Analysis of nuclear battery using semiconductor

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1. Introduction

Until now, the development of the useful micro-electro mechanical systems (MEMS) has the problems because previous batteries (solar, chemical, etc) did not satisfy the requirements related to power supply. At this point of time, nuclear battery using isotope sources is rising as the solution of this problem. Nuclear battery can provide superior output power and lifetime. So a new type of micro power source (nuclear battery) for MEMS was designed and analyzed

2. Analysis of battery

Using visual c++, The nuclear battery is analyzed.

2.1 Parameter study

Parameter study is very meaningful work for calculating the battery output power. Each optimized parameter is changed by situation and circumstances. Around 13 parameters are used for simulating real battery. Using these parameter, efficiency, short circuit current, potential distribution, field rate, recombination rate, electron and hole concentration, electron and hole trap concentration, etc are obtained. And as the isotope source, various power distributions are obtained.

2.2 Simulator development

By upper parameter, simulator calculates the specification of nuclear battery. But the efficiency of battery is verified by actual experiment. Below Fig.1. shows the simulator interface and results. Simulator interface is organized by GUI.

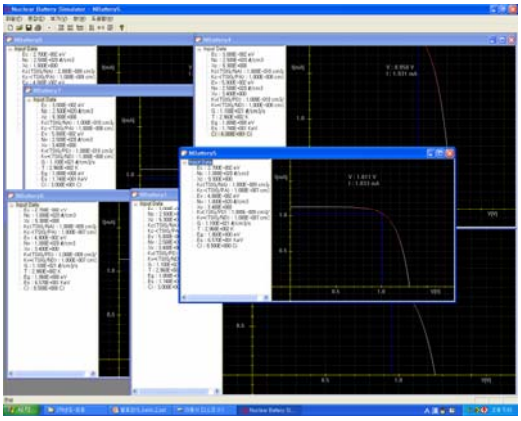

Fig. 1. Simulator of nuclear battery

3. Conclusion

In this study, nuclear battery that is useful to overcome the limitations of the past power sources to MEMS was designed. The isotope source as the fuel is used. The semiconductor is used for pn-junction type battery.

Results of analyzing nuclear batter show several optimized value. When increasing dopant(N_A^-), optimized thickness of p layer get thin. Thick battery height guides the increasing J_{sc} and the decreasing V_{oc} & FF. Temperature show the similar trend about J_{sc} and V_{oc} & FF. J_{sc} is increasing and V_{oc} is decreasing in proportion to energy density of source. Band gap show the gentle slope when supplied voltage is close to Voc, so electric field is decreasing and recombination is increasing at i layer. And diffusion current can be offset by drift current that is made by interface electric field, so current density is uniform among the battery.

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