Evidence for identification of divacancy oxygen center in high purity oxygenated Si

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- ✓ Experimental details
- samples characteristics

- ✓ Results and discussion
- SIMS data*
- DLTS data

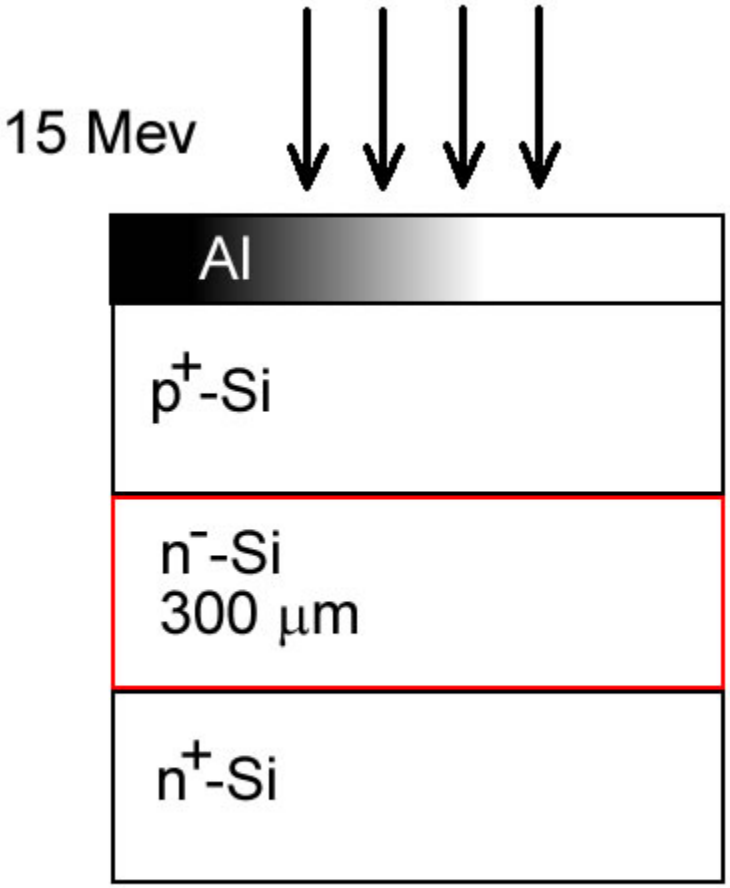
- ✓ Conclusion

*Performed at SINTEF

3 p^+-n^--n^+ diodes were made using high-resistivity high purity FZ-Si

Sample	Doping	Oxidation process	Oxygenation process
A	$5x10^{12}$ P/cm^3	21h dry oxidation at 1200°C	80h in N_2 at 1150°C
B	$4x10^{12}$ P/cm^3	21 h dry oxydation at 1200°C	---
C	$3x10^{12}$ P/cm^3	3.7h and wet oxidation at 1100°C	---

