CONSERVATION OF ENERGY

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Conservation of energy states that the total amount of energy in an isolated system remains constant. In thermodynamics, the first law of thermodynamics is a statement of the conservation of energy for thermodynamic systems.

The energy conservation law is a mathematical consequence of the shift symmetry of time; energy conservation is implied by the empirical fact that physical laws remain the same over time.

Ancient philosophers as far back as Thales of Miletus had inklings of the conservation of some underlying substance of which everything is made. However, there is no particular reason to identify this with what we know today as "mass-energy" (for example, Thales thought it was water).

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With the discovery of special relativity by Albert Einstein, it was found that energy is one component of an energy-momentum 4-vector.

In quantum mechanics, energy is defined as proportional to the time derivative of the wave function.

RESEARCH OF NUCLIDE KINETICS FOR REACTOR FUEL

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During the operating time of nuclear reactor, there are a lot of nuclides with the different physical properties generated as fission products. Among these nuclides, there are some isotopes which have special characteristics and strong absorb neutron that affect to the physical properties of fuel assemblies. The investigation of the burnup processes that happen inside the reactor, especially the transmutation of U^{235} as well as other nuclides that formed in reactor is very important. By understanding this, the plant could be operated safety, prolonged the life time of reactor and reduced the nuclear wastes. [1]

This paper will present the research results of the nuclides transformation in fuel assemblies at the Tomsk research reactor [2] based on MCU Monte Carlo calculations [3].

In operating mode of reactor, the concentration of U^{235} will decrease by the burning-up process. But there are a lot of new nuclides formed as reaction products. To determine which nuclides significantly affecting to fuel assembly properties, it must be calculated the contribution of every individual isotope to the general absorbed reaction rate. There are 20 isotopes with the highest impact on the neutron-physical properties of fuel assemblies chosen to be researched: U^{235}, Xe^{135}, Nd^{143}, Sm^{149}, U^{236}, U^{238}, Pu^{239}, Rh^{103}, Pm^{147}, Cs^{133}, Xe^{131}, Sm^{151}, U^{234}, Tc^{99}, Sm^{152}, Nd^{145}, Pm^{148m}, Sm^{150}, Eu^{153}, Np^{237}, Pu^{240} and Mo^{95}.

Due to the calculations, the discrete concentration values for those isotopes had been received. By using the linear interpolation method to show the mathematical forms of every single isotope [4], the transmuted rules of above nuclides will be

changed differently. For example, the concentration of U^{235} after 20 days of operating time will change by the linear function, Np^{237} change by a quadratic mathematical one, meanwhile Sm^{149} and Pu^{239} transform with the completely complex forms.

The reason causes this phenomenon is that some of those nuclides are not only reaction products that generated after a period of operating time of reactor, they are also a fissile isotope and decays by time. All of these factors contribute to the burnup process. Otherwise the others, U^{235}, are only fissile isotope and are not a product of any reaction and get the more simple mathematical equations.

According to the calculated data, the experiments have been done with the periods of time 20 and 50 days, respectively, are more accurate, their deviations are less than 1%. Additionally, the optimal period of time for measuring – 50 days because the absolute deviation corresponding to this time is lowest when compare to all of the others. Comparing the 8-tubes assembly to 6-tubes assembly, the absolute deviations for Pu^{239}, Pu^{240} and Np^{237} are more than 7 %. For the rest, the absolute differences will be less than 3 %.

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ФОРМИРОВАНИЕ ЭМИ МЕТОДОМ ПРЕОБРАЗОВАНИЯ СВЧ ИМПУЛЬСОВ В МНОГОКАНАЛЬНОЙ РЕЗОНАНСНОЙ СИСТЕМЕ

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В настоящей работе представлены результаты исследования процессов формирования электромагнитного излучения (ЭМИ) наносекундной длительности в устройстве, работа которого основана на принципах преобразования многочастотных сигналов с помощью резонансных систем с эквидистантным распределением резонансных частот. Актуальность данного исследования обусловлена возрастающим интересом к использованию СВЧ-энергии в технологических целях, решении экологических задач, в ускорительной и лазерной технике. Применение различных методов преобразования импульсов СВЧ в резонансных структурах позволяет увеличить мощность источников ЭМИ путем сокращения его длительности без изменения энергетических характеристик самого генератора. Это обеспечивает таким приборам ряд преимуществ, обусловленных меньшими габаритными размерами, потребляемой мощности от сети питания. Проблема, которая ограничивает использование таких приборов, связана с отсутствием промышленных СВЧ коммутаторов.

Задача, решаемая исследованиями, является разработка способов создания источников ЭМИ наносекундной длительности с использованием методов преобразования энергии с помощью резонансных систем без применения коммутирующих элементов.

Для исследования процессов формирования импульсов использовалась схема мультиплексора на основе резонаторов бегущей волны. Методом матриц рассеяния получены выражения, которые описывают