

THE EVIDENCE OF NUCLEAR TRANSMUTATION PHENOMENO IN Pd-H SYSTEM USING NAA(NEUTRON ACTIVATION ANALYSIS)*

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Abstract

Phenomenon of nuclei transmutation in Pd-H(Pd-D) system was confirmed with NAA technique. The zinc-main product of nuclei transmutation was measured in the samples.

This experiment was repeated, the results are the same. the highest content of zinc-main products of nuclei transmutation is about 30%(atom). The different of isotopes content of zinc was observed in experimental samples.

1. Introduction

Phenomenon of nuclei transmutation in Pd-H(Pd-D) system has been researched for a long time by us^{[1],[2]}. In past several years, We concentrated our attention to search charged particles, precursor and got some positive results.^{[1],[3]} But it is difficult to repeat them any time and any where. Recently, We concentrated our attention upon nuclei transmutation of metal Pd in Pd-H(Pd-D) system^[4]. Through a long term treatment, Pd in Pd-H or Pd-D system created nuclei transmutation. the products of nuclei transmutation are various, but Zinc is one of main products. For confirmation of it, especially for Zinc, a lot of experiments had been done. This paper reports about using NAA methods to confirm the nuclei transmutation phenomena.

2. Experimental condition

Six metal samples were sampled. No.1,3,4,5 came from Pd-H or Pd-D system, No.2 is original Pd. No.6 is pure zinc. Their weight of every sample is about 10mg. All samples were cleaned, sealed in a small quartz ampoule respectively, then put them into vertical neutron beam channel which was located in reflector of Tsinghua University pool-reactor. The thermo-neutron flux is 10^{12} n/sec.cm² in the reflector. they were irradiated for one and half hours, then took out from reflector, and 'cooling' it for 72 hours. Their activity were measured with pulse-height(energy) spectroscopy with a HPGe Gamma Ray detector produced by EG&G ORTEC. The certified peaks of ⁶⁵Zn (1.1155MeV) and ^{69m}Zn(438.7KeV) γ -ray were measured and analyzed.

3. Experimental results

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The first results was shown in Table.1.

(72 hrs cooling)

Table. 1.activities of ^{65}Zn and $^{69\text{m}}\text{Zn}$

sample	area of $^{65}\text{Zn}(1.1155\text{MeV})$	area of $^{69\text{m}}\text{Zn}(438.7\text{KeV})$	ratio of area
z.weld. No.1	467 ± 23	21 ± 10	22.2 ± 11.8
4.0 h. No.2	0	0	
No.3	713 ± 27	45 ± 17	15.84 ± 4.40
2.5 h. No.4	1683 ± 42	201 ± 26	8.37 ± 1.29
No.5	2291 ± 49	254 ± 18	9.02 ± 0.82
5.5 h. No.6	4072 ± 68	492 ± 26	8.28 ± 0.57

from table 1, we can see the areas of samples No1,3,4 $^{69\text{m}}\text{Zn}(438.7\text{KeV})$ are so small, that the error are too large. Owing to the long cooling time, the $^{69\text{m}}\text{Zn}(438.7\text{KeV})$ decayed too much to measure it.

The second time experiment was done with shorter 'cooling' time the results was shown in table 2.

Table. 2.activities of ^{65}Zn and $^{69\text{m}}\text{Zn}$

sample	area of $^{65}\text{Zn}(1.1155\text{MeV})$	area of $^{69\text{m}}\text{Zn}(438.7\text{KeV})$	ratio of area
No.1	$980 \pm 3.25\%$	$143 \pm 12\%$	$6.85 \pm 15\%$
No.2	0	0	
No.3	$1157 \pm 2.74 \%$	$245 \pm 16 \%$	$4.7 \pm 17\%$
No.4	$2352 \pm 2\%$	$531 \pm 7.54 \%$	$4.43 \pm 8.0\%$
No.5	$5277 \pm 1.44 \%$	$999 \pm 3.76\%$	$2.938 \pm 5.0\%$
No.6	$9217 \pm 1.05\%$	$1492 \pm 2.81\%$	$6.18 \pm 3.5\%$

