

# The Detection of K-Ca Transmutation in the Mixture of K and Hydride Chemicals

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**Abstract:** Here, we report the transmutation of K-Ca under the negative hydrogen condition ( $\text{NaBH}_4$ ,  $\text{LiBH}_4$  and  $\text{NH}_3\text{BH}_3$ ) at room temperature. In all reaction systems, the amount of  $\text{K}^+$  and  $\text{Ca}^{2+}$  concentrations were monitored by inductive coupled plasma optical emission spectroscopy (ICP-OES) and inductive coupled plasma mass spectrometry (ICP-MS) techniques. The ICP-OES test results showed that  $\text{K}^+$  concentration was gradually decreasing, while the  $\text{Ca}^{2+}$  concentration was gradually increasing. In addition, by comparing the K and Ca concentrations and their isotopes from the ICP-MS results, we found the increase of  $^{40}\text{Ca}$  concentration accompanied by the increasing concentration of  $^{41}\text{K}$  in the presence of hydride under our “reaction” conditions, which implying  $^{40}\text{Ca}$  formation correlated to  $^{41}\text{K}$ .

**Key words:** K-Ca transmutation; negative hydrogen; low energy nuclear reaction

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It is well accepted that the elements in the Earth are produced by nuclear reactions in the stars in universe and segregated in the Earth. In the mean time, some element atoms can convert into other atoms via radioactive decay, such as U to Pd, by which we know the age of our Earth. One element or its isotope can also be converted into another element or corresponding isotope by natural nuclear reaction<sup>[1-3]</sup>. For example, the radionuclides  $^{14}\text{C}$  in Earth's atmosphere is formed by constantly bombing by the high energy cosmic rays and the most of  $^{40}\text{Ar}$  comes from the decay of  $^{40}\text{K}$  in the air. The natural transmutation of radioactive elements (such as plutonium and uranium) can yield other radioactive elements or isotopes, some are dangerous and harmful to human beings due to their strong radioactive emission<sup>[4-6]</sup>.

By bombing the target elements with high energy particle in accelerators or Tokamak, one element can be converted into another element, which is called artificial transmutation<sup>[2,7]</sup>. The first artificial transmutation from N into O was done by Rutherford in 1919, who used  $\alpha$  particle bomb nitrogen atoms to produce  $^{17}\text{O}$ ,

known as  $^{14}\text{N} + \alpha \rightarrow ^{17}\text{O} + \text{p}$ <sup>[2,4-6]</sup>. John Cockcroft and Ernest Walton fulfilled an artificial nuclear reaction by bombing  $^7\text{Li}$  with accelerated protons to split the Li nucleus into two  $\alpha$  particles in 1932, known as “splitting the atom”<sup>[8]</sup>. Otto Hahn et al. discovered that the artificial uranium fission in 1938<sup>[9-11]</sup>. From 1991 to 1997 in the Laboratori Nazionali del Gran Sasso, Ga (gallium trichloride-hydrochloric acid solution as the target) transmutation into Ge through a neutrino-induced nuclear reaction was reported, via reaction:  $\nu_e + ^{71}\text{Ga} \rightarrow ^{71}\text{Ge} + \text{e}^-$ <sup>[12-13]</sup>. Although these transmutation processes require high energy and high-cost equipment, the artificial nuclear transmutation has been considered as a possible way to convert the radioactive waste to less hazardous nuclear elements via accelerator<sup>[4,7]</sup>.

Surprisingly, many experiments reported that element transmutation could be initiated under much lower energy level through metabolism processes of vegetal and animal organisms<sup>[14-21]</sup>. Some living organisms exhibit capability to transmute one element into another under very mild conditions. For example, Kervran et al. reported potassium and calcium contents changed

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during the growth of 840 seeds and 403 sprouts, their results indicated potassium might transmute into calcium during seeds growing, which could be represented in formula:  $^{39}\text{K} + ^1\text{p} \rightarrow ^{40}\text{Ca} + \Delta E^{[15-19]}$ . Some other elemental transmutations were also reported, such as sodium to magnesium ( $^{23}\text{Na} + n \rightarrow ^{24}\text{Na}^* \rightarrow ^{24}\text{Mg} + e^- + \nu_e^*$ ) and manganese to iron ( $^{55}\text{Mn} + n \rightarrow ^{56}\text{Mn}^* \rightarrow ^{56}\text{Fe} + e^- + \nu_e^*$ )<sup>[20]</sup>. It was found that bio-transmutations were associated with ATP hydrolysis processes catalyzed by ATPase in biological bodies<sup>[21]</sup>. It is suggest that the elemental transmutation is essential to maintain a balance of certain elements in the biological bodies, which is critical to organism growth.

