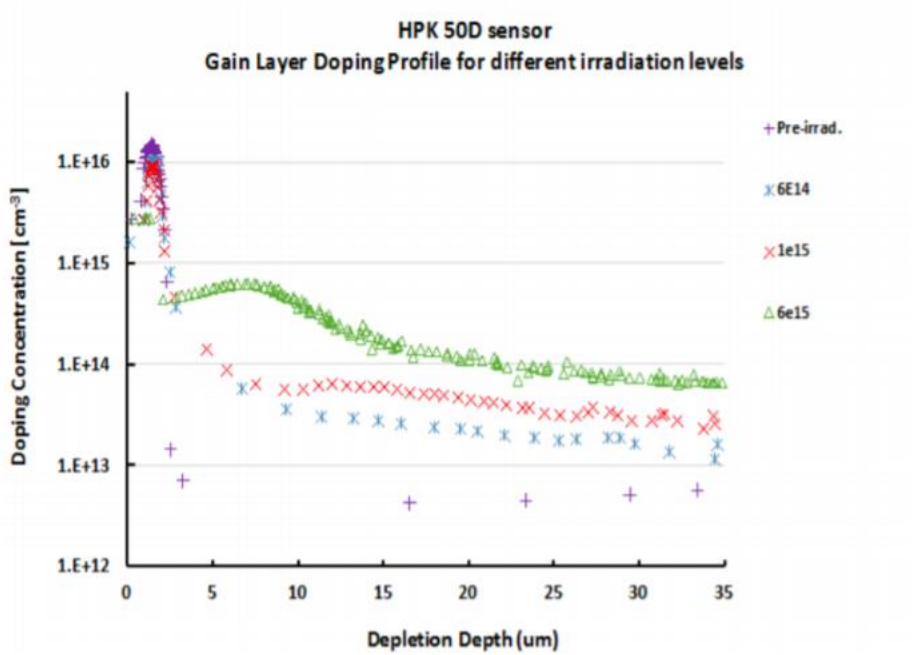
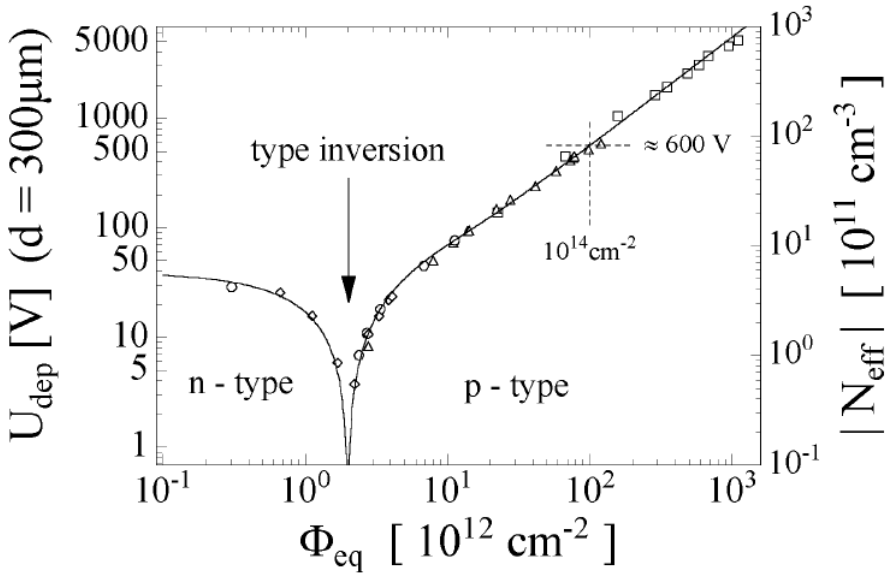
Last Question





- Radiation lead to opposite effects, with an exponential removal of acceptors (initial acceptor removal). Besides the creation of acceptors-like defects that increase the acceptors concentration.

- When the creation of acceptors-like defects prevails, type inversion can occur: n-type regions become p-type after high fluences and p-type ones become p+. It can be pointed that, in most cases, one is interested in keeping the doping concentration low in order to limit the leakage current; therefore the growth of Neff with irradiation is an undesired effect.

