

FEATURES OF NICKEL-63 LARGESCALE PRODUCTION WITH NUCLEAR POWER PLANT

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Nickel-63 is perspective isotope to produce microsized radioisotope power source [1]. Advantage of nickel-63 is combination of long half-life ($T_{1/2} = 100$ y), low beta-particle energies and absence of accompanying gamma-emissions. In industry nickel-63 is produced by nuclear reactor irradiation of nickel-62 [2].

Nickel-63 has been produced with nuclear power plant irradiation of nickel-62. Initial nickel abundance was 99.36% of nickel-62 and chemical purity - 99.9%. After nickel-62 irradiation for 300 days in a power nuclear reactor a product with abundance about 1.5% has been obtained. Production of nickel-63 was accompanying by accumulation of lateral gamma-radioactive isotopes (^{60}Co , ^{46}Sc , ^{59}Fe , ^{65}Zn , ^{51}Cr , ^{117}Sn , ^{54}Mn , ^{124}Sb) with activation of admixtures and via parallel nuclear reactions. The main doze-generating admixture was ^{60}Co with specific activity 1 mCi/g of product.

In order to use nickel-63 as a power source it has to contain minimal amount of such radioactive admixtures. Radiochemical purification of nickel-63 from radioactive admixtures was based on the principle of volatile tetratriphosphine of nickel [3]. This allowed to obtain product with contamination of lateral gamma-radioactive isotopes lower than $1 \mu\text{Ci/g}$.

Measured activity values of nickel-63 and its accompanied admixtures has been compared with calculated ones to verify a computer code to predict a future nickel 63 production with use of other nuclear reactors.

1. B.D. Bryskin, A.V. Fedorov, A.I. Kostylev et al. // Ener. Tech. 2014. V. 2(2), P. 210.
2. RU Patent 2569543, 11.27.2015.
3. RU Patent 2650955, 18.04.2018.

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