Most recently, we found such a low energy nuclear reaction could be achieved under normal conditions. Experimental results indicated that small amount of deuterium and helium can be produced during photocatalytic hydrogen evolution process from water catalyzed by Pt-graphene sensitized with Br-dye under visible light irradiation<sup>[3]</sup>. Similarly, helium 3 can be formed during photocatalytic hydrogen generation over CdS semiconductor dispersion under visible light irradiation<sup>[7]</sup>. In addition, we found potassium could be transmuted into calcium during photocatalytic hydrogen evolution in water mixture dispersion of dye (Eosin Y) and catalyst under irradiation of light with wavelength longer than 440 nm. We proposed that calcium atoms might originate from K-Ca transmutation through low energy nuclear reaction (LENR) under very mild conditions, which might be related to the involvement of negative hydrogen (hydride,  $\text{H}^-$ ) formed during photocatalytic hydrogen generation<sup>[2]</sup>.

In fact, hydride, the negative hydrogen, can be provided from some compounds, such as  $\text{NaBH}_4$ ,  $\text{LiBH}_4$  and  $\text{NH}_3\text{BH}_3$ , in which, the H atoms attached to boron are hydride<sup>[2,22]</sup>. If this hydride is offered in the mixture with potassium compound, the transmutation of potassium into calcium will take place. The electro-negativity ( $\text{H}^-$ ), hydrides, will initiate potassium transmutation.

In this work, we found the transmutation of K-Ca with negative hydrogen from  $\text{NaBH}_4$ ,  $\text{LiBH}_4$  and  $\text{NH}_3\text{BH}_3$  in the mixture of K and those chemicals. Here,  $\text{K}^+$

was chosen as the target element, and  $\text{K}^+$  and  $\text{Ca}^{2+}$  concentrations in the mixture were monitored by inductive coupled plasma optical emission spectroscopy (ICP-OES) and inductive coupled plasma mass spectrometry (ICP-MS) techniques. The results showed  $\text{K}^+$  concentration was gradually decreasing, and the  $\text{Ca}^{2+}$  concentration was gradually increasing. By comparing the K and Ca concentrations and their isotopes, we found K to Ca transmutation taking place in the presence of hydride, while the increasing concentration of  $^{41}\text{K}$  correlating to the increase of  $^{40}\text{Ca}$  concentration under our “reaction” conditions, which implying  $^{40}\text{Ca}$  formation correlated to  $^{41}\text{K}$ .

## 1 Experimental details

### 1.1 Chemicals and Materials

All chemicals were purchased and used without further purification.  $\text{NaBH}_4$  (Shanghai Guangming Chemical Reagent Co., Ltd, AR,  $\geq 97\%$ ),  $\text{LiBH}_4$  (Sam Chemical Technology Co., Ltd, AR,  $\geq 95\%$ ),  $\text{NH}_3\text{BH}_3$  (Sinopharm Chemical Reagent Co., Ltd, AR,  $\geq 90\%$ ),  $\text{KCl}$  (Xilong Chemical Co., Ltd., AR,  $\geq 99.5\%$ ),  $\text{HCl}$  (BeiJing Chemical Works, GR, 36%~38%),  $\text{Ca}(\text{NO}_3)_2$  (Xilong Chemical Co., Ltd., AR,  $\geq 99.5\%$ ) and  $\text{RuCl}_3$  (Shanghai Guangming Chemical Reagent Co., Ltd, AR,  $\geq 37.3\%$ ). Ultrapure water:  $18.2 \text{ M}\Omega \cdot \text{cm}^{-1}$  at 25 °C (Milli-Q water, Millipore Mili-Q reference ultrapure water purification system, USA) was used in this study.

Since the polypropylene (PP) volumetric flask only has two elements (C and O), it was chemical stable in the acidic and alkaline environment. Therefore, the involvement of other elements can be ignored from the PP volumetric flask, which was used as a reactor and a fixed vessel for all experiments. Prior to the reaction, all PP volumetric flasks (100 mL) were recalibrated and washed several times with high pure Mill-Q water, and then they were dried at room temperature.

### 1.2 Element transmutation experimental

**1.2.1  $\text{NaBH}_4 + \text{KCl}$  system** The element transmutation was performed at room temperature in a 100 mL PP volumetric flask. 1.0 mL of  $\text{KCl}$  solution ( $C_K = 170 \text{ ppm}$ ) was placed into the PP volumetric flask with

50 mL Mill-Q water, which was uniformly dispersed by ultrasound treatment 5 min. Then, the calculated amount of negative hydrogen chemical  $\text{NaBH}_4$  (945.8 mg) was added in the aqueous solution of KCl by adjusting reaction temperature and time. In order to eliminate the test error caused by the precipitation of calcium in the alkaline environment, the pH of reaction solution was adjusted by adding 1 mL HCl. After that, the mixed solution was titrated to 100 mL with Mill-Q high purity water and was kept over the designed reaction time.

