^{63}Ni in beta voltaic battery

Jin Joo Kim*, Young Rang Uhm, and Kwang Jae Son

Radioisotope Research Division Korea Atomic Energy Research Institute, 989-111 Daeduckdaero, Yuseong-Gu, Daejeon 305-353, Republic of Korea

1. Introduction

A nuclear battery with diode junction is a device that converts nuclear radiation directly to electric power [2]. In betavoltaic battery, beta particles are collected and converted to electrical energy as similar principle as photovoltaic. Radioactive thin-film based power source also haveen ergy density order so magnitude higher than chemical-reaction-based energy sources.The thickness dependents self shielding effect of the seed layer was studied by using both simulation using MCNP code an dmeasurement of I-Vcurve.

2. Experimental Results

To fabricate the P-N absorber, new type of 3D single trenched P-N absorber was developed for easy trenching and doping process. ^{63}Ni can be deposited and power output can be measured.

3. Results and discussion

Ni seed layers were deposited by an e-beam on the single trench P-N absorber with spacing 5, 110 and 190 mm. The optimum total thickness of ^{63}Ni and seed layer was determined about 2μm as regarding the minimum self-shielding effec to beta-ray(β-ray). Both the conductivity and the uniformity of the seed layer are enhanced, as the thickness of deposit layer is increased. However, self-shielding of β-ray is significantly increased, as the thickness of the seed layer become thick. To fabricate effective battery, the thickness of seed layer about 500 Å have been determined.

4. Conclusion

Ni seed layers were deposited by an e-beam on the single trench P-N absorber with spacing 5, 110 and 190 mm. The optimum total thickness of ^{63}Ni and seed layer was determined about 2μm. To fabricate effective β -voltaic battery, the thickness of seed layer about 500 Å have been determined.

5. Reference

[1] J. Ulmen B, Desai PD, Moghaddam, Miley GH, Massel RI (2009) J. Radioanal Nucl. Chem 282:601