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Mathematical modeling of charges generation rate in the SiC semiconductor

The miniature and low-power devices with long service life in hard operating conditions like beta-decay energy converters indeed as power supply for integrated MEMS and NEMS are actively modeled by several groups nowadays. The idea of the C-14 atoms including in silicon carbide porous structure molecules by endotaxy technology results to increase the efficiency of the converter due to the greater intensity of electron-hole pairs generation rate in the space charge region and due to the larger volume charge density. The development of energy-saving technologies, the functioning of the MEMS devices, the reliability of their operation for a longer time in offline conditions led to the search of appropriate means of generating energy for them. Especially in trends of the microelectronics into the 30-micron size benchmark active microprocessor board that hosts all the necessary devices. Author will discuss how to model the power source for MEMS/NEMS devices based on por-SiC/Si porous structure, which is to be tested and used as the beta-decay energy converter of radio Carbon-14 into electrical energy. This involves silicon carbide obtaining by self-organizing mono 3C-SiC endotaxy way on the Si substrate. The key interest in the present aspect has the systematic optimization of main parameters that affect the operational efficiency of the betavoltaic current source. The non-porous layer of n-type is determined by under the porous SiC, which is inevitably formed on the bottom of the pores and in fact is non-porous, i.e. p-n junction is the place to be in the right picture in figure 1 is still not in the porous layer, and indirectly associated with it and the space-charge region (SCR), between non-porous layers. To calculate the depth of the active layer, known methods of mathematical physics with partial differential equations for electron-hole pairs will be used, and the probabilistic approach is applied for the sorting of the electron energy and the construction of the loss function.

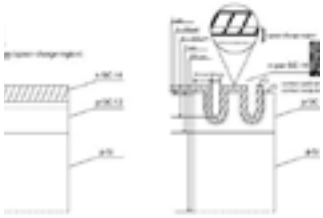

Figure 1: Two model structures variants (1, 2)

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2. Tariq R Alam and Mark A Pierson (2016) Principles of betavoltaic battery design. Journal of Energy Power Sources 3(1):11-41.
3. A A Gorbatsevich, V I Korneev, A B Danilin, E P Magomedbekov and A A Molin (2016) Analysis (Simulation) of Ni-63 beta-voltaic cells based on silicon solar cells. Technical Physics: The Russian Journal of Applied Physics 61(7)1053-1059

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