**1.2.2  $\text{LiBH}_4$ +KCl system** In order to further prove potential transmutation from potassium to calcium via hydride  $\text{H}^-$  via low energy nuclear reaction,  $\text{NaBH}_4$  was substituted with another negative hydrogen chemical  $\text{LiBH}_4$ . In the  $\text{LiBH}_4$ +KCl system, the experimental process and conditions were similar to the  $\text{NaBH}_4$ +KCl system.

**1.2.3  $\text{NH}_3\text{BH}_3$ +KCl+ $\text{RuCl}_3$ + $\text{Ca}(\text{NO}_3)_2$  system** 50.0 mL of  $\text{Ca}(\text{NO}_3)_2$  solution ( $C_{\text{Ca}}=100$  ppm), 1.0 mL of KCl solution ( $C_{\text{K}}=170$  ppm), and 2.0 mL  $\text{RuCl}_3$  solution (20 mmol/L) were added in a 100 mL PP volumetric flask. After being ultrasound treatment for 5 min,  $\text{NH}_3\text{BH}_3$  of different content was added in the mixture solution for 2 days until no bubbles were gene-

rated under the room temperature. Similarly, the pH of reaction solution was adjusted by adding 1 mL HCl. And the mixed solution was also titrated to 100 mL with Mill-Q high purity water.

1.3 Measurements and Analysis

To verify the element transmutation in the presence of hydride, the negative hydrogen, inductive coupled plasma optical emission spectroscopy (ICP-OES, 730) and inductive coupled plasma mass spectrometry (ICP-MS, 7700) measurements were conducted. ICP-MS was mainly used to detect changes in low concentration elements and isotopes. The samples after reaction were directly extracted and detected by the ICP-OES and ICP-MS, and all the solutions tested were not further diluted prior to analysis. The every sample was detected at least three times and the average value was presented.

2 Results and discussion

ICP-OES measurement is conducted to monitor the concentration variation of elements in the reaction mixture to verify the element transmutation in the presence of hydride, and the corresponding results are given in Fig.1a. For the  $\text{NaBH}_4$  case, the  $\text{Ca}^{2+}$  concentrations in the  $\text{NaBH}_4$ +KCl mixture are  $0.131 \pm 0.010$ ,

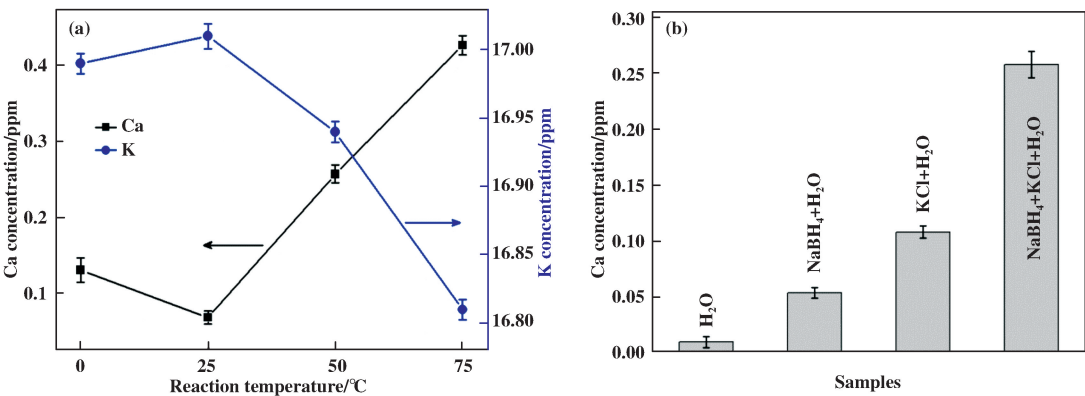


Fig.1 The elements concentration are detected by ICP-OES. (a)  $\text{Ca}^{2+}$  and  $\text{K}^+$  concentration of  $\text{NaBH}_4$ +KCl system at 0, 25, 50 and 75 °C after reaction 2 h. 100 mL aqueous solution of KCl ( $4.115 \times 10^{-5}$  mol) and  $\text{NaBH}_4$  (0.025 mol); (b)  $\text{Ca}^{2+}$  concentration of the  $\text{H}_2\text{O}$ ,  $\text{NaBH}_4$ , KCl, and  $\text{NaBH}_4$ +KCl system at 50 °C after reaction 2 h.

$0.069 \pm 0.008$ ,  $0.258 \pm 0.012$  and  $0.427 \pm 0.013$  ppm, under the reaction temperature after 2 h reaction at 0, 25, 50 and 75 °C, respectively. Distinctly, the  $\text{Ca}^{2+}$

concentration of the  $\text{NaBH}_4$ +KCl system gradually increase and are strongly dependent on the reaction temperature. It needs to be pointed out that there is no ad-

ditional calcium source in these initial reaction mixtures. The ICP-OES measurements for every datum are repeated for three times and the average value is presented. Fig.1a also displays the change of  $K^+$  concentration with the increase of reaction temperature. The concentration of K decreased with the reaction operation.

