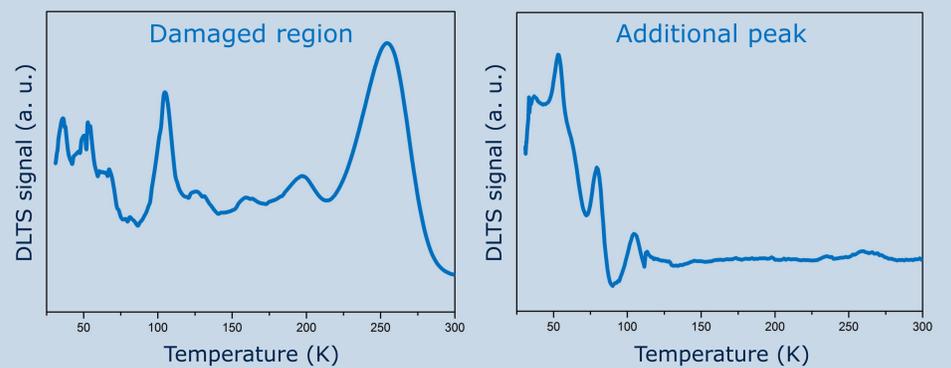


### DLTS

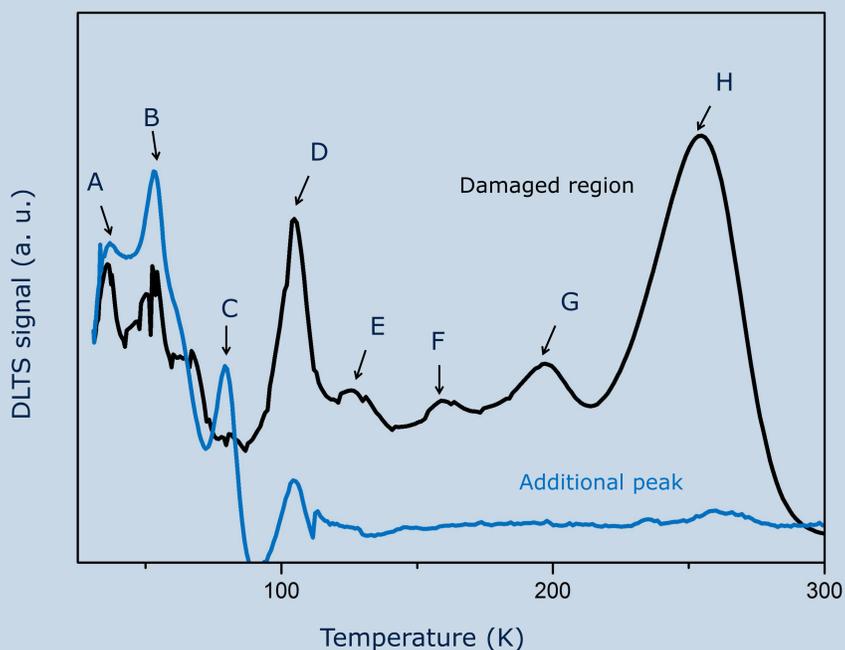
#### Sample preparation - thinning



#### DLTS - spectra



### Results and conclusions



#### Energy levels and cross sections of the observed traps

Trap	$E_c - E_T$ (meV)	$\sigma$ ( $10^{-15} \text{ cm}^2$ )	DLTS-temperature range (K)	Assignment
A	$60 \pm 8$	$4 \pm 3$	33-43	unknown
B	$103 \pm 9$	$1.0 \pm 0.7$	45-59	OTDD <sup>0/+</sup>
C	$151 \pm 7$	$5 \pm 2$	73-86	$\text{C}_2\text{O}_2\text{-H}^{+/0}$
D	$204$	$17$	95-117	OTDD <sup>+2+</sup>
E	$212 \pm 7$	$31 \pm 6$	120-138	unknown
F	$333 \pm 8$	$6 \pm 2$	149-172	$(\text{V}_2\text{O}^{2-/-})$
G	$418 \pm 7$	$14 \pm 2$	180-214	$\text{VOH}^{+/0?}$
H	$437 \pm 9$	$23 \pm 5$	220-290	$\text{V}_2\text{O}_2^{+/0}$ $\text{X}^{2-/-}$ $\text{V}_2\text{H}^{+/0} + \text{V}_2^{-/0}$

- Proton implantation and subsequent annealing in m:CZ-substrate results in an additional peak  $\sim 15 \mu\text{m}$  deeper than the projected range
- DLTS measurements reveal that the additional peak does not show vacancy related deep levels
- Several vacancy related deep levels as known from previous reports could be detected in the damaged region of the profiles

#### References:

- J. G. Laven, *PhD-Thesis*, Springer Vieweg (in print)  
 Jelinek et al., Deep-Level Defects in High-Dose Proton Implanted and High-Temperature Annealed Silicon, submitted to the 226<sup>th</sup> ECS meeting in Cancun, Mexico



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