IMPLEMENTATION OF RADIOACTIVE POWER IN SPACE

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In this paper, the application of radioisotope thermoelectric generators and nuclear reactors as sources of energy in space technologies is examined. The paper provides an overview of successful implementation of radioisotope thermoelectric generators, such as Orion-1, Kosmos-84 and 90, Lunohod-1 and 2, Pioneer-1 and 2 [1].

There are two general types of reactors demonstrated. The first one is based on direct thermoelectric conversion. The second one is a reactor with heated fluid driving a turbine. The greatest development of implementing nuclear reactors was in the period of 60's to 70's years of the 20th century because of the popularity of this idea [2]. Consequently, most reactors presented in this work are related to this period of time.

REFERENCES

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PLUTONIUM-240 AS A BURNABLE ABSORBER

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The basis of nuclear power in Russia is power reactors of WWER type, which are reliable and safe to operate. Currently, the improvement of WWER reactors is carried out in the direction of increasing nuclear fuel burnup. High burnup is ensured by the longer fuel cycle. Reactor lifetime elongation is possible by increasing the initial fuel enrichment, which results in the need to compensate the high excess reactivity at the beginning of the fuel cycle. Compensation of excess reactivity is possible by injection of the burnable absorber (BA). BA prevents excessive use of boron control and reduces the implication on the control rods [1].

The paper considers the possibility of using as a burnable absorber such material, as plutonium-240. As the burnable poisons in the WWER reactors, it is advisable to use materials having high neutron absorption cross section with values more than 1000 barns, such as *Eu*, *Sm*, *Dy*, *Gd*, *Er*, *Cd* and *Hf*. Apart from the choice of material, it is important to select a method for placement of the absorber in the fuel assembly.

Also, it is important to take into account both technological and physical aspects. Normally, plutonium is used in a nuclear reactor as a fuel [2]. It is perfectly fissionable by thermal neutrons, rather than uranium-235. For calculating the neutronic characteristics of plutonium, the WIMSD5 program was used. The main value describing the development of nuclear fission chain reaction (and the neutron balance in the reactor) is an effective neutron multiplication factor k_{eff}. The effective multiplication factor is the ratio of the number of neutrons in one generation to a corresponding number of neutron generation immediately preceding it. Neutron multiplication factor for the various