To avoid misunderstanding of the results, we double checked the initial Ca concentration in Milli-Q  $H_2O$ ,  $NaBH_4$  and KCl solutions by ICP-OES (pre-heated to  $50\text{ }^\circ\text{C}$  and kept  $pH = 7$ ). As shown in Fig.1b, the  $Ca^{2+}$  concentration in Milli-Q  $H_2O$  is only  $0.010 \pm 0.005$  ppm. For the  $NaBH_4$  and KCl aqueous solution, the  $Ca^{2+}$  concentrations are  $0.053 \pm 0.005$  and  $0.108 \pm 0.006$  ppm, respectively. However, for the  $NaBH_4 + KCl$  reaction mixture, the  $Ca^{2+}$  concentration obviously increase to  $0.258 \pm 0.012$  ppm. It is doubtless that the excess Ca in the mixture originated from the reaction of  $NaBH_4$  and KCl.

To further study the K-Ca transmutation reaction, the cyclic experiments was done and the results were presented in Fig.2. The concentration of  $Ca^{2+}$  ions

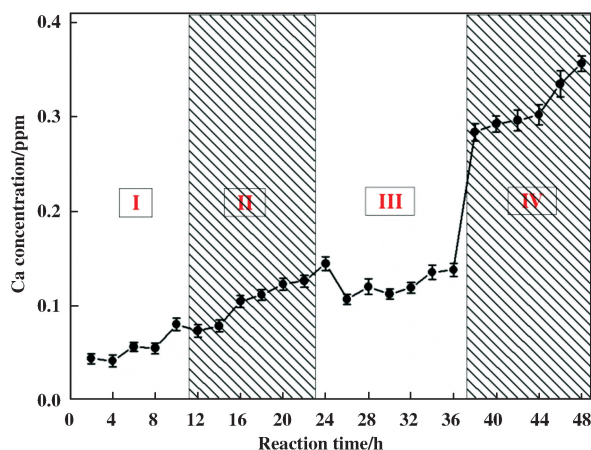


Fig.2 Cyclic experiment of  $NaBH_4 + KCl$  system at  $25\text{ }^\circ\text{C}$ ,  
(I) First cycle,  $[NaBH_4]$ :  $0.025\text{ mol}$ ;  $[K^+]$ :  $4.115 \times 10^{-5}\text{ mol}$ ;  
(II) addition of fresh  $NaBH_4$  ( $0.025\text{ mol}$ );  
(III) third repeat; (IV) fourth repeat.

increases continuously when fresh  $NaBH_4$  is introduced in the reaction mixture. After four cycles of  $NaBH_4$  addition, the concentration of  $Ca^{2+}$  reached  $0.356 \pm 0.008$  ppm. The ICP-OES data obvious confirmed that the concentration of  $Ca^{2+}$  increases with the reaction time

and the amount of  $NaBH_4$  in mixture. The final  $Ca^{2+}$  concentration increased up to  $0.356\text{ ppm}$  after the four cycles. Although there is fluctuation of measured Ca concentration, the increase tendency of calcium is very obvious during reaction.

These are exotic phenomena that the increase of calcium concentration in  $NaBH_4 + KCl$  reaction mixture. Given that the reaction system is conducted in well sealed container which could prevent any exogenous contaminate, there is almost no choice but to believe that some substance in the reactive mixture might be converted to Ca element. Considering previous biotransmutation research mentioned in introduction section ( $^{39}K + ^1p = ^{40}Ca + \Delta E$ ) and based on the above experimental results, a feasible way is the potassium element transmutation into calcium via  $H^-$  LENR in the  $NaBH_4 + KCl$  system under a mild condition<sup>[15-19]</sup>.

In order to further prove above suggestion of this potential transmutation from potassium to calcium via  $H^-$  LENR, comparative experiments are carried out by substituting  $NaBH_4$  with  $LiBH_4$  in the reaction mixture. Comparative experiments are repeated for several times, and their ICP-OES analysis results are presented in Fig.3. The results indicated the concentration of

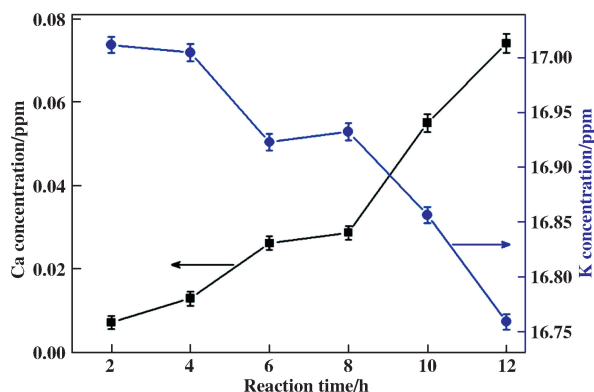


Fig.3  $Ca^{2+}$  and  $K^+$  concentration of  $LiBH_4 + KCl$  system at various time are detected by ICP-OES at  $0\text{ }^\circ\text{C}$  after reaction 2 h. 100 mL aqueous solution of KCl ( $4.115 \times 10^{-5}\text{ mol}$ ) and  $LiBH_4$  ( $0.025\text{ mol}$ ).

