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Multeity of Nuclides Arising in the Process of Cold Nuclear Transmutations

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***Abstract*—It is shown that a huge variety of nuclides arising as a result of cold nuclear transmutations is the result of energetically favorable rearrangements of nucleons.**

At the present time many different devices have been created, as a result of their operation nuclides arise that were originally absent. It indicates the occurrence of nuclear transmutations in these devices. Moreover, this occurs without the emission of neutrons and gamma quanta, which inevitably accompany the usual nuclear transformations. Note various installations, where as a result of the electroplasma process, iron, zinc, calcium, silicon, phosphorus, aluminum, titanium and a number of other elements appear in water and other liquids [1], [2], [3], [4]. A number of initially missing elements were discovered after electric explosions of foils [5], in gas-discharge installations [6], in combustion products of thermite reaction [7], in various nickel-hydrogen reactors [8], [9], [10], [11], [12], [13], [14], in results of impact of powerful electromagnetic impulses on melts of metals [15].

Articles [13], [14] present the results of an analysis of the isotopic and elemental composition of fuel and matter near the core of four nickel-hydrogen reactors before and after working with the accumulation of excess thermal energy up to 790 MJ. A significant increase in the concentration of impurities of a multitude of nuclides was observed not only in fuel, but also in structural materials adjacent to active zones of reactors, as well as matter accumulated in the cavity of the reactor near the core. The content of boron, sodium, potassium, vanadium, scandium, iron, copper, silver, lanthanides, mercury, lead, and bismuth was particularly large.

In this paper the principal possibility of the formation of such a rich diversity of emerging nuclides will be shown, without delving into the physical mechanisms of the occurrence of cold nuclear transmutations. The essence of the changes is that a certain set of stable nuclides passes into another set of stable nuclides with the release of energy. Since neutrons or charged particles are not emitted or absorbed, the total number of nucleons and the total charge of the nuclei remain unchanged. Put physical mechanisms in the 'black box'. At the entrance of this box are stable nuclides, at the output - also stable nuclides plus energy. In the simplest case, there are one or two nuclides at the input, one or two nuclides at the output, the number of protons and the number of neutrons at the input equal to the number of protons and neutrons at the output.

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Consider three types of such transformations: fusion of two cores into one, fission nucleus into two, transformation of a pair of nuclei into another pair (transposition):

Fusion:

$$(A1, Z1) + (A2, Z2) \to \blacksquare \to (A3, Z3) + Q,$$
$$A3 = A1 + A2, \quad Z3 = Z1 + Z2$$

Fission:

$$(A3, Z3) \to \blacksquare \to (A1, Z1) + (A2, Z2) + Q,$$
$$A3 = A1 + A2, \quad Z3 = Z1 + Z2$$

Transposition:

$$(A1, Z1) + (A2, Z2) \to \blacksquare \to (A3, Z3) + (A4, Z4) + Q,$$
$$A1 + A2 = A3 + A4, \quad Z1 + Z2 = Z3 + Z4$$

A computer program was compiled that selected combinations that satisfy the above formulated conditions, out of possible combinations of 280 stable nuclides, information on which was taken from [16]. As a result of the work of this program, 1389 synthesis variants, 817 fission variants and 516789 transposition variants were identified. It is impossible to bring so great information in the article. Those who want to read it can get it from the author of this article in the form of an EXCEL file.

Thus, the number of even the simplest variants is enormous. But in fact, more than two nuclei can be involved in such processes, and processes involving electrons are also possible. However, it should be noted that processes involving many particles are usually unlikely. The processes involving electrons are associated with weak interactions, the estimation of the probability of which is problematic.

Let us consider possible transmutations associated with the operation of nickel-hydrogen reactors. In the core of such reactors is nickel, containing hydrogen dissolved in it ('fuel'). In addition, if the reactor is loaded with a mixture of nickel powder and lithium aluminum hydride, an impurity of lithium and aluminum may be present. But it should be noted that when the reactor is operating, the fuel is heated to a temperature of the order of 1500°C or higher. At this temperature, lithium and aluminum evaporate and condense in the cold parts of the reactor, as a result of which the concentration of these substances in the core of the reactor becomes very low. The main interactions are:

reactions of nickel with hydrogen dissolved in it

$$
\begin{array}{l}
{}^{62}Ni + {}^{1}H \to {}^{63}Cu + 6,125 \text{ MeV} \\
{}^{64}Ni + {}^{1}H \to {}^{65}Cu + 7,450 \text{ MeV}
\end{array}
$$

and reactions of various isotopes of nickel with each other

$$
\begin{array}{l}
{}^{58}Ni + {}^{62}Ni \to {}^{60}Ni + {}^{60}Ni + 1,957 \text{ MeV} \\
{}^{58}Ni + {}^{64}Ni \to {}^{60}Ni + {}^{62}Ni + 3,8871 \text{ MeV} \\
{}^{58}Ni + {}^{64}Ni \to {}^{61}Ni + {}^{61}Ni + 1,1206 \text{ MeV} \\
{}^{60}Ni + {}^{64}Ni \to {}^{62}Ni + {}^{62}Ni + 1,9114 \text{ MeV} \\
{}^{61}Ni + {}^{61}Ni \to {}^{60}Ni + {}^{62}Ni + 2,7665 \text{ MeV} \\
{}^{58}Ni + {}^{64}Ni \to {}^{56}Fe + {}^{66}Zn + 2,1620 \text{ MeV} \\
{}^{61}Ni + {}^{61}Ni \to {}^{56}Fe + {}^{66}Zn + 1,0414 \text{ MeV} \\
{}^{58}Ni + {}^{64}Ni \to {}^{59}Co + {}^{63}Cu + 0,4807 \text{ MeV} \\
{}^{58}Ni + {}^{64}Ni \to {}^{58}Fe + {}^{64}Zn + 0,8234 \text{ MeV}
\end{array}
$$

