Conceptualized Transmutation Reactor based on Cold Fusion Mechanism

(Possibility of Transmutation to Superheavy Element by Cold Fusion Mechanism)

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Abstract:- I propose the Conceptualized Transmutation reactor based on Cold Fusion mechanism. Cold Fusion is caused by the compression of covalent bond of D_2 gas, which create small D_2 in deeper electron orbit of n=0 than n=1. This deeper orbit is in the position of a few femto meters from the nucleus, which can shield the coulomb repulsive force between the nucleus. For cold fusion D_2 gas is used to create the extra power generation but for transmutation, H_2 gas is used to prevent the metal heating. For transmutation, small H_2 molecules are created based on the electron deep orbit theory, the small H_2 has two protons and 2 electrons in the deep orbit and can add two protons to the element. The disadvantage of this transmutation reactor is that the transmutation occurs only on the surface of metal, therefore it is impossible to transmute the whole chunk of metal. Therefore, I also proposed the different cold fusion reactor in aqueous solution. In H_2O, metal element is metal ion with H_2O ligand. Thus, because the size is larger than metal ions, it is easy to be compressed, and compress against metal hydrate is the compress against H-O covalent bond of H_2O ligand. The created small hydrogen by the compression can transmute metal ions to add one proton. This phenomenon was observed in the biological transmutation of Cs+p=Ba and K+p=Ca by the mechanism of compression in biological system. I think that this can be applicable to the transmutation of all of metal hydrate. I also proposed the transmutation reactor made of ceramics having many nano-holes which exits are smaller than the size of metal hydrate and entrances are much larger than the size of hydrate to compress the covalent O-H bond of H_2O of metal hydrate at the nano-hole exit by supplying H_2O into the nano-hole to push hydrate into the exit. Another proposed transmutation reactor is to use nano-fiber or nano-particle bundled together to compress them and the space between nano-fibers or nano particles is a fraction of a nanometer and compression stress deform the nanofiber and nano particle to be narrower to compress effectively the hydrate at the space. I also propose the conceptualized transmutation reactor to compress the film of material which has the covalent bond. ${}^{291}_{115}$Mc can be created from ${}^{295}_{117}$Ts(=${}^{214}_{82}$Pb+${}^{81}_{35}$Br); Pb has added neutrons to be ${}^{214}_{82}$Pb. We can have the experiment to create ^{291}Mc with the longest half-life of decay about 1200 years, and which may have interesting features.

Keywords:- *transmutation, Cold Fusion, Plutonium, Moscovium, Tennessine, stability island, element-115.*

I. INTRODUCTION

I published the paper on the transmutation to super heavy element in ref [1], and here I would like to correct the mechanism of transmutation reactors in ref [1] in this paper.

In 1989, Martin Fleischmann and Stanley Pons published the experiment to claim that they have achieved fusion in a simple tabletop apparatus working at room temperature [2].

After Fleischmann and Stanley's report, a substantial number of follow-up research was conducted to reproduce the reported Fleischmann and Pons Effect (FPE). I published the mechanism of Cold Fusion in ref [3],[4],[5] and here I explain the mechanism of cold fusion by quoting from my work of [3] to [5].

Although FPE is not Cold Fusion but it is just the D loading into metal, Cold Fusion just happens to occur under the special condition. Therefore, the reproducibility was so low explained in ref [3], and I found the mistake of current nuclear physics in ref [6] based on my cold fusion study and other researchers' study on soft-x-ray emission during cold fusion that electron deep orbit. The conclusion is that we have no neutron but the neutral particle which Chadwick found is NOT the fundamental particle but the proton-electron pair in the tight bonding state of n=0, and that the nucleus is constituted by proton and internal electrons [6]. Thus, the nuclear transmutation and super heavy element study need to consider the correct nuclear physics. Especially the techniques of cold fusion can be applicable to fabricate the super-heavy element of element-115[7] to study the physical and chemical nature. This method will give a new experimental method based on the correct nuclear physics.

For transmutation of chunk of plutonium to the safer element is very difficult and several projects are ongoing but they have the limitation of the transmutation reaction with surface reaction, therefore new approach based on the cold fusion is needed to enable the transmutation of plutonium chunk.

II. COLD FUSION OVERVIEW

A. *Electron deep orbit theory and small H_2*

I explain the electron deep orbit theory which cause the cold fusion.

- Electron deep orbit theory and existence of small hydrogen

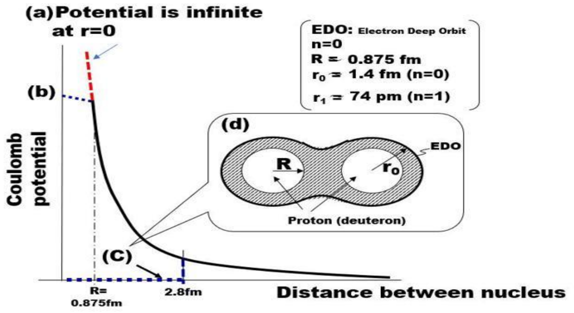


Fig. 1: Electron Deep orbit theory (small H_2 theory) which can shield the Coulomb repulsive potential by electron deep orbit [3].