$Ca^{2+}$  ions increased continuously in the  $LiBH_4 + KCl$  system. Correspondingly, the content of potassium decrease in the same system. Those results provide evidence that the increase of calcium concentration in the

reaction mixture is closely related to the presence of  $\text{H}^-$ , namely, indicating elemental transmutation from potassium to calcium.

Moreover, we use ICP-MS to detect the change of corresponding elemental isotope in the  $\text{NH}_3\text{BH}_3 + \text{KCl} + \text{RuCl}_3 + \text{Ca}(\text{NO}_3)_2$  mixture. To verify the accuracy and

credibility of ICP-MS results, other elements and their isotopes were simultaneously measured, such as Mo, because there was no Mo in the mixture. Mo, here, was used as a probe element to check if the reaction was contaminated. Fig.4a shows the ICP-MS results of the measured concentrations of Mo isotope in the

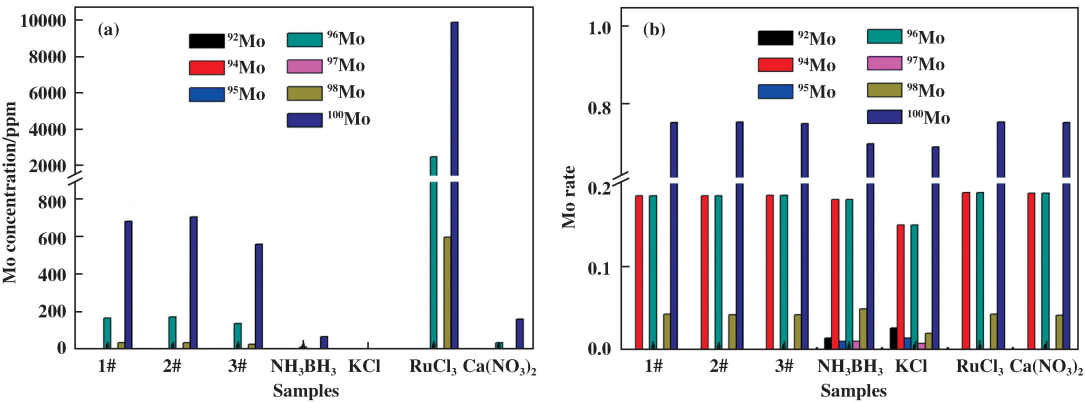


Fig.4 (a) Mo isotope concentration of  $\text{NH}_3\text{BH}_3 + \text{KCl} + \text{RuCl}_3 + \text{Ca}(\text{NO}_3)_2$  system with different  $\text{NH}_3\text{BH}_3$  content 1# (358.5 mg), 2# (717.0 mg) and 3# (1075.5 mg), and the isotope content in  $\text{NH}_3\text{BH}_3$ , KCl,  $\text{RuCl}_3$  and  $\text{Ca}(\text{NO}_3)_2$  are detected by ICP-MS. (b) the corresponding isotope ratio in their respective systems.

different  $\text{NH}_3\text{BH}_3$  loading (1#, 358.5 mg; 2#, 717.0 mg; 3#, 1075.5 mg), as well as in other used chemical reagents, KCl,  $\text{RuCl}_3$  and  $\text{Ca}(\text{NO}_3)_2$ . The results indicated that the isotopes content of Mo are very low, and the ratio between different isotopes of Mo remains almost unchanged in the reaction mixture (Fig.4b). This mean that the ICP-MS can be used to detect and track the minor change of elemental isotopes.

Fig.5a and Fig.6a show the ICP-MS results of K and Ca isotope concentration in  $\text{NH}_3\text{BH}_3 + \text{KCl} + \text{RuCl}_3 + \text{Ca}(\text{NO}_3)_2$  mixture with different  $\text{NH}_3\text{BH}_3$  loading. We can find that the K isotope ratio, such as  $^{39}\text{K}$ ,  $^{40}\text{K}$  and  $^{41}\text{K}$ , have obvious changes after the reaction, as shown in Fig.5b. In particular, the amount of isotope  $^{41}\text{K}$  gradually increase with the increase of negative hydrogen loading from  $\text{NH}_3\text{BH}_3$ . In addition, we can clearly