The data of table 2 can tell us that the area error of the $^{69\text{m}}\text{Zn}(438.7\text{KeV})$ are smaller than first experiment. Owing to the different cooling time, different irradiating time and position, different neutron flux, and different order of measurement with first time experiment, the results of second time experiment can not be compared with first experiment data. The data of table 2 has to be generalized to data of No.6 experiment data(second time) . The first time experiment ratio of area of No.6(pure Zinc)has to be equal to second time experiment ratio of area of No.6.(pure Zinc). The computed results were listed in table 3.

Table 3. The generalization of second measured activities of ^{65}Zn and $^{69\text{m}}\text{Zn}$ to No.6

sample	area of $^{65}\text{Zn}(1.1155\text{MeV})$	area of $^{69\text{m}}\text{Zn}(438.7\text{KeV})$	ratio of area
No.1	$342 \pm 3.32\%$	$30.9 \pm 17.3\%$	11.1 ± 2.0
No.2	0	0	
No.3	$409.5 \pm 2.74\%$	$58.8 \pm 16\%$	8.3 ± 1.34
No.4	$1010.6 \pm 2\%$	$130 \pm 7.54\%$	7.7 ± 0.61
No.5	$1807 \pm 1.44\%$	$246.7 \pm 3.76\%$	7.32 ± 0.27
No.6	$3081 \pm 1.05\%$	$373 \pm 2.81\%$	8.26 ± 0.24

The table 3 tell us the generalized results , we can compare it with table .1.

4. discussion

4.1 experimental environment

all of the samples were cleaned ,packed, and sealed in super clean condition, all of interference source of zinc were removed. As a result, the peak of $^{69\text{m}}\text{Zn}(438.7\text{KeV})$ and $^{69\text{m}}\text{Zn}(438.7\text{KeV})$ were not observed from data of sample of No.2(original Pd).

4.2 Confirmation of zinc

Sample No.6 (pure zinc) supplied the position and intensity of certified peaks of $^{65}\text{Zn}(1.1155\text{MeV})$ and $^{69\text{m}}\text{Zn}(438.7\text{KeV})$. the products of Pd nuclei transmutation of sample No.1,3,4,5 were measured ,there are the same position of certified peaks (see fig.1). but their areas are different, because the quantity of the products of Pd nuclei transmutation is different.

In fig 1, the highest peak of curve is Sample No.6 (pure zinc), the peak of curves of sample No.5, 4, 3, 1 go down in proper order. The peak of natural zinc was show in Fig .2, the peak of sample No.5 was given in Fig.3 . In Fig 1, 2, 3 the left peaks are $^{69\text{m}}\text{Zn}(438.7\text{KeV})$, the right are $^{65}\text{Zn}(1.1155\text{MeV})$. the zinc content was estimated, it is about 30%(atom) in sample No.5. The peak position of products of Pd nuclei transmutation is the same with pure zinc without any different. After one month, the samples had been measured once again. The area of the certified peak had changed, according to the decay constant of zinc. So they are conformed. They are zinc!