Thermally Stimulated Current(TSC)

Yuhang
tanyuhang@ihep.ac.cn
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Introduction:

- TSC can measure the effective doping concentration
- So TSC can investigate defects in irradiated silicon detectors
- DLTS also can measure defects in silicon detectors, but it can only be used in low radiation fluence

Principle of operation:

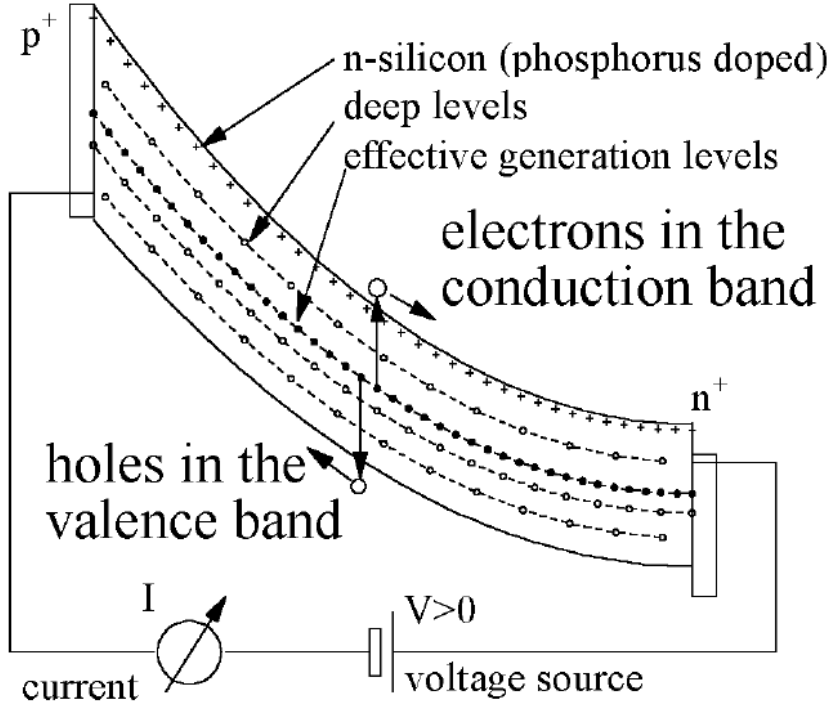
a).Cooling

b).Filling

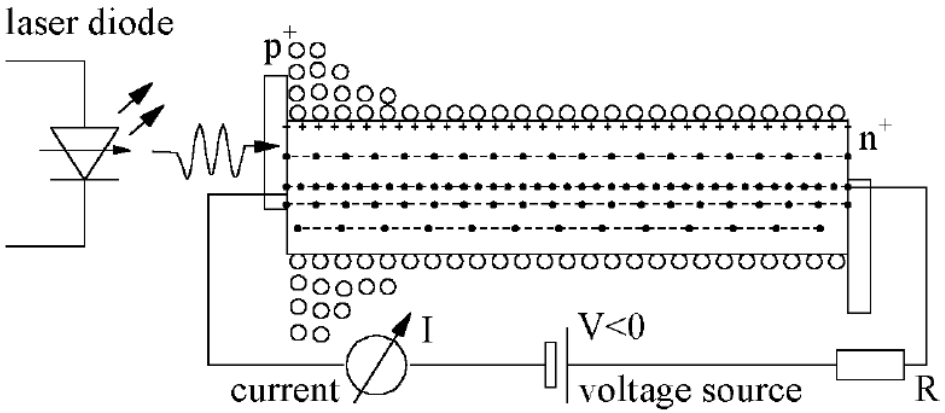
c).Recording

Principle of operation-cooling

- Cooling down under reverse bias.
- The sample is cooled to a low temperature at which the traps will be filled with electrons or holes
- If the sample is cooled down under reverse bias the steady state generation can be monitored and the traps will not be filled with carries during the cooling.
- The current measured is due to the steady state generation at the close to midgap levels



Principle of operation-Filling



- Current injection (applying forward bias) or illumination with band gap light produce both, holes and electrons, in the bulk.