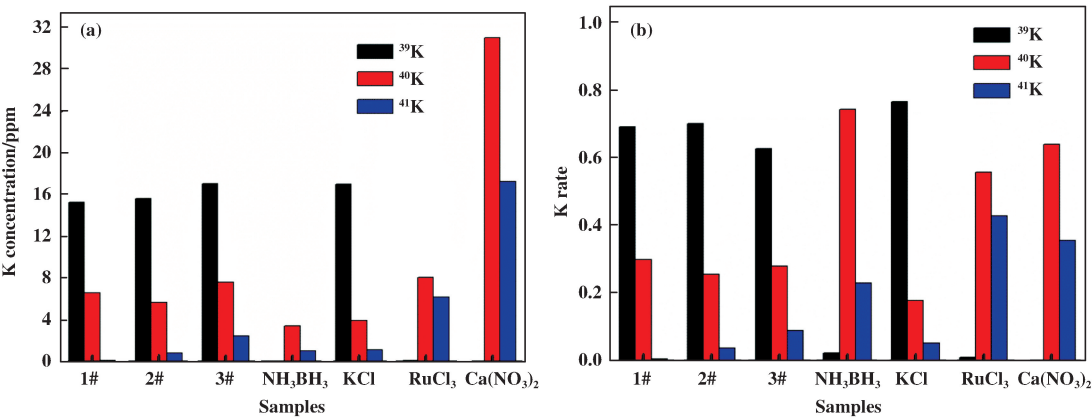


Fig.5 (a) K isotope concentration of  $\text{NH}_3\text{BH}_3 + \text{KCl} + \text{RuCl}_3 + \text{Ca}(\text{NO}_3)_2$  system with different  $\text{NH}_3\text{BH}_3$  content 1# (358.5 mg), 2# (717.0 mg) and 3# (1075.5 mg), and the isotope content in  $\text{NH}_3\text{BH}_3$ , KCl,  $\text{RuCl}_3$  and  $\text{Ca}(\text{NO}_3)_2$  are detected by ICP-MS. (b) the corresponding K isotope ratio.

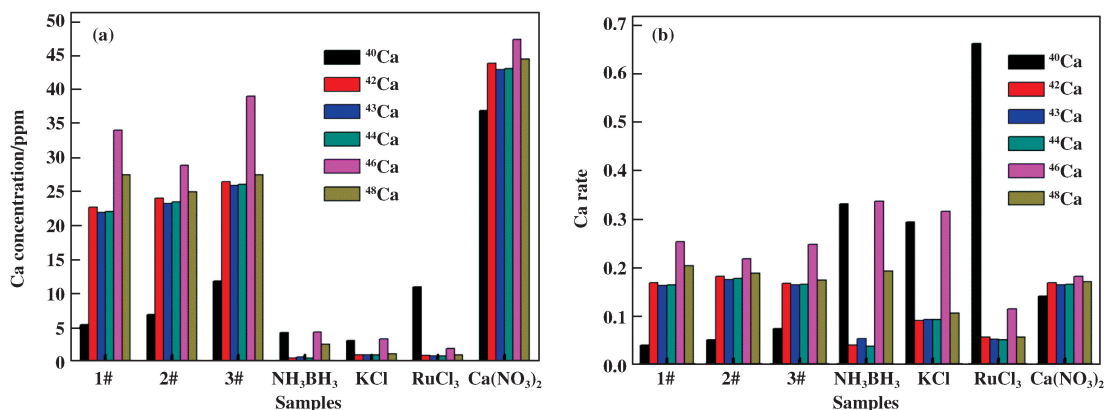


Fig.6 (a) Ca isotope concentration of  $\text{NH}_3\text{BH}_3 + \text{KCl} + \text{RuCl}_3 + \text{Ca}(\text{NO}_3)_2$  system with different  $\text{NH}_3\text{BH}_3$  content 1# (358.5 mg), 2# (717.0 mg) and 3# (1075.5 mg), and the isotope content in  $\text{NH}_3\text{BH}_3$ , KCl,  $\text{RuCl}_3$  and  $\text{Ca}(\text{NO}_3)_2$  are detected by ICP-MS. (b) the corresponding Ca isotope ratio.

see that the isotopes of Ca exhibits similar changes in Fig.6b. Compared with isotope  $^{42}\text{Ca}$ ,  $^{43}\text{Ca}$ ,  $^{44}\text{Ca}$ ,  $^{46}\text{Ca}$  and  $^{48}\text{Ca}$ , the amount of isotope  $^{40}\text{Ca}$  also increase with

the increase of  $\text{NH}_3\text{BH}_3$ . The variation of  $^{41}\text{K}$  and  $^{40}\text{Ca}$  is obviously not due to the experimental error, as shown in Fig.7a and 7b.

