Production of Neutron and Tritium from D_2O Electrolysis with Palladium Cathode

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ABSTRACT

Anomalous neutron burst and an increase in tritium concentration were observed simultaneously from heavy water electrolysis with palladium cathode. Considered with previous experiment results, we presumed that production of neutron and tritium from D_2O electrolysis depends heavily on the constitution and the state of each cathode.

Keywords: electrolysis, palladium, neutron, tritium

1. Introduction

Since first reports on cold fusion [1, 2], a great number of experiments have been done for verifying these phenomena. Many new positive results have been published which confirm that the claims of cold fusion can not be pushed aside quite easily. However, most of laboratories were not able to reproduce the observations controllablly. It has been realized that some features have not been discovered.

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Previous experiments from our laboratory have been reported by Zhou. H.Y, in which a neutron spectrum has been measured from D_2O electrolysis with palladium cathode. Experiment results showed that only one type of palladium tubule which we used in electrolysis experiment is favourable for cold fusion. It will be most interesting to understand the influences of the constitution of material. Repeat experiments have been done in order to verify this assumption.

2. Experimental Aspects

Experimental details regarding this experiment were described previously[3] and will not be elaborated here. Only some important parts would be explained following. In this electrolysis experiment, cathode is a palladium tubule which was used as a deuterium gas filter for a long time. Before we used, no special treatment was done for it except a normal cleaning. Palladium tubule was put in the center of a teflon tube with holes. The diameter of teflon tube was 10 mm. Platinum wire which wound around the teflon tube was used as an anode. The