- Infinite at r=o due to the incorrect point charge assumption
- Coulomb potential due to the correct model of the uniformly distributed positive charge in the nucleus.
- Repulsive force shielding by electron deep orbit
- Small hydrogen molecule; 2 protons with two electrons in electron deep orbit.

The mechanism of Cold Fusion is based on the electron deep orbit theory, which shows the existence of small hydrogen (small H_2), with deeper electron orbit at a few femto meter from the nucleus of hydrogen in Fig.1(d), explained in ref [8]-[26]. By this theory, proton is NOT the point charge. Point charge cause the infinite potential at r=0, but the charge is distributed uniformly in the proton, which can prevent infinite potential at r=0 in Fig.1(b) with this correct coulomb potential model and with the relativistic Schrödinger equation were used to solve the wavefunction numerically and the authors showed the existence of deeper electron orbit with relativistic electron deeper than n=0, as is shown in Fig.1(d).

I use the theory to explain for the mechanism of Cold Fusion [2] in Fig.2(B), small D_2 with electron deep orbit.

B. *Mechanism of Cold Fusion based on electron deep orbit theory*

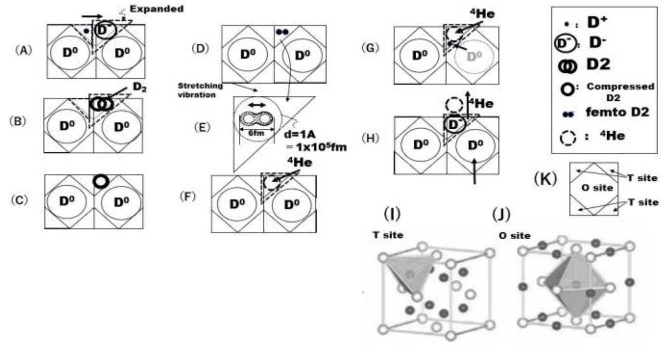


Fig. 2: Cold fusion Mechanism [3]

- D^- in surface T site and D^+ in the adjacent surface site.
- D^+ hops to T site with D^- and D_2 is created in T site.
- D_2 is compressed.
- (D), (E) D_2 turns into smaller D_2 with Deep Electron Orbit
- (F) Fusion creates ^{4}He

The mechanism of cold fusion is explained in this section by quoting from my work of [3] to [5].

a) Step (A):

D is absorbed into the metal and D^- occupied at the surface T site, D^0 in O site; the Hydrogen can be positive, neutral, and negative ion, depending on the electron exchange with the surrounding electronic state which is explained in ref [4]. In case of Hydrogen at T site, Hydrogen is negative (D^-) because it accepts the electron from the surrounding metal atoms due to their electronegativity.

b) 2.2.2 Step (B): Hopping of D^+ to D^- at the surface T sites by the surface positive potential

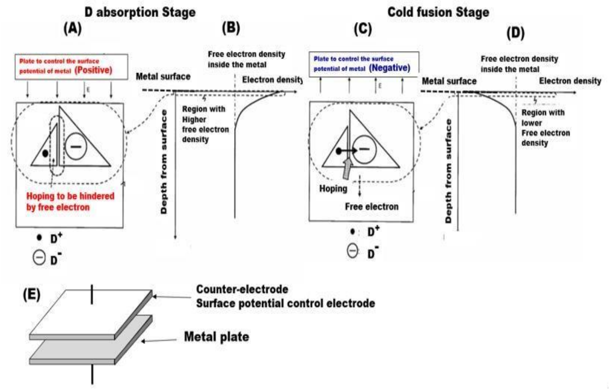


Fig. 3: surface potential control electrode

- (A), (B) metal surface potential control voltage is positive at the D absorption Stage; the surface potential of metal is negative.
- (C), (D) Metal surface potential control voltage at Cold Fusion stage is negative; the surface potential of metal is positive.
- (E) 3D schematic of the Cold fusion with the counter electrode and metal plate, which are the parallel plate electrodes.

Nota that original experiment by Fleischmann and Pons was just the D loading condition so the experimental setup has 2 Rod of metal therefore, it was very difficult to control the surface potential of Rod. For the experiments and production cold fusion reactor need to have the flat metal plate to control the surface potential of metal. And because cold fusion occurs after D loading into metal, Cold Fusion need to start after the D loading.

Because Cold Fusion occurs by the compression against D-D covalent bonding explained in se 3.2, D_2 need to occupy at surface T site as is in Fig.2(A). The positive charge has two rolls;

(1) the metal surface potential needs to be positive join for D to D^+ to be D_2 at surface T site (Fig.2(B)).

(2) the depletion of free electron from metal surface to prevent coulomb attractive force shielding between D^+ and D^-. The hopping of D^+ to join D^- and D^++D^- be D_2 at surface T site due to (1) and (2). Therefore, D_2 is compressed by metal lattice atoms due to the larger size of D_2 than T site space. This mechanism requires that cold fusion reactor needs the metal plate to control the metal surface potential to be positive.

