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"Elemental Transmutation in Biological and Chemical Systems,"

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Abstract
Nuclear transmutation in biological and chemical systems is investigated with the use of a Trapped Neutron Catalyzed Fusion (TNCF) model. Using knowledge of nuclear physics, it is possible to explain the experimental results consistently with conventional physics, without relying on any new principles outside of common sense in physics. The success of the explanation substantiates the reality of the TNCF model, in turn.

Introduction

On the recommendation of Dr. Wayne Green, I have read Michio Kushi's book "The Philosopher's Stone." The part I have been most interested in has to do with information cited from a preceding book on Elemental Transmutation in Biological Systems, published in 1978. Biological systems are more complicated than any physical system, so I don't think it is possible to forever treat the whole phenomenon occurring there physically. Even so, some facts in the book are very interesting to can be treated with my TNCF model for cold fusion. In this note, a qualitative interpretation of some biological and semi-quantitative treatment of chemical nuclear transmutations are given using the TNCF model.

TNCF Model

The TNCF model in relation to the present problem can be explained as follows.
Assuming the existence of trapped neutrons in a crystal lattice, there will be nuclear reactions between the neutron and nuclei on irregular sites of the material. The starting reaction triggers the reaction between the trapped neutron caused by thermal energy and an occluded deuteron (proton) on an interstitial site:

$$n + p = d\,(1.33\ \text{keV}) + \gamma\,(2.22\ \text{MeV}), \qquad (1)$$

$$n + d = t\,(6.98\ \text{keV}) + \gamma\,(6.25\ \text{MeV}), \qquad (2)$$

These reactions generate energy mainly in a form of photons, which can then decay into matter. In the case of nuclear (elemental) transmutation we have to take up another type of reaction: neutron absorption by a nucleus to form an intermediate nucleus and then beta decay (or disintegration) of the intermediate nucleus:

$$n + {}^{A}\mathrm{M} \longrightarrow {}^{A+1}\mathrm{M} \longrightarrow {}^{A+1}\mathrm{M}' + e^{-}. \qquad (3)$$

In this reaction formula, ${}^{A}\mathrm{M}$ is a nucleus with mass number A and atomic number Z and ${}^{A+1}\mathrm{M}'$ is a nucleus with atomic number $A + 1$ and atomic number $Z + 1$.
Using those reaction formulae, we can investigate nuclear transmutations in matter.

Nuclear Transmutations in Biological Systems

First of all, to treat phenomena in a biological system, let us quote some sentences related with our investigation from page 25 of Michio Kushi's book [1]. The elemental

transmutation (ET) in biological systems is considered as "most likely taking place at the cellular level."
And "it was concluded that, granted the existence of transmutations (Na to Mg, K to Ca, Mn to Fe), then a net surplus of energy was also produced."
"A proposed mechanism was described in which Mg adenosine triphosphate (MgATP) played a double role as an energy producer." "The MgATP, when

placed in layers one atop the other, has all the attributes of a cyclotron."
"It was concluded that elemental transmutations were indeed occurring in life organs and were probably accompanied by a net energy gain."
Now, let us examine the empirical facts of ET described above from our point of view:

Mechanism

The structure where the MgATP placed in layers one atop other has a property of a periodic potential for thermal neutrons taken up in the TNCF model [3]. According to the calculation [4], the neutrons trapped in regions with a periodic potential become stable against beta decay. Such a neutron can make a fusion reaction with an impurity nucleus located at an aperiodic site.
In the more than 3 billion years of history of living creatures after life's birth on the earth, cells of creatures have been living in coexistence with radiation pouring onto them from heaven. It is conceivable to imagine that some cells have developed a mechanism to utilize thermal neutrons to generate energy or to transmute elements according to their needs. The mechanism to repair radiation damage on cells has been known for long. So why wouldn't the cells develop a more positive mechanism?
Let's assume that thermal neutrons can stably exist in a living body on some occasions, considering above mentioned possibility. Then, we can proceed to next step.

Elemental Transmutation

From a table of nuclides, we can see natural abundance of the relevant nuclei ^{A}M with their abundance and stability of the intermediate nuclei $^{A+1}$M of the reaction (3): ^{23}Na 100%, ^{39}K 93.3% and ^{55}Mn 100 %, and all intermediate nuclei produced from them are unstable for beta decay!
Furthermore, we know the fusion cross sections σ_f (barns) of a thermal neutron with a nucleus ^{A}M *(5):* 0.9 (^{23}Na), 3.0 (^{39}K) and 20 (^{55}Mn). Comparing with the value of Cd (2550) used as the absorber of neutron in the pile, we can recognize that these values are fairly large. Therefore, if such element as K, Na or Mn is in an aperiodic site of a molecule in a living body with a lot of trapped neutrons, it is possible to expect nuclear transmutation to Mg, Ca or Fe to occur by the above reaction (3).
This mechanism explains the empirical facts written about in Michio Kushi's book [1].

Nuclear Transmutation in an Electrochemical System

The nuclear transmutation in the electrochemical systems used in cold fusion experiments has been extensively investigated in the last few years. From recent results we can take tip from an experimental result showing numerical change of isotope ratios [6].
In the experiment of electrolysis of light water with electrolyte Rb_2CO_3 and RbOH, using a Ni cathode and Pt anode, the generation of excess heat and the change of the Sr isotope ratio η(^{86}Sr/^{88}Sr) were observed.
The original value was $1/\eta = 8.515 \pm 0.004$. When there was excess energy, the

enhancement of ^{86}Sr relative to ^{88}Sr was observed. In an experiment (I) where an excess heat Q_1 was detected, the value became $1/\eta = 3.504 \pm 0.002$. In another experiment (II) where excess heat is $Q_2 = 5Q_1$, the value became $1/\eta = 2.731 \pm 0.003$.