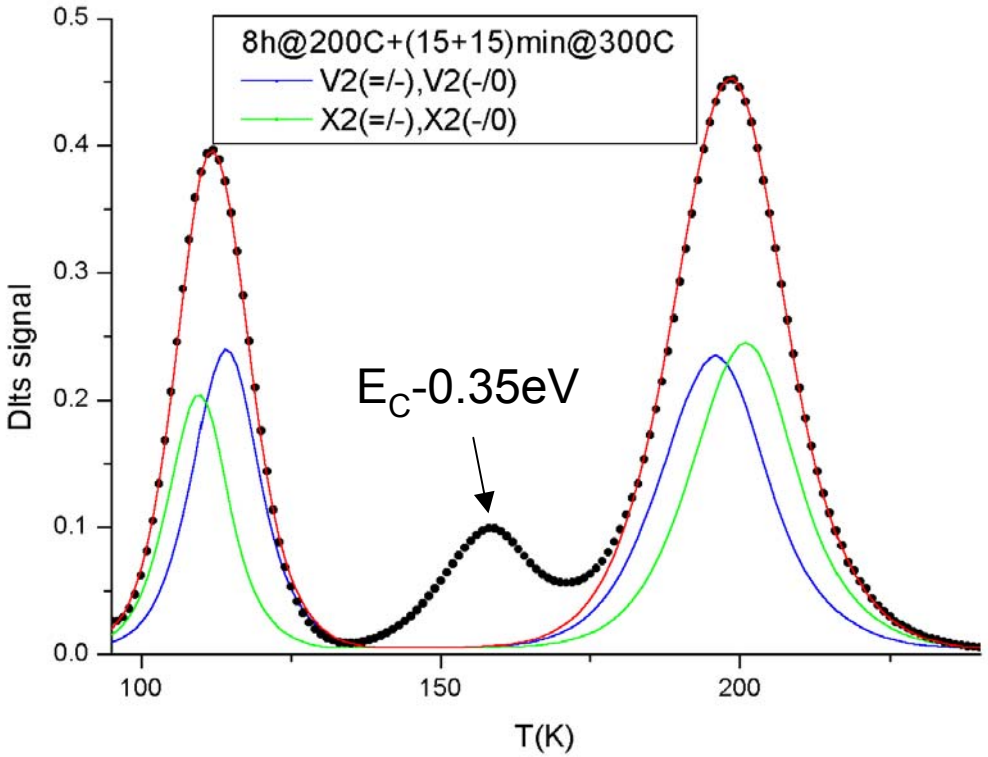
experimental details



- ✓The diodes were irradiated at RT
- ✓15-MeV electrons beam
- ✓Dose of 4×10^{12} cm^{-2}

E.V. Monakhov, B.S. Avset, A. Hallén and B.G. Svensson, Phys. Rev. B **65**, 233207 (2002)

- ✓7-MeV protons irradiated FZ-Si
- ✓Some wafers received oxygenation treatment ([O]~$10^{17}cm^{-3}$)



transformation observed

V_2(-/=)	→	X(-/=)
E_c-0.237eV		E_c-0.232eV
$1.3x10^{-16}cm^2$		$1.3x10^{-16}cm^2$

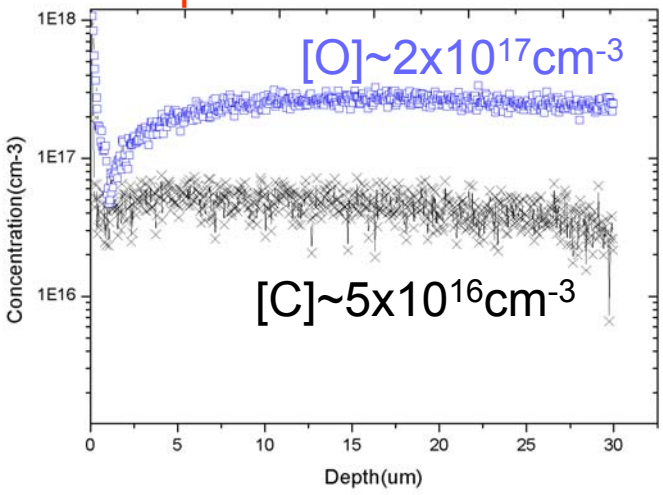
V_2(0/-)	→	X(0/-)
E_c-0.43eV		E_c-0.47eV
$3.1x10^{-15}cm^2$		$9.6x10^{-15}cm^2$

possible explanation

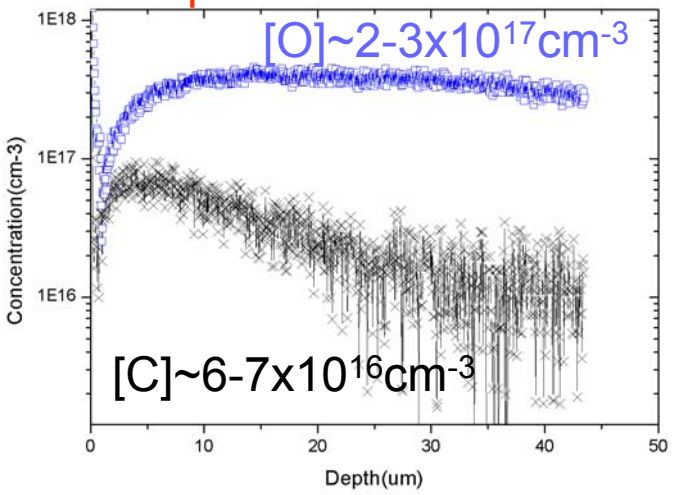
$$X \rightarrow V_2O$$
$$V_2+O \rightarrow V_2O$$