III. EXPERIMENTAL EVIDENCE OF SMALL HYDROGEN

A. Experimental evidence of small hydrogen which can be created by the compression stress

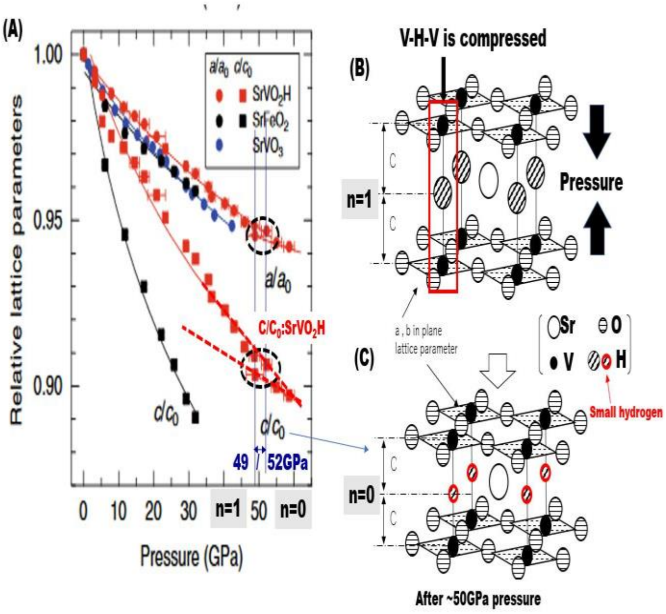


Fig. 4: High-pressure behavior of $SrVO_2H$ and SrFeO [26].

- (A)Pressure dependence of lattice parameters for the experimental (red) and the DFT-computed (sky blue) values of $SrVO_2H$ (note that some error bars are smaller than the width of the symbols). The decrease in pressure from 52 GPa to 49 GPa as the cell volume decreases suggests a phase transition to a denser phase. Relative lattice parameters, a/a0 and c/c0, of $SrVO_2H$ (red), $SrFeO_2$(black), and $SrVO_3$(dark blue) as a function of pressure.
- (B)Schematics of $SrVO_2H$, and V-H-V bonding, which is compressed by the mechanical pressure.
- (C)Schematics of $SrVO_2H$ under the 52 GPa pressure, illustrating the decrease in size of hydrogen negative ion.

Figure 4 is the experimental evidence of the existence of the smaller hydrogen by the compressed V-H-V bonding [26]. The authors showed via a high-pressure study of anion-ordered strontium vanadium oxyhydride $SrVO_2H$ that H^- is extraordinarily compressible, and that pressure drives a transition from a Mott insulator to a metal at ~ 50 GPa. I think that this experiment is the direct evidence of the existence of EDO as discussed in 2.1.1.

As is explained in Fig.1, Cold Fusion can be explained by the small hydrogen (small D_2) which is in the electron deep orbit at a few femto meters from the nucleus.

The existence of small hydrogen and he theory of electron deep orbit studied by J. Maly and J. Va'vra and A. Meulenberg, in ref [8]-[25] were proved by these experiments [26].

B. Mechanism of electron transition from n=0 to electron deep orbit

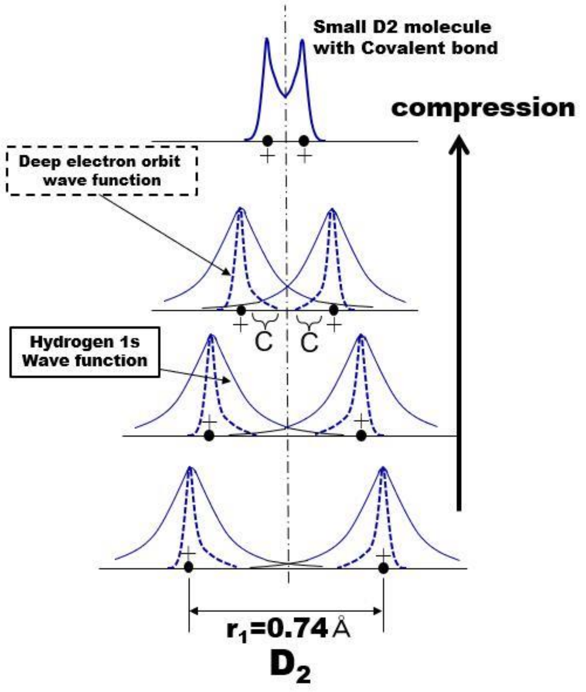


Fig.4. Mechanism of small atoms (molecules) generation by the compression of D-D covalent bonding.

The mechanism of electron transition to EDO proposed in this work is illustrated in Fig. 4. The size of D_2 at the surface T site is determined by the balance between the compression stress from the lattice metal atoms and the elastic rebound force of covalent bond and due to the nature of the covalent bonding the compression can cause the d-d distance shorter in d-d compression direction that brings two ds to be closer together in a collision direction. Under compression of D_2 by external pressure, the d-d distance can be decreased and the D1s wave function tail can extend to overlap with the EDO wave function, which is localized at a distance of a few femtometers from the nucleus. Because the d-d distance is so small, the overlap (C in Fig. 4) of wave functions can be large enough to achieve a high tunneling probability of electrons from D1s to the EDO (D0s). Radius of EDO is calculated to be few femtometers [8], [9], and is by far smaller than that of D1s of 0.53 pm (Bohr radius). A small D_2 molecule can be created due to the simultaneous transition of both D atoms to small D atoms by electron transition from n=1 to n=0(electron deep orbit), so D_2 molecule can be transformed to small D_2.