Thus iron, zinc, cobalt are formed. The appearance of these elements in spent fuel, in besides of zinc, is confirmed by analyzes [13], [14], [15]. Zinc, having a boiling point of 906°C, 'boils out'. It is found in colder places of the reactor, where its vapor condenses.

As was mentioned above, during the operation of nickel-hydrogen reactors, transmutations can occur not only in 'fuel', but in the surrounding matter. Perhaps this is due to the fact that transmutations are not just process in 'fuel', but in local formations, which G.V. Myshinsky called 'capsules' [17]. In these capsules must fit at least two atoms. In condensed matter, the distance between neighboring atoms is about 10 nm. Therefore, the diameter of the capsules is not less than 10 nm. They are electrically neutral, so they move fairly freely in the substance. They are able to leave the zone where they occur, and, permeating the substance, cause transmutations in their path. They can go outside the reactor and, getting on a photographic film or other detector, cause in it the appearance of surprising tracks, absolutely not similar to tracks from nuclear particles [18].

Consider the transmutations possible in corundum tubes (Al_2O_3), which are commonly used to house fuel and as an outer shell.

A feature of aluminum is that, in addition to ${}^{27}Al$, it does not have other isotopes. But even in monoisotopic aluminum, several energetically favorable transmutations are possible:

$$
\begin{array}{l}
{}^{27}Al + {}^{27}Al \to {}^{54}Fe + 21,2426 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{50}Cr + {}^{4}He + 13,4284 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{42}Ca + {}^{12}C + 4,1377 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{38}Ar + {}^{16}O + 5,0580 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{34}S + {}^{20}Ne + 5,0580 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{30}Si + {}^{24}Mg + 3,9719 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{29}Si + {}^{25}Mg + 0,6884 \text{ MeV} \\
{}^{27}Al + {}^{27}Al \to {}^{28}Si + {}^{26}Mg + 3,3087 \text{ MeV}
\end{array}
$$

In addition, transmutations are possible with the participation of oxygen nuclei, as well as oxygen and aluminum:

$$
\begin{array}{l}
{}^{16}O + {}^{16}O \to {}^{32}S + 16,5390 \text{ MeV} \\
{}^{16}O + {}^{16}O \to {}^{31}P + {}^{1}H + 7,6734 \text{ MeV} \\
{}^{16}O + {}^{16}O \to {}^{28}Si + {}^{4}He + 9,5944 \text{ MeV} \\
{}^{16}O + {}^{27}Al \to {}^{42}Ca + {}^{1}H + 9,3121 \text{ MeV} \\
{}^{16}O + {}^{27}Al \to {}^{39}K + {}^{4}He + 9,4388 \text{ MeV} \\
{}^{16}O + {}^{27}Al \to {}^{31}P + {}^{12}C + 2,5029 \text{ MeV}
\end{array}
$$

Oxygen, in addition to the ${}^{16}O$ isotope, has two more stable isotopes. But their content is small and possible transmutations with their participation are not listed here.

Thus, in corundum, iron, chromium, calcium, sulfur, silicon, magnesium, phosphorus, potassium can appear. Analyzes [13], [14], [15] confirm a significant increase in the concentration of these elements after the presence of corundum in the operating reactor.

In addition, the analysis of the substance in the reactor shows the appearance of heavy elements (bismuth, lead, mercury, silver, lanthanides, etc.). They can arise as a result of transmutations in the tungsten from which the wire of the heater is made, for example,

$$
\begin{array}{l}
{}^{182}W \to {}^{18}O + {}^{164}Dy + 18,897 \text{ MeV} \\
{}^{183}W \to {}^{4}He + {}^{167}Hf + 1,5528 \text{ MeV} \\
{}^{180}W + {}^{184}W \to {}^{182}W + {}^{182}W + 1,3320 \text{ MeV} \\
{}^{180}W + {}^{186}W \to {}^{181}Ta + {}^{185}Re + 0,2981 \text{ MeV} \\
{}^{180}W + {}^{186}W \to {}^{174}Yb + {}^{192}Pt + 0,8104 \text{ MeV} \\
{}^{180}W + {}^{184}W \to {}^{178}Hf + {}^{186}Os + 0,1490 \text{ MeV}
\end{array}
$$

In total, there were found 116 variants of transmutations in tungsten. In 87 cases lanthanides are formed, in 30 cases mercury, in 22 cases plumbum, in 20 cases platinum, in 15 cases hafnium, in 11 cases osmium. Less likely the formation of thallium, tantalum, rhenium, gold. In addition, calcium, xenon, helium, carbon, oxygen, neon, boron, nitrogen, magnesium, silicon, titanium are formed.

Thus, a huge variety of nuclides arising as a result of cold nuclear transmutations can be understood as the result of energetically favorable transposition of nucleons without knowing of physical mechanisms.

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