Pining of Quasi Fermi Level on Photojunction defects

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The illumination intensity spectra of photovoltage leads to the scan of quasi Fermi level along the semiconductors band gap and to the pinning of it by the defects correlated to the nanostructures in the junction region. Paper presents theoretical model describing of open circuit voltage illumination intensity spectra [1,2] and compares it with correlated experimental data for Si p/n homojunction and CdTe/ZnTe heterojunction.
The laser monochromatic radiation was used to illuminate the photojunctions. Proper radiation energy hν was used to be absorbed in selected side of the photojunction e.g. absorbed in CdTe and transparent for ZnTe side. In the case of silicon layered homojunction Si (n/p) the upper n-type layer mainly contribute to the generated open circuit voltage value while the lower p-type layer as well contributes to the total measured voltage value. Measured intensity spectra strongly depend on crystalline quality of Si p/n homojunction. The junction of high crystalline quality gave a continuous smooth spectra without any structure on the measured curve. The spectra are well described by the presented model. For not good crystalline structure of the Si (n/p) junction the steps appears on the measured curves. It is expected that the defects located in these energy pins the quasi Fermi position of minority carriers at these energy region. The pining step length keeps for further increase of illumination intensity and then it returns to the previous increase of inclination. The measured steps are well illustrated by presented model description.
The presented method allows to determine parameters of the defect, e.g. binding energy position relatively to the thermal equilibrium Fermi level position and to approximate the value of it's concentration.

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This work was partly supported by the Polish National Science Centre (NCN) Grant No. UMO-2016/21/B/ST5/03378 and by the Polish National Centre for Research and Development (NCBiR) through the project DZP/PBSII/1699/2013. Author K.G. would like to acknowledge the financial support in the form of the scholarship from the special-purpose grant awarded to Faculty of Fundamental Problems of Technology by Ministry of Science and Higher Education in 2016 for research and development of the young scientists and Ph. D. students.