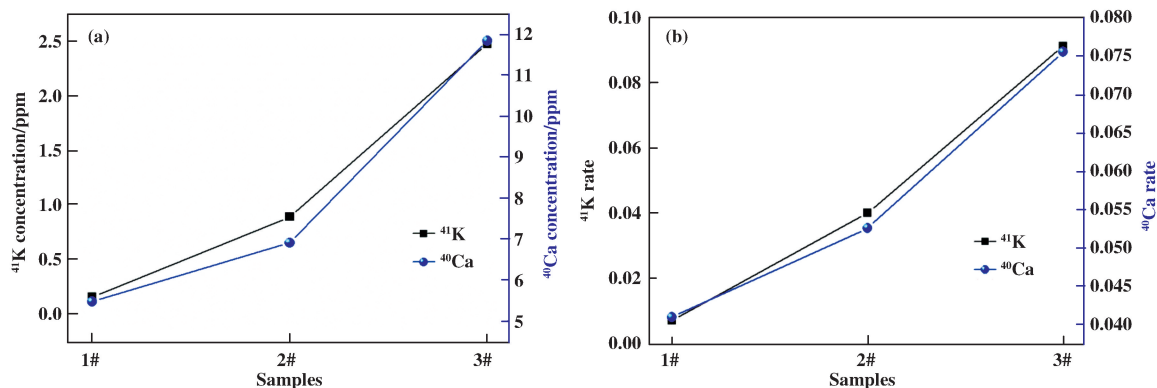
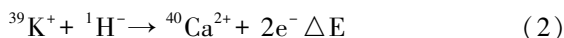
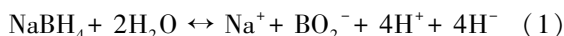


Fig.7 (a)  $^{41}\text{K}$  and  $^{40}\text{Ca}$  isotope concentration of  $\text{NH}_3\text{BH}_3 + \text{KCl} + \text{RuCl}_3 + \text{Ca}(\text{NO}_3)_2$  system with different  $\text{NH}_3\text{BH}_3$  content 1# (358.5 mg), 2# (717.0 mg) and 3# (1075.5 mg) are detected by ICP-MS. (b) the corresponding  $^{41}\text{K}$  and  $^{40}\text{Ca}$  isotope ratio.

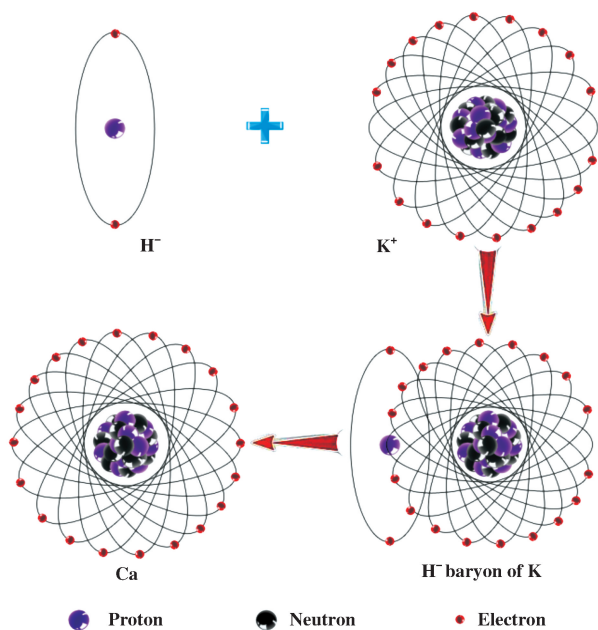
These surprising experimental results are difficult to interpret and even beyond our existing theoretical knowledge. However, based on the above experimental results, a plausible transmutation process might be shown in Scheme 1. Negative hydrogen compound molecule (such as  $\text{NaBH}_4$ ) is easy to hydrolyze and produce  $\text{H}^-$  ions, which is a complex substance composed of a hydrogen atom that weakly binds two electrons and can be seen as a baryon<sup>[23]</sup>. Due to the strong electrostatic attraction,  $\text{K}^+$  ions that come from KCl could randomly capture a  $\text{H}^-$  in a manner we still

not clearly understand, probably by nucleus-electron-nucleus interaction, forming  $\text{H}^-$  baryon-potassium intermediate, and this intermediate(s) could decay to  $^{41}\text{K}$  and  $^{40}\text{Ca}$ :



Transmutation process could mainly be attributed to the formation of  $\text{H}^-$ -K intermediate<sup>[22]</sup>. The  $\text{H}^-$  baryon, like electrons in ordinary atoms, approaching the potassium nucleus. According to the Bohr Theory, the atomic orbital radius ( $r_n$ ) is inversely proportional to





Scheme 1 Scheme diagram of a typical K-Ca transmutation process

the mass of  $H^-$  baryon :

$$r_n \approx \frac{h^2}{8\pi^2 z e^2 m} [3n^2 - l(l+1)]$$

$$\approx \frac{m_e}{m} \frac{[3n^2 - l(l+1)]}{2z} a_0 \quad (3)$$

where  $h$  is Plank constant ( $6.6262 \times 10^{-34}$  J s),  $n$  is main quantum number,  $l$  is angular quantum number,  $z$  is atomic number,  $e$  is charge of negative ions ( $1.6022 \times 10^{-19}$  C),  $m_e$  is electronic mass ( $9.1096 \times 10^{-31}$  kg),  $m$  is the mass of negative ions in the atom ( $1.6811 \times 10^{-27}$  kg),  $a_0$  is the Bohr radius of H atom ( $0.5292 \times 10^{-10}$  m) [24-25]. For the  $H^-$ -K, if the outer valence electron of K is occupied by  $H^-$  baryon, and the possible particle radius  $r$  is about  $3.5216 \times 10^{-14}$  m, which is only 1/1836 of the normal K atom. This means that the radius of  $H^-$ -K is in the same order of magnitude as the radius of the nucleus. So that the  $H^-$  baryon has a higher probability to enter the K nucleus.