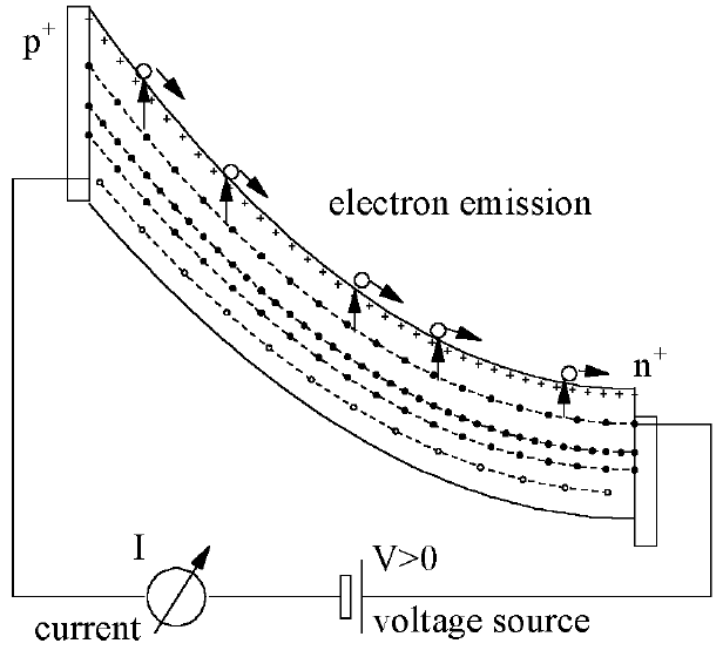
- Eg. Illumination with short wave length light of n+ junction side or the p+ junction side of the sample can be used fill only electron respectively hole traps.

- These lead to traps filled with majority carries

- The occupation of the traps is determined by their Individual ratio between electron and hole capture coefficient

Principle of operation-Recording

- After the filling process the sample is heated under reverse bias and at a specific temperature the trapped charges are emitted giving rise to unique current peak signal for each kind of level



Result:

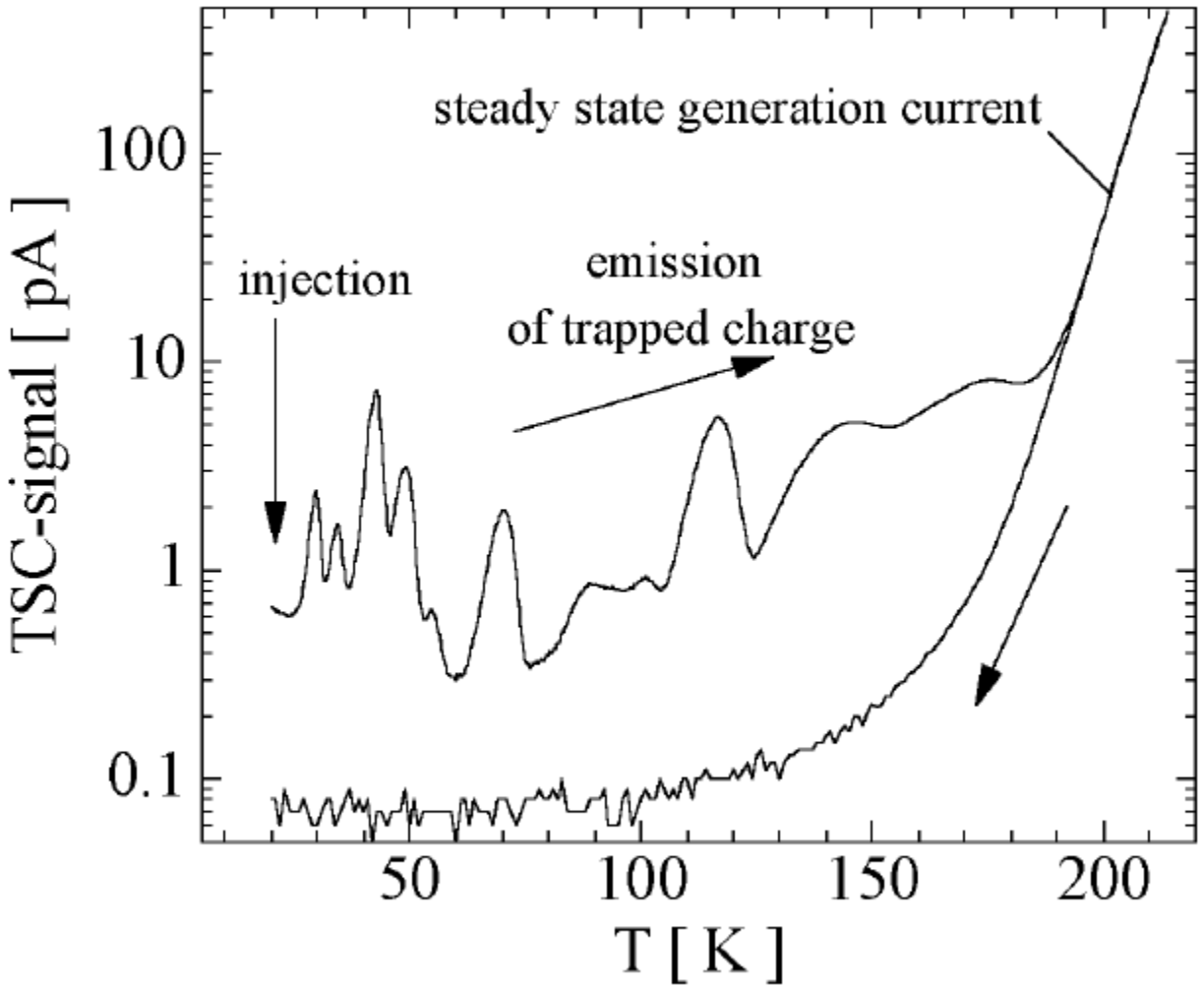


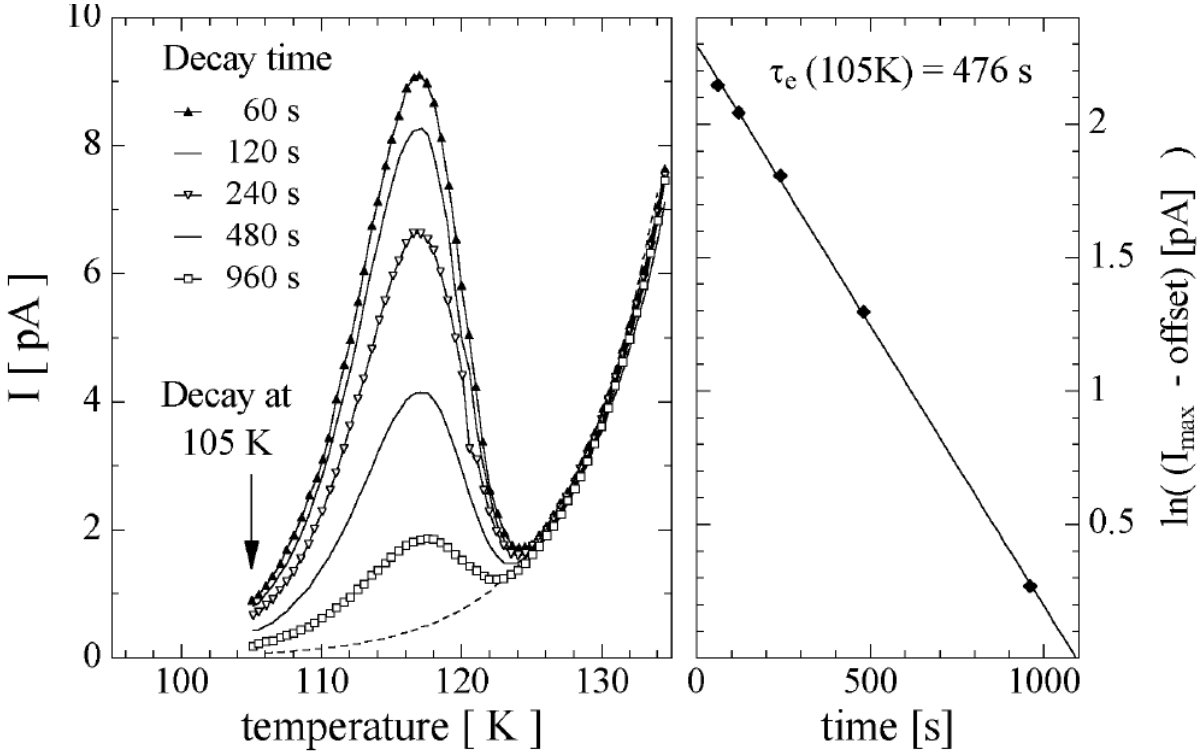
Figure 4.15: Typical TSC spectrum of a detector irradiated with $\Phi_{eq} = 1 \times 10^{13}\,\mathrm{cm}^{-2}$.

(sample M20713; $\beta = 0.183\,\mathrm{K/s}$; 30 s injection at 20 K (1.7 mA); 100 V; after 100 min annealing at room temperature)

The method to obtain the defect level parameters:

Delayed heating method

- The TSC-peak is measured several times from the same starting temperature T0 with different decay time
- On the right hand side of the figure the natural logarithm of the peak amplitude is plotted against the delay time
- The slope can give the activation energy and the cross section of defects



Thank you