IV. CORRECT NUCLEUS MODEL

A. History of nucleus model

The history of nucleus model is explained in ref [12], and in ref [6]. Before the introduction of neutron in ref [28], the neutral particle is believed to be the proton-electron pair in the tightly bonded states. However, the based on the current nucleus experiment found that nucleus is constituted by 3 quarks so the proton is not the true sphere but has the protrusions on the surface, which affect the electron deep orbit.

Based on the cold fusion research that soft-x-ray has the broader peak which indicates that the broader peak is caused by the nucleus shape with protrusions.

The neutron's beta-decay can be easily understood by this correct nucleus model that neutral particle is not neutron but proton-electron pair in the electron deep orbit [12], and nucleus is also constituted by proton and internal electron, and in case of d that is constituted by 2 protons was probed by transmutation experiment explained in the next section (4.1).

This correct model will change the nuclear physics and the study of super heavy element.

V. TRANSMUTATION OVERVIEW

A. *Transmutation based on Cold Fusion Reactor*

Authors in ref [27] reported the transmutation of the following ways.

They have the two transmutations

^{38}Sr+2d=^{42}Mo
^{55}Cs+2d=^{59}Pr

Because they use D_2 gas, Cold Fusion Reactor create small D_2 so 2d is added to the ^{55}Cs and ^{38}Sr. The above transmutation can be explained if d is 2 protons, not neutron and proton.

This experiment proved the correct nucleus theory that proton and internal electron constitute the nucleus in ref [6].

This transmutation is the reaction on the surface as well as other transmutation techniques, it is not possible to transmute the whole bulk materials to another element.

VI. CONCEPTUALIZED TRANSMUTATION REACTOR BY DI- NEUTRON AND NEUTRON CREATION

A. *Conceptualized Transmutation Reactor*

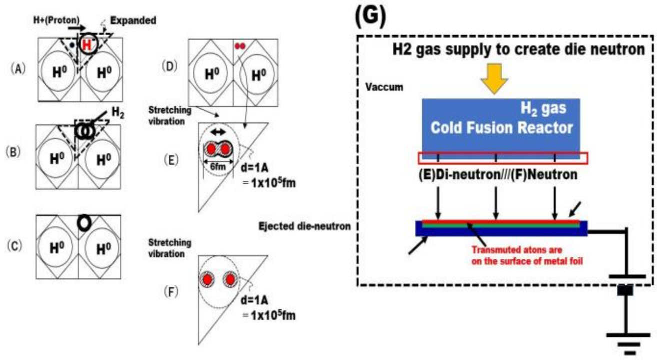


Fig.5: Conceptualized Transmutation reactor to die-neutron and neutron [5]

- (F) die-neutron emission with lower temperature
- (G) breakdown of die-neutron with higher temperature

Although experiment on the heavy element needs both the proton and neutron addition, current transmutation reactor can just add protons and no mechanism to add neutrons. Thus, I propose the experiments of this conceptualized transmutation reactor to study the chemical and physical nature of the heavy element.

In order to create neutron (proton-electron pair in electron deep orbit), metal temperature to be higher to breakdown die-neutron by faster vibration of p-p bonding of small H_2.

I am not sure of this mechanism because this is inconsistent with the biological transmutation in sec 7, however I think it is worth running experiments.

VII. HEAVY ELEMENT INSTABILITY

A. *Issues of transmutation of heavy element*

Although transmutation reactor by Cold Fusion was thought to be transmute Plutonium to heavier stabler element, it has difficulty because of the instability of heavy element, and because of the research interest in the superheavy element of so-called element-115, Mc(meconium). So, I will explain here the difficulty in the next section.

B. *Issue of island of stability*

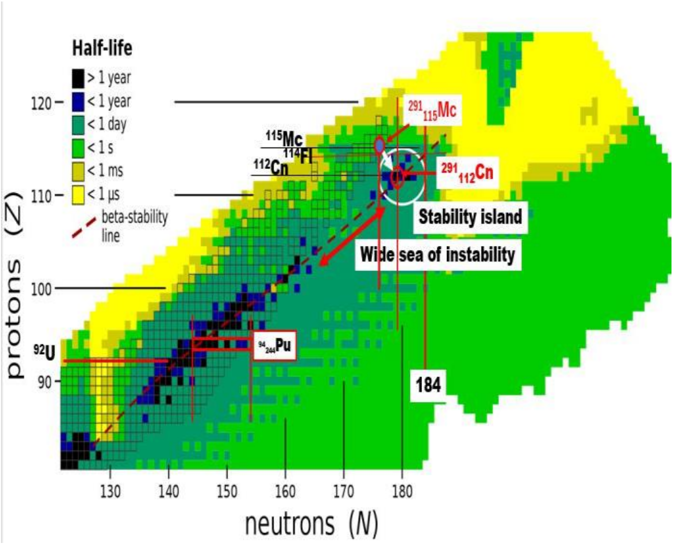


Fig. 6: Island of stability [28]

Figure 6 shows the instability of the heavier element and Pu (Plutonium) is red rectangle of Z=94, and the nuclear stability and white circle is the stability island. ^{115}Mc (Moscovium) is predicted to be located on a stable island centered on ^{112}Cn and ^{114}Fl.

