Calculations for "ALPHA FUSION ELECTRICAL ENERGY VALVE"

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The purpose of this paper is to provide a brief explanation of the calculations of nuclear energies in the patent entitled "**ALPHA FUSION ELECTRICAL ENERGY VALVE"** by Bruce Perreault. The device claims to get at least some of its energy from the specified nuclear reactions. The alpha fusion reaction uses the energy of naturally decaying isotopes of alpha emitting material to provide the energy for nuclear fusion. Below in equation 1, is a reaction cited as an alpha fusion reaction that is important for the energy generation process in the patent.

$_{32}Ge^{72} + _{2}He^{4}$ **(high energy *alpha*)** $\rightarrow _{34}Se^{75} + _{0}n^{1}$ **Equation 1**

To calculate the lowest possible threshold for this reaction to occur, we will do a mass-energy balance calculation for this equation, using the famous relation between mass and energy, $E= M C^2$. For simplicity we will use the units of MeV for both masses and energies, where 1 atomic mass unit (amu) = 931.494 MeV.

66994.9813 MeV (Ge^{72}) + 3728.40068 MeV (He^{4})

– {70718.2914 MeV (Se^{75}) + 939.564464 MeV (n)}

= 6.06 MeV

This equation has more mass on the right hand side, so this reaction is endothermic and requires 6.06 MeV as a minimum to make this reaction possible. Later in the paper, it will be shown that there are alpha emitters that are capable of supplying much more energy than this, and thus allowing this reaction to happen. The produced neutron is then used in a second reaction to produce several mega-electron Volts of energy in beta emissions.

$_{32}Ge^{76} + _{0}n^{1} \rightarrow _{32}Ge^{77}$ **Equation 2**

$_{32}Ge^{77} \rightarrow _{33}As^{77} +$ ***beta*** **(2.702 MeV max)** **Equation 3**

$_{33}As^{77} \rightarrow _{34}Se^{77}$ **stable +** ***beta*** **(682 MeV max)** **Equation 4**

These equations show that a single neutron absorption liberates an enormous amount of energy in the form of beta decay. Since part of the energy is taken away in the form of a neutrino, this is only the maximum possible energy available for this decay mode. The average energy per decay will be lower, but it is still a large amount of energy. This type beta of radiation is also easily converted directly to electrical current, and is also not very penetrating radiation, so it is easily shielded, for personal safety.

A second important reaction stated in the patent is the following alpha fusion reaction.

$_4Be^9$ + $_2He^4$ (high energy *alpha* particle) → $_6C^{12}$ + $_0n^1$ (fast neutron) Equation 5

This reaction is actually exothermic and releases 5.70 MeV in addition to the initial energy of the alpha particle (on the order of another 5+ MeV).

The second part of the energy reactions we will look at, are concerning the production and utilization of alpha radiation. This alpha radiation is produced from radon and its decay products. It is found that the daughter isotopes of radon are actually more energetic than radon itself, and are energetically capable of producing (Equation 1). Below is a table of decay products of thorium and uranium, and the corresponding alpha energies associated with each alpha decay.

Thorium 232	**Alpha energy**
Rn^{220}	6.40 MeV
Po^{216}	6.90 MeV
Po^{212}	8.95 MeV
Bi^{212}	6.20 MeV

Uranium 238	**Alpha Energy**
Rn^{222}	5.59 MeV
Po^{218}	6.11 MeV
At^{218}	6.87 MeV
Rn^{218}	7.26 MeV
Bi^{214}	5.61 MeV
Po^{214}	7.83 MeV
Pb^{210}	3.79 MeV
Bi^{210}	5.03 MeV
Po^{210}	5.41 MeV

The Rn220 daughter elements Po216, Po212, and Bi212 of the Thorium232 decay series all have energies above 6.06 MeV, as required for equation 1. In addition, Po218, At218, Rn218, and Po214 of the Uranium 238 decay series all have energies in excess of what is required for equation 1.

Conclusion

According to the calculation of energies present above, it appears that nuclear reactions presented in the patent entitled "**ALPHA FUSION ELECTRICAL ENERGY VALVE"** by Bruce Perreault, are reactions that will generate a substantial amount of energy, which can be utilized in a nuclear type battery to provide electrical power.