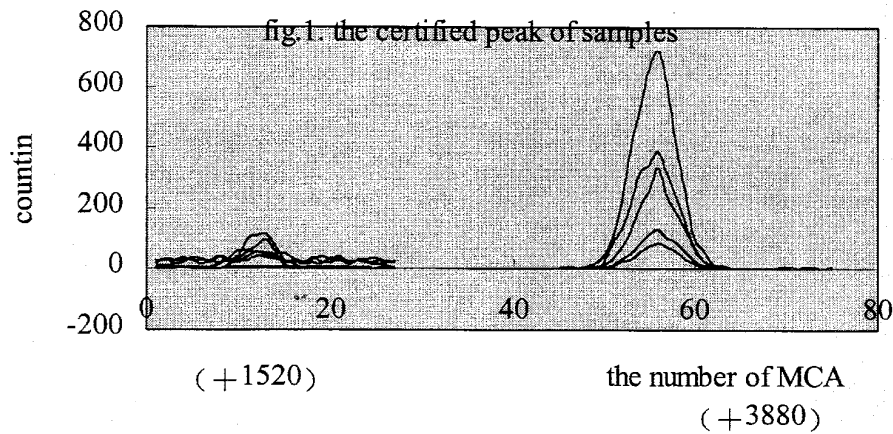


Fig.2 the peak of zinc of sample No.6

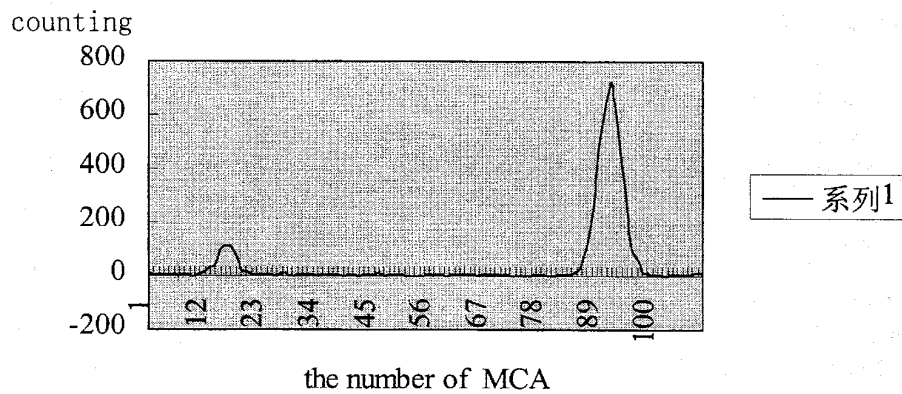
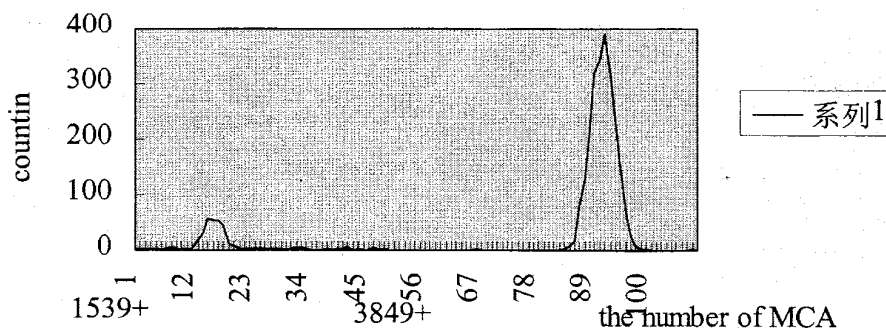


Fig.3 the peak of zinc sample No.5



4.3 the ratio of zinc isotope

the ratio of area in table.3 give us an information: the ratio of isotope ^{68}Zn and ^{64}Zn is different in sample No.1, 3, 4, 5 and different with sample No.6(natural zinc). This is a collateral evidence, which conformed the zinc comes from Pd nuclei transmutation do not come from environment or contamination.

5. conclusion

These results told us:

- 1.)Zinc is dominate products of Pd nuclei transmutation. In sample No.5, the zinc content is about 30%.
- 2.)The ratio of area difference between No.6 sample (pure Zinc) and others means that every sample is possessed of himself ratio of isotope(^{65}Zn , ^{69}Zn) i.e. products of Pd nuclei transmutation have different ratio of isotope between natural Zinc.
- 3.)The experiment is reliable, zinc dose not either come from contamination or natural environment. The zinc comes from Pd nuclei transmutation
- 4.)There are some other peaks of Gamma Ray appear, for example ^{187}W , ^{192}Ir etc. these elements were not discovered in No.2 sample(original Pd) ,

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