The hypothetical isotope $^{291}_{115}$Mc has only one more neutron than the heaviest known isotope $^{290}_{115}$Mc and has interesting properties. Although it is thought to be produced as a decay product of $_{295}$Ts. Eventually $^{291}_{115}$Mc will be $_{291}$Cn, which is located on a stable island and has a half-life of about 1200 years. This is believed to be the most likely way to reach a stable island using current technology.

Transmutation of plutonium(^{94}Pu) to be ^{95}Am or ^{96}Cm by adding 1 or 2 protons by the transmutation reactor in 5.1.

VIII. BIOLOGICAL TRANSMUTATION

A. Biological transmutation

a) Background

The biological transmutation has the same mechanism of Cold fusion, So I briefly discuss its the mechanism as an additional evidence of the Cold fusion mechanism.

It is well known that in biological systems chemical elements can be transmuted into other elements [29].

Although these facts have been established since the early 19th century, they have been ignored by established science ever since. In [30], the author reported that femto atoms may cause the transmutation.

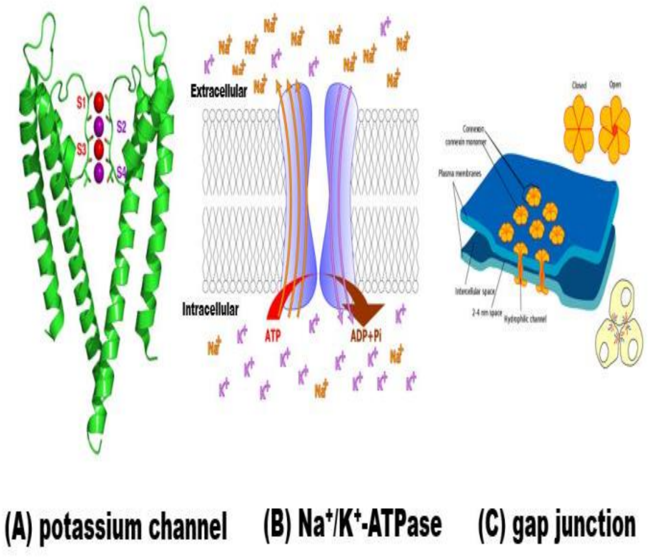
b) Category of biological transmutation

I categorized the types of biological transmutation based on the report [29] as follows:

(1) Adding one proton (adding atomic nucleus of Hydrogen)
$^{39}_{19}K+1p={}^{40}_{20}Ca$,
$^{137}_{55}Cs+1p={}^{138}_{56}Ba$

(2) Adding 6*proton+6*neutron (adding atomic nucleus of 12C) or adding Si.
$^{28}_{14}Si+{}^{12}_{6}C={}^{40}_{20}Ca$,

c) Mechanism of compression of metal-H, metal-C, Metal-Si bond in the biological system with cold fusion



(A) potassium channel (B) Na⁺/K⁺-ATPase (C) gap junction

Fig. 7: Biological mechanism that incorporates essential elements which can compress the bonding of hydride and carbide. (A)[31], (B)[32], (C)[33]

Because this mechanism is effective to compress from all the directions at the atomic level, I would like to realize a structure that imitates this biological mechanism.

d) Mechanism of biological transmutation by compression of hydrated metal ions

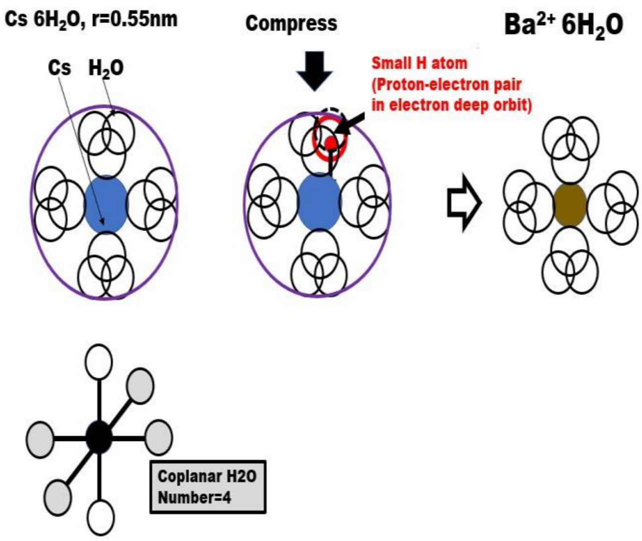


Fig. 8: metal in aqueous solution

I explain the nature of metal in H2O in Fig.8 for the case of Cs transmutation in the biological system in H_2O.

In many aqueous metal solutions, it is often expressed as if metal ions are dissolved, but in reality, bare ions do not exist, but exist as hydrated ions of water molecules. The shape of this hydrated ions is so complicated, thus I estimated by drawing figure with the parameters below.

The number of valence electron, Coordination number, and the effective ionic radius of Cs are 1+,6,1.67A and these of Ba are 2+, 6, 1.35A, and these of Pu is 3+, 6, 1.0A. Thus, I estimated by the figure that the radius of Cs6H2O and Pu6H2O is around 0.55nm as is Fig.8.