The energy levels of  $H^-$ -K have also changed greatly. From the formula (4), we find that the  $H^-$  baryon does not move on the original electron orbit, but has its own set of energy level orbits. These orbital energy levels ( $E_n$ ) can be determined by the following

formula:

$$E_n = -\frac{mc^2}{2} \left( \frac{\alpha z}{n} \right)^2 \left[ 1 + \left( \frac{\alpha z}{n} \right)^2 \left( \frac{n}{j + \frac{1}{2}} - \frac{3}{4} \right) - \dots \right] \quad (4)$$

where  $c$  and  $\alpha$  are the light speed and fine-structure constant;  $j$  is total angular momentum quantum number of negative particles. The meaning of other symbols is the same as that of the former formula. For this particular structure,  $E_n$  depends on the  $H^-$  baryon mass. Compared to the normal electronic transitions,  $H^-$  baryon released energy is higher.

As for the mass difference before and after reaction in formula (4), it should corresponds some energy variation during this reaction. According to the mass-energy equation,  $E = mc^2$ , the mass difference may correlate energy releasing or new matter formation, for example, some quarks.

$$K^+ + H^- \rightarrow Ca^{2+} + 2e^- + \Delta m \quad (s^{-1/3} + u^{+2/3} + d^{-1/3}) \quad (5)$$

A lot of research facts show that calcium is an important element for human body, like constituting the bones and teeth and helping heart and other muscles do their work normally [26-30]. Low calcium intake could lead to fragile bones, high blood pressure, and certain types of cancer. Actually,  $H^-$  can act as antioxidant by selectively reducing cytotoxic oxygen radicals [30]. It could be supposed that there might be hydrogen which existing as negative hydrogen in human body, for  $H^-$  ions are more solvable in body fluids compared with  $H_2$  molecule. Those  $H^-$  ions could facilitate elements transmutation in organism body. Base on the reported data and proposed mechanism, we can suppose that K-Ca transmutation is beneficial for maintaining human body health, which might be a potential answer to a long-lastingly unsettled question, that what environment can induce "mild" element transmutation, for example, the transmutation in biological bodies and bionics reactive system, typically, energy release and new matter formation via such a LENR. It can also help to answer the question that why the chickens can produce so many eggs while they do not take in enough calcium, and how can organisms take in some special elements even they grow in isolated environments. In addition, the mitochondrion in cells might capture the energy re-

leased from transmutation, accumulate those energies, and release them slowly for organism metabolism.

### 3 Conclusion

We finds some exotic and interesting results about potassium transmutation to calcium in the mixture containing  $K^+$  and  $H^-$ . The results showed  $K^+$  concentration is gradually decreasing, while the  $Ca^{2+}$  concentration is gradually increasing in the mixture dispersion. Those results indicate that some of calcium elements in nature might originate from K-Ca transmutation through LENR under very mild conditions, which might be related to the yield of  $H^-$ . Besides, we can make some predictions if the formation of K-Ca transmutation follows the mechanism of the combination of  $K^+$  and  $H^-$  baryon. One can achieve the element transmutation of some light nucleus to a little bit heavy nucleus base on the  $H^-$  baryon, such as transmutation from Na to Mg, Mn to Fe, or Cs to Ba under mild conditions. These reactions can help us further understand the Ca formation and loss mechanism in our body and remove dangerous nuclear waste like  $^{137}Cs$ . We realize those discoveries may raise some questions and arguments.

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# 关于在钾与负氢混合物中钾钙嬗变的检测

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**摘要:** 报道了在室温下钾与负氢混合物中钾钙发生嬗变的现象, 负氢是由 NaBH<sub>4</sub>、LiBH<sub>4</sub> 和 NH<sub>3</sub>BH<sub>3</sub> 提供的. 实验中的钾和钙的浓度分别用诱导耦合等离子发射光谱法 (ICP-OES) 和诱导耦合等离子质谱法 (ICP-MS) 进行检测. ICP-OES 结果表明随着混合物中钾浓度的降低伴随着钙的浓度增加. 此外 ICP-MS 结果还表明 <sup>40</sup>Ca 浓度的增加伴随着 <sup>41</sup>K 浓度的增加, 可能表明在负氢存在的条件下混合物中 <sup>40</sup>Ca 的生成与 <sup>41</sup>K 物种有关.

**关键词:** 钾钙嬗变; 负氢化合物; 低能核反应