SIMS data for sample A,B,C

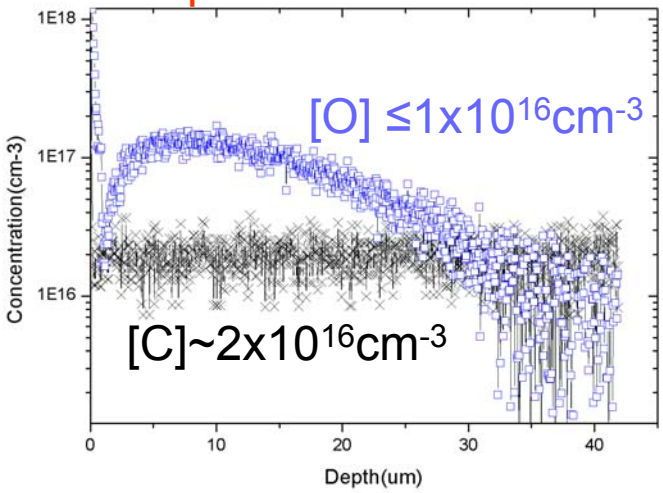
sample A



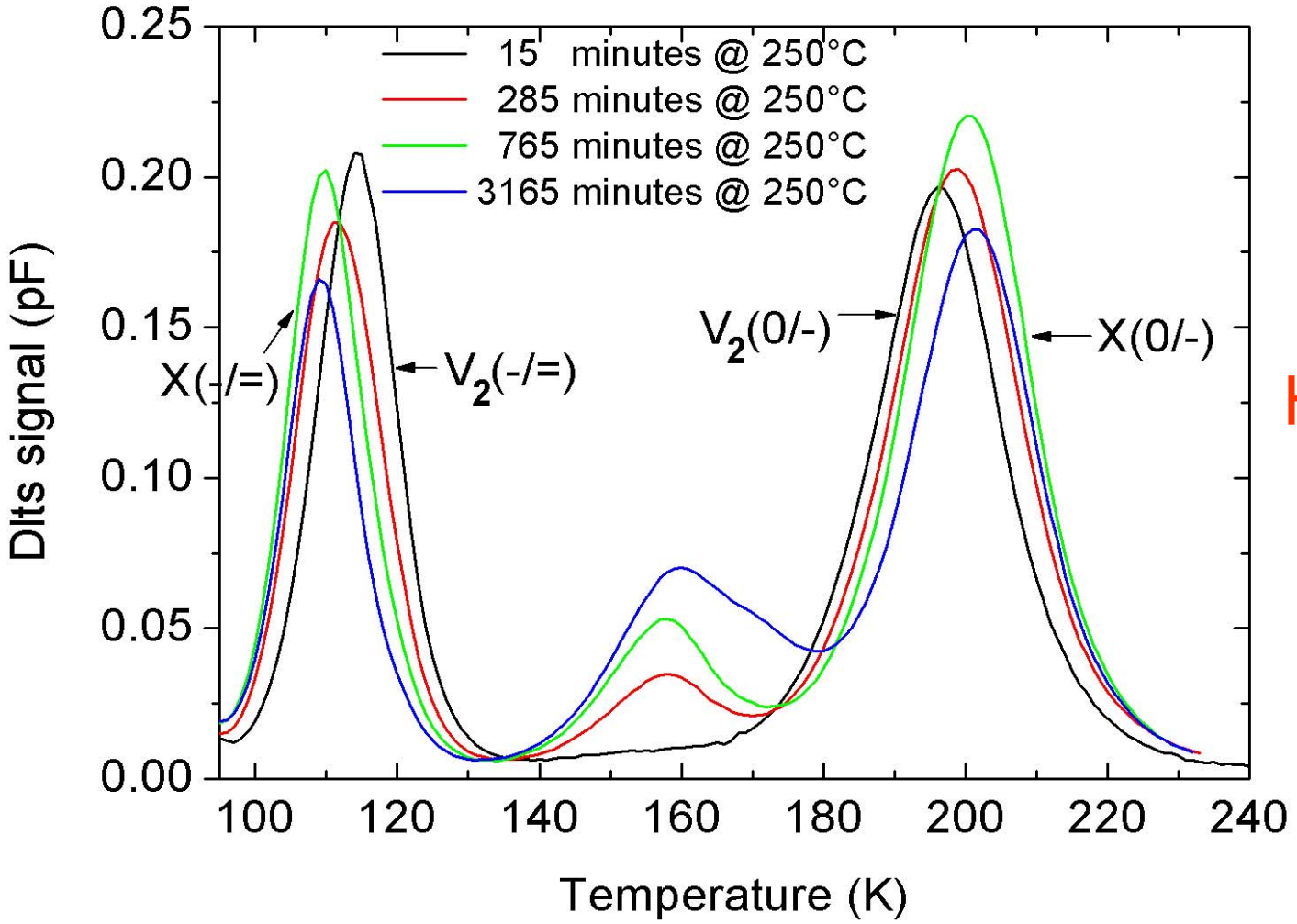
sample B



sample C

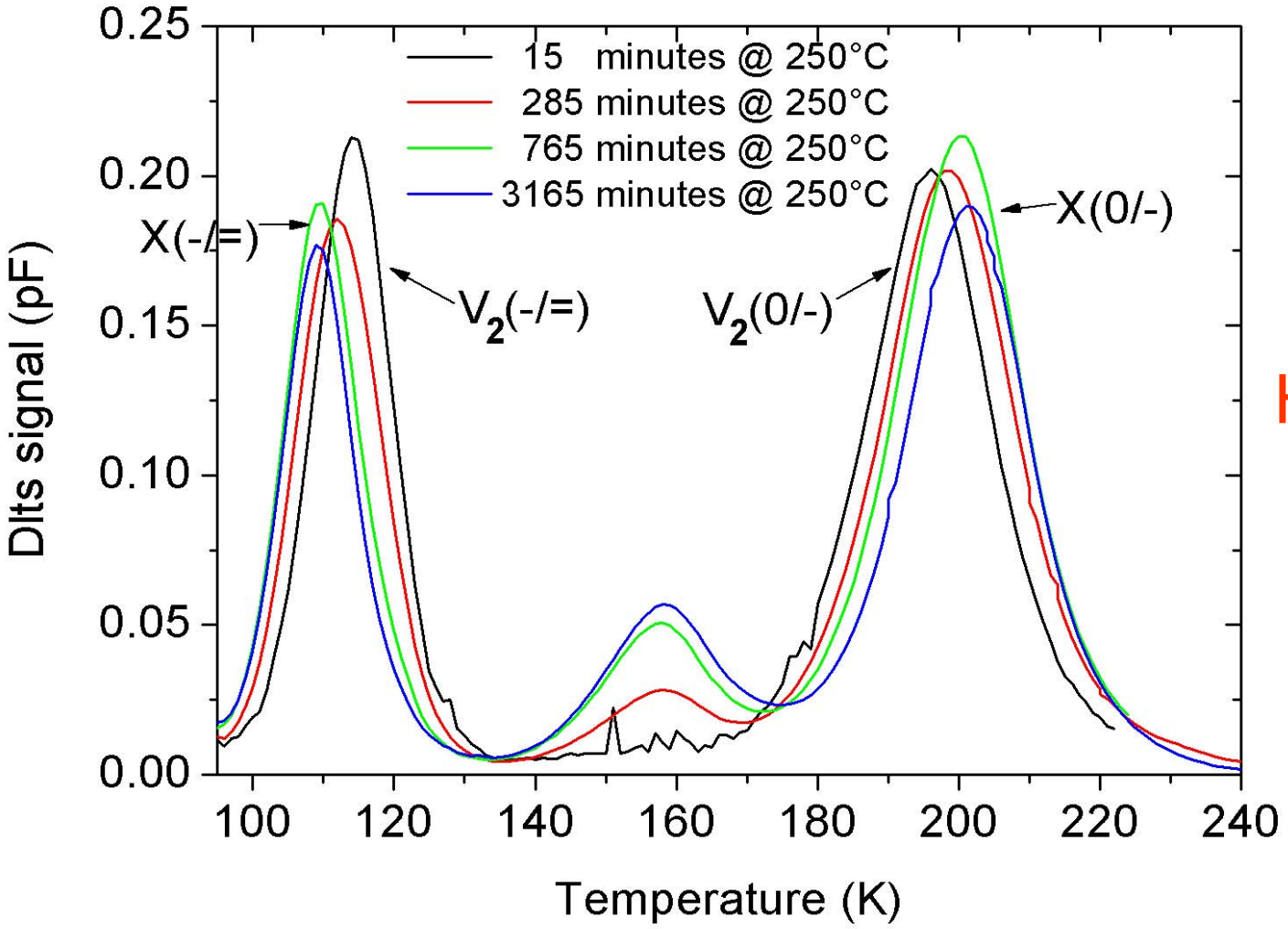


DLTS spectrum of Sample A



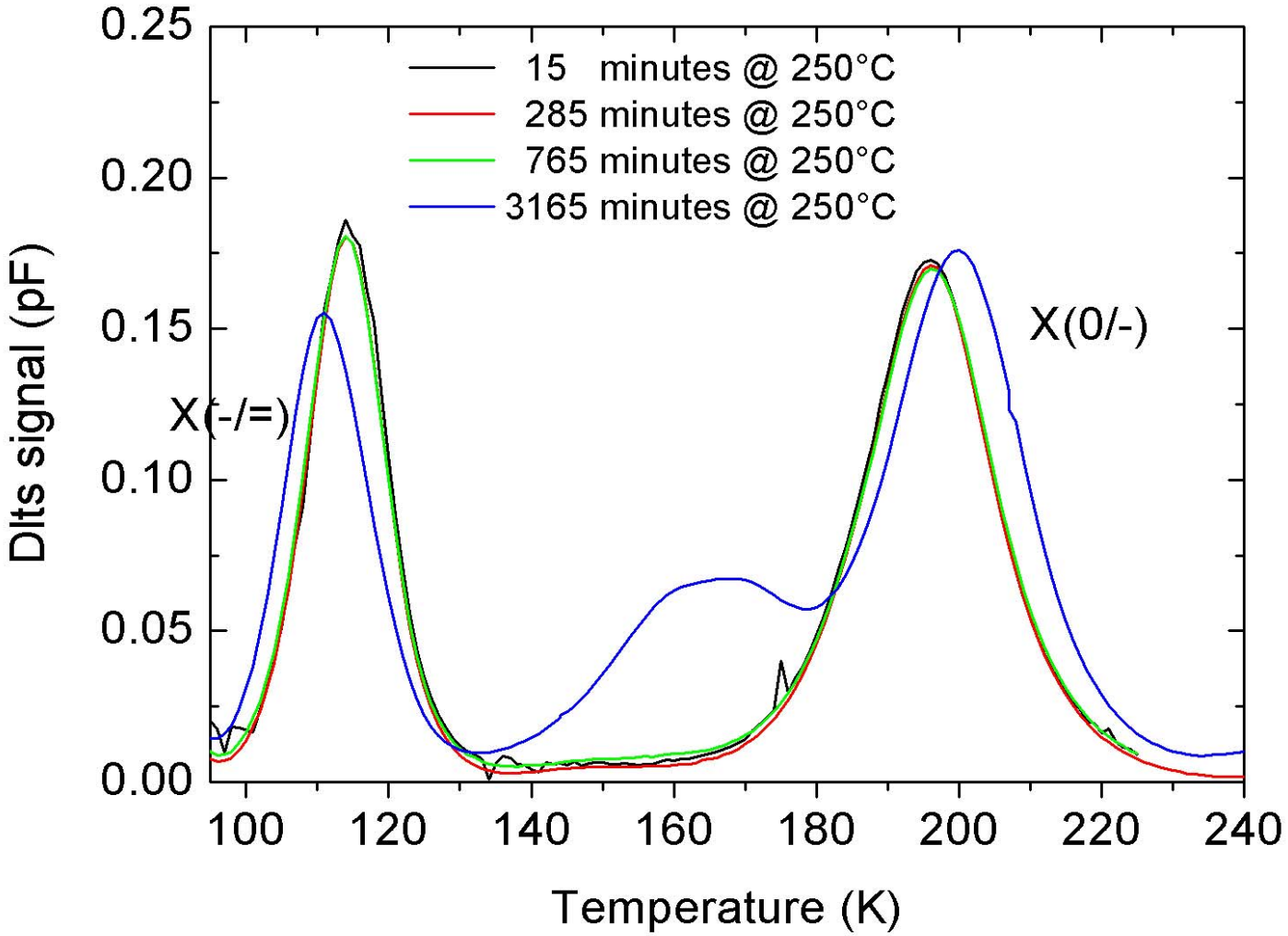
HIGH [O]

DLTS spectrum of Sample B



HIGH [O]

DLTS spectrum of Sample C



LOW [O]

- Both in proton and electron irradiated samples the same results have been found.
- The results of the annealing study show that the transformation of V_2 into X occurs at a rate that is directly correlated with oxygen content.
- This observation supports our previous tentative identification of X as V_2O which is formed through the interaction of migrating V_2 with an interstitial oxygen:$V_2+O_i \rightarrow V_2O$

aknowledgments

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