Under this hydrated Metal the H-O covalent bond is compressed by the biological system shown in Fig. 7, and small hydrogen is created to be transmuted by $^{55}Cs+p={}^{56}Ba$

This can be applicable to other metal elements, like strontium, and actinoids, and the conceptualized reactor in aqueous solution is shown in sec 12.1 in Fig 12 and Fig.13.

e) Mechanism of biological transmutation by compression of Si-C covalent bond

Si-C has the covalent bond which can be compressed to have small Si and small Carbon based on electron deep orbit theory.

IX. TRANSMUTATION TO SUPER HEAVY ELEMENT

A. Possibility of Mc (Moscovium) creation by transmutation from Pb-Br compound to Transmutation to Ts (Tennessine) by Pb-Br Covalent bond compression

As is explained that transmutation is possible by covalent bond compression.

Based on the transmutation of metal by the compression of covalent bonding, I select the heaviest stable metal of Pb and Br of the heaviest nonmetallic element.

$^{(204\sim214)}_{82}Pb+{}^{(79\sim82)}{}_{35}Br={}^{(283\sim296)}{}_{117}Ts$
$_{82}Pb$ has the stable isotope of ^{204}P(stable),^{206}Pb(stable)

^{207}Pb(stable),^{208}Pb(stable),^{209}Pb(3.25h),^{210}Pb(22.6y), ^{212}Pb(10h), ^{214}Pb (26.8min).

Br has the isotope of ^{79}Br (stable), ^{81}Br (stable), ^{82}Br (35h),

The reachable heaviest element is $^{296}{}_{117}$Ts by $^{214}{}_{82}$Pb+$_{35}{}^{82}$Br.

The elements after decay of $^{294}{}_{117}$Ts, $^{293}{}_{117}$Ts are $^{290}{}_{115}$Mc and $^{289}{}_{115}$Mc, respectively, and so $^{295}{}_{117}$Ts decay to $^{291}{}_{115}$Mc, thus it has the possibility to have $^{291}{}_{115}$Mc from $^{295}{}_{117}$Ts(=$^{214}{}_{82}$Pb+$^{81}{}_{35}$Br). with this method, and study of super heavy element can be easier by this method, which conceptualized reactor is shown in Fig.10. ^{291}Mc decay to Cn because 291Cn, which is located on a stable island and has a half-life of about 1200 years.

X. CONCEPTUALIZED REACTRO FOR TRANSMUTATION BY COVALENT BOND COMPRESSION

A. Nature of $PbBr_2$ (Lead (II) bromide)

Lead(II) bromide is the inorganic compound with the formula $PbBr_2$. It is a white powder.

$PbBr_2$ has the same crystal structure as lead chloride; they are isomorphous. In this structure, Pb^{2+} is surrounded by nine Br^- ions in a distorted tricapped trigonal prismatic geometry. Seven of the Pb-Br distances are shorter, in the range 2.9-3.3 Å, while two of them are longer at 3.9 Å. The coordination is therefore sometimes described as (7+2).

Lead compounds usually do not have covalent properties, however, the above detailed study of the structure indicates that lead(II) chloride structure contain the covalent bond property.

In the powder state, it is slightly soluble in water (0.455 g per 100 g of water at 0 ° C), but in boiling water, the solubility is about 10 times higher.

B. Nature of metal borides and carbide and metal complex

In ref [34], Many metal borides and carbides have a complicated crystal structure, and also have a complicated bond including ion bond, covalent bond, and metallic bond. This study suggests that metal borides and carbides can contain the co-valent bond property.

The organic metal complex can have the covalent bond between metal and H, O, Cl, C. Thus, the compressive metal complex which has the covalent bond with other elements.

These methods can expand the scope of transmutation to Virtual isotope of super heavy element of $^{291}{}_{115}$Mc, which attracts the researchers' interests.

C. Transmutation reactor to have superheavy element by bond compression of Pb-Br after by adding neutron.

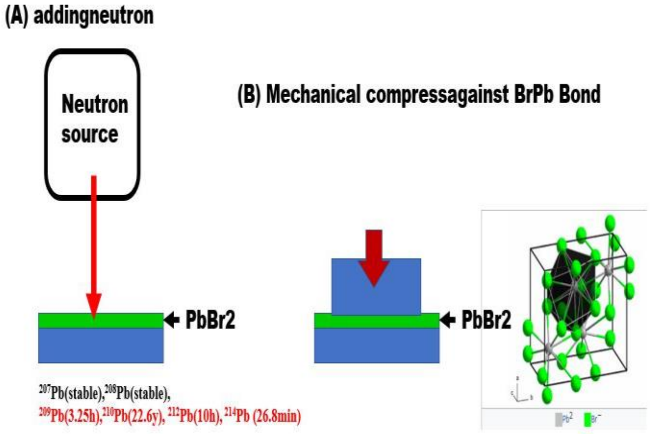


Fig. 9: Transmutation to create super heavy element. by neutron addition and mechanical compress

- neutron absorption into Pb to add neutron
- Mechanical compression against Br-Pb bond

$PBBr_2$ can be deposited to form thin films on the supporting metal plate shown in Fig.10. As is explained in 8.1, $PbBr_2$ bond contains the nature of covalent bond, therefore, the compression of Pb-Br bond can create the smaller elements to transmute to the fusion of the two elements.

