Exercise 10

Exercise 1: In this exercise you will find out more about photodiodes and photoconductors.

a) Explain the different mechanisms that lead to photoconductivity in the case of photodiodes and photoconductors.

b) Consider a photodiode (p-n or p-i-n junction) with

   (a) an intrinsic layer of c-Si of 100 µm thickness

   (b) an intrinsic layer of a-Si of 100 µm thickness

c) Consider a photoconductive material (only undoped material) with

   (a) an intrinsic layer of c-Si of 100 µm thickness

   (b) an intrinsic layer of a-Si of 1 µm thickness

All cases have a TCO front contact and a metallic back contact. Calculate the relation $\frac{J_{\text{ill}}}{J_{\text{dark}}}$ between the current density J_{ill} under illumination (laser at $\lambda = 632\,\text{nm}$, $I = 1000\,\text{W}\,\text{m}^{-2}$) and the current density J_{dark} in the dark, when a bias voltage of $-1\,\text{V}$ is applied. Make assumptions for parameters that are not given here and check if the results are reasonable. Hints: For b): Start with the Shockley equation. For c): Treat photoconductors like resistors with a illumination dependent conductance that has an activation energy of half the energy gap.

Exercise 2: In this exercise you will take a deeper look into the requirements of a semiconductor used for the drum in xerography.

- Explain the working principle of a xerography copying machine.
- Consider a semiconductor thickness of 20 µm and a surface charge on the drum causing a voltage of 500 V. Calculate the mobility of your semiconductor required to discharge the drum within a time window of 50 ms.