Let's analyze above experimental results on the TNCF model. Denoting natural abundance of ^{85}Rb and ^{87}Rb as N_a (72.15%) and N_b (27.85%), that of ^{86}Sr and ^{88}Sr as n_a (10.51%) and n_b (89.49%), the ratio η after neutron-rubidium fusion in a time τ will be given by a relation:

$$\eta = (n_a + n\varepsilon\tau\sigma_a N_a)/(n_b + n\varepsilon\tau\sigma_b N_b) \qquad (4)$$

In this equation, n is a flux density of thermal neutrons (cm^{-2}), ε is ratio of the number density of rubidium and strontium, σ_a (σ_b) is a fusion cross section (barns) of a thermal neutron and a ^{85}Rb (^{85}Rb) nucleus. A table of nuclear data [5] gives us the following values; $\sigma_a = 0.7$ and $\sigma_b = 0.2$ barns. The relation of $1/\eta$ to $n\varepsilon\tau$ is plotted in Fig.1 assuming Na and Nb does not change in the experiment.

On the other hand, the excess energy Q_1 generated by the reaction (3) for experiment i (i=I or II) can be given by a formula;

$$Q_i = C_i n\varepsilon\tau (a_a N_a + a_b N_b), \qquad (5)$$

where a_j is an energy generated by a single reaction of the isotope j, and C_i is the rate of observed energy to generated energy (the efficiency of energy measurement). From the nuclear data we can get the following values for a_j:

$a_a = 1.77$ keV, $a_b = 5.28$ keV.

Using the relation (4), we can calculate $n\varepsilon\tau$ for the above experiment (I) and (II); $n\varepsilon\tau = 0.307 \times 10^{24}$ and 0.459×10^{24}cm^{-2}, respectively.

In turn, we can calculate ratio of Q's for the experiments (II) and (I) from the relation (5) as $1.5\ C_2/C_1$. This value should be compared with the experimental value 5 given in the paper [6]. Therefore, if there are no reactions generating excess energy without nuclear transmutation, we can get $C_2/C_1 = 3.3$.

For a temperature of 300°K, thermal velocity of a neutron is 2.7×10^5 cm/s. Then, using an average value for $n\varepsilon\tau$, $\langle n\varepsilon\tau \rangle = 0.38 \times 10^{24}$ cm^{-2}, we can obtain an average neutron density n multiplied by the atomic ratio ε of Sr and Rb in the cathode;

$\langle n\varepsilon \rangle = 1.4 \times 10^{18}$ cm^{-3}.

If we know the ratio ε, we can calculate the density of trapped neutrons in the cathode from above relation. If we assume the ratio $\varepsilon = 10^3$ arbitrarily, we get $n = 10^{15}$ cm^{-3}.

This investigation gives us a consistent understanding of the phenomena observed in an electrolysis experiment and supports the idea of the trapped neutrons with fairly high density in the material.

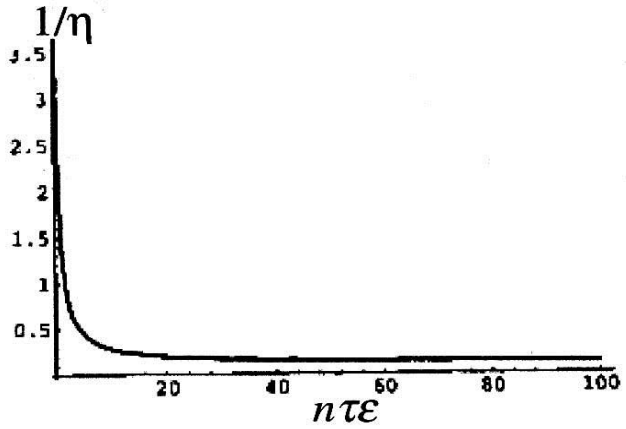

Fig.1 Relation of $1/\eta$ and $n\varepsilon\tau$ $\times 10^{24}$ cm^2 in the electrolysis experiment

Conclusion

Unfortunately, many experimental results in cold fusion investigation over the last seven years have not resulted in good quantitative reproducibility. Therefore, some theorists have been able to let their imaginations to fly. However, before exploring beyond the presently accepted physical principles which have evolved over many years, perhaps we don't need fantasies to explain the facts of cold fusion. If we recognize that the cold fusion phenomenon is occurring in a complex system composed of a solid matter, with neutrons and other particles interacting with Coulomb and nuclear forces, perhaps we can apply principles of physics to explain the truth of cold fusion phenomenon.

To explain the experimental facts obtained by cold fusion researchers, the idea of trapped neutrons in the crystal lattice was proposed two years ago at ICCF-4 [7]. This model has been developed further by applying it to the data from several researchers, as has been published in the references cited in this paper and others that have appeared in this journal.

The problem of nuclear transmutation (or elemental transmutation) has given us another chance to show the validity of the model, as shown in the preceding sections. The proposed actions based on TNCF model substantiate the empirical facts in biological systems and the experimental results in electrochemical systems, without any doubt. New experimental data, when looked at using the concept of the trapped neutron should make this model more acceptable and perhaps help to cultivate this new science and technology.

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