$PbBr_2$ has attracted the research interest for Perovskite solar cell and stress studies have been done because of the soft nature of organic–inorganic halide perovskites. Although the purpose is not transmutation, it may show the small Pb or small Br by their study as is the case of small hydrogen.

XI. TRANSMATATION OF PU TO MINOR ACTINOIDS BY ADDING

protons on the foil metal surface created by electroplating.

A. MOX powder

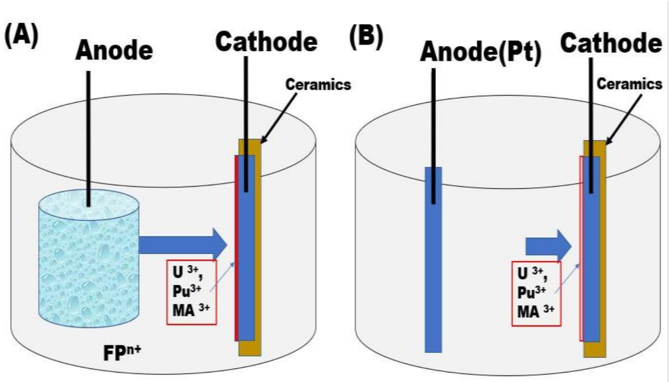


Fig. 10: (A)(B) formation of thin metal of the mixture of U, Pu and Minor Actinoids on the metal plate by electrochemical plating method.

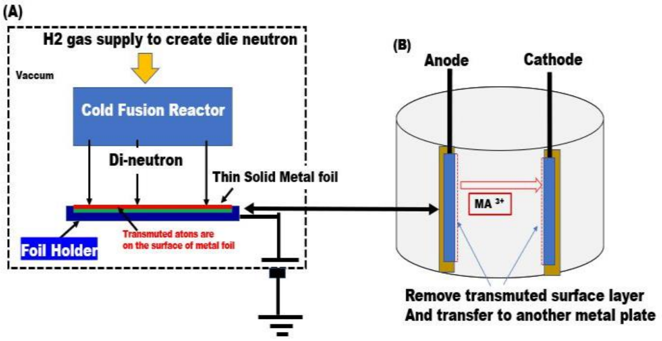


Fig.11: Transmutation reactor of thin film.[35][36]

- surface element can be transmuted by adding 2 protons by transmutation
- transmuted atoms on the metal surface are dissolved into solution and they are transferred to another metal plate

(A)-(B) is repeated to transmute all of the bulk metals.

Figure 10 is from ref [36] which uses Ga liquid metal electrode to separate MA U and Pu from Ga. If hard metal is used for this method, we can have the very thin metal of mixture of U Pu and MA, so as is shown in Fig.11, this conceptual transmutation reactor can transmute the surface element of these metals can be transmuted to Am to Cf, up to proton=98 in Fig.5. the most of these element decay to Am with longer half-life of decay 140 years to 7300 years, so after repeating the transmutation by removing surface layer transmuted dissolved into solution and new metal surface appears. The cycle of (A) to (B) and after all the foil metal is consumed, new fail can be created with used solution with transmuted elements as is shown in Fig.11(B).

Thus, it is very complicated and very slow because we need to repeat the process of Fig.10. (A)-Fig.11(A)-(B).

By repeating this sequence, the heavier element decay to Am finally, so most Pu atoms can be transmuted to Am.

XII. NATURE OF METAL IN AQUERIOUS SOLUTION

A. *Nature of metal in biological system*

Reactions in the biological system occur in water, and hydrated biomolecules react cooperatively to create functions. The specificity of water is due to its hydrogen bonds. The hydrogen bonds are repeatedly broken and formed in water at room temperature. The flexibility of such hydrogen bonds is closely related to the reaction process in the living body that proceeds under mild conditions. Thus, the biological transmutation needs the further study.

XIII. TRANSMUTATION TO HEAVIER METAL IN SOLUTION BY COMPRESSION OF THE BOND OF METAL-ELEMENTS IN THE SOLUTION.

A. *Transmutation reactor with soluble metal compounds.*

As is explained in sec 8.2.4 and Fig.8, some of the metal is dissolved, soluble in the solutions, they can have the element of metal. In case of the biological transmutation by the compression against O-H covalent bond to create the small hydrogen atoms, which fuse to metal element, Thus, a small hydrogen adds the proton to metal. I think this is possible for other elements and the mixture of the metal elements. For example, Pu U and MA can be soluble in special solution in ref [35]. Thus, I proposed the conceptualized transmutation reactor with compression of the bond of metal hydrate in the solution.

