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Theory of photo-conversion in polycrystalline silicon A.I. SHKREBTII, University of Ontario Institute of Technology, Oshawa, Canada, A.V. SACHENKO, A.P. GORBAN, V.P. KOSTYLYOV, I.O. SOKOLOVSKY, V. Lashkarev Institute of Semiconductor Physics, Kiev, Ukraine, A. KAZAKEVITCH, University of Ontario Institute of Technology, Oshawa, Canada — We developed a three–dimensional analytical formalism of photo-conversion in polycrystalline silicon based solar cells. Polycrystalline Si was modeled by representing the grains as parallelepipeds or cylinders, considering spatial dependence of generation and recombination of electron-hole pairs both in the bulk and at the grain boundaries. We calculated spectral dependence of the short circuit current and open circuit voltage averaged over the grain. The recombination of the photo carriers at the grain boundary was described by introducing the effective diffusion length, responsible for the attenuation of excess electron–hole pairs. The recombination dependence on the bulk diffusion length, grain size and effective recombination velocity at the boundaries were derived and discussed. The short circuit current, open circuit voltage and photo-conversion efficiency in polycrystalline Si are in good agreement with the experimental data available. The research was supported by the Centre for Materials and Manufacturing/Ontario Centres of Excellence (OCE/CMM) "Sonus/PV Photovoltaic Highway Traffic Noise Barrier" project.

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