

## Public Abstract

First Name:Tongtawee

Middle Name:

Last Name:Wacharsindhu

Adviser's First Name:Jae

Adviser's Last Name:Kwon

Co-Adviser's First Name:

Co-Adviser's Last Name:

Graduation Term:SS 2012

Department:Electrical Engineering

Degree:PhD

Title:Composite-Semiconductor-Based Micro Power Source

This work covers the development of a radioisotope loaded micropower source from the initial stages of design, simulation and fabrication through the characterization and performance optimization of the device. Various mechanisms causing losses in conventional betavoltaic conversion were investigated. A new betavoltaic device was introduced that shows efficiency improvement over traditional betavoltaics through the use of a semiconductor infused with a beta source. Specifically, radioactive material sulfur ( $^{35}\text{S}$ ) was blended with a semiconductor material (selenium), effectively encapsulating the radioisotope within the semiconductor. By eliminating or reducing potential loss factors by optimizing the device geometry, fabrication techniques, and other factors, more efficient energy conversion was achieved. This approach enabled more effective conversion of energy emitted from the radioisotope without the need for additional shielding structures.

The prototype devices (first and second generation) were fabricated and tested with current-voltage measurement at room temperature. A maximum output power of 687 nW was obtained from the micro power source using 1.24 GBq (33.61 mCi) of  $^{35}\text{S}$ . An open-circuit voltage of 410 mV and short-circuit current of 6.44  $\mu\text{A}$  were also observed. The overall efficiency of the prototype device was 7.05 %. This is a distinct improvement over traditional betavoltaic sources, whose maximum efficiencies are around 2.7%.