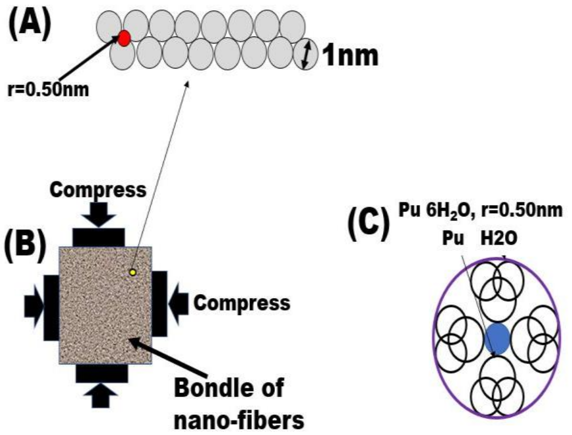


Fig.12: Conceptualized transmutation reactor by covalent bond compression by carbon nano-fiber and nano-particle

- space of nano-fiber(diameter=1nm) has the narrow space between fibers.
- The bundle of nano-fibers can be compressed
- Size of Pu4H$_2$O

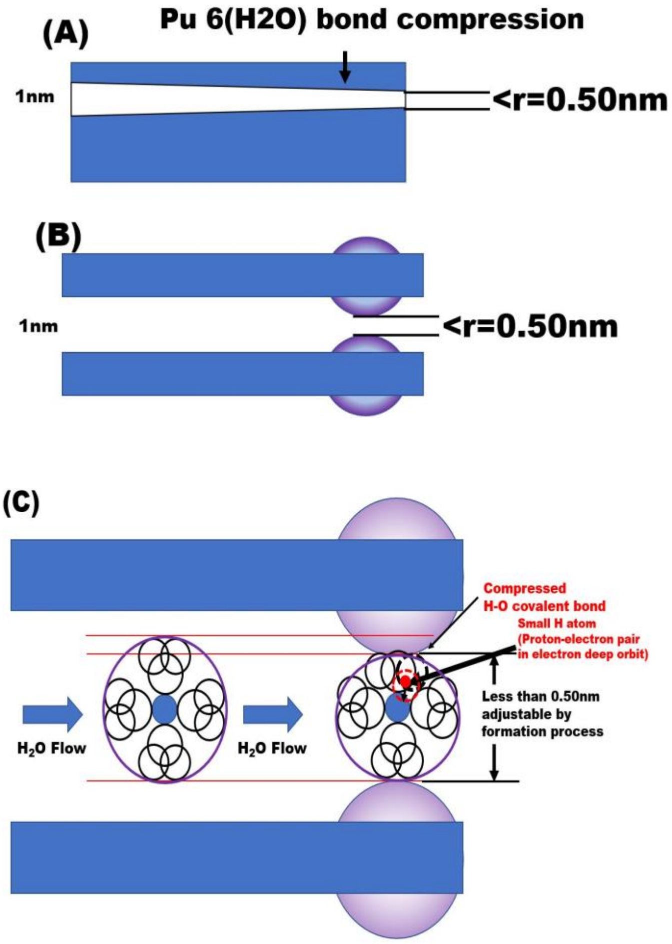


Fig.13: Transmutation reactor with nano-hole by covalent bond compression of O-H based on cold fusion mechanism

- Fabrication of nano-tapered hole in ref [37]
- Fabrication of nano hole in ref [38]
- Mechanism of compression of H-O covalent bond to create small hydrogen (proton-electron pair in electron deep orbit)

I think that it is also possible to transmute metal based on cold fusion to compress the O-H covalent bond to create small hydrogen (proton and electron pair in electron deep orbit).

We have several options to enable this compression.

Fig.12 uses the nano-fiber or nano-particle to be compressed and the metal hydrate molecules exists space between them, and the space is narrow enough they are compressed by nano-fiber or nano particle. Such nanofiber is available of diameter is 3nm and development is needed to have smaller diameters around 1nm with high elasticity like biological mechanism to compress. The elastic fiber is needed so carbon nano-fiber is an option. By the strong stress, carbon nano-fiber/nano-particle can be deformed and the space between carbon nano-fibers/nano-particles can be narrower than the size of element with bond.

Fig.13(A) and (B) shows the nano-porous structure in ceramics which were actually developed and used to filter H_2 gas in Fig13(B), which can be fabricated by semiconductor process with adjusting the apace to deposited the structure at the location near the outlet of the hole of 1um.

So, the size can be adjusted down to the size of H_2 in Fig13(B), it also can have the size of a bit smaller than the metal hydrate. Fig13(A) cab be also adjusted.

The compression stress can be created by the H2O flow into this nano-hole and at the gate of the narrowest location, due to the smaller size than metal hydrate, the H2O molecule can be compressed because it located symmetrically around the metal ions, and the compression against covalent bond of O-H can create the small hydrogen atoms which add proton to metal ion and it transmuted metal element to be the element with a large atomic number by one.

XIV. SUMMARY

I proposed the tress new transmutation reactors based on bond compression mechanism of Cold Fusion.

- Transmutation by small hydrogen to add two protons. with small H_2.
- Transmutation of $PBBr_2$ crystal film transmuted by Pb-Br bond compression with extra neutrons to be element-115(Moscovium) from Ts
- Method of transmutation by (1) of thin film of the mixture of Pu and MA on metal plate by electro-plating and after transmutation the surface metal to be removed and the new surface is transmuted by (1). this cycle needs to be repeated to transmute whole Pu in the solution.
- Transmutation reactor to compress the bond of the metal compound in aqueous solution. Mostly the metal is metal hydrate and compression against O-H bond can create the proton-electron pair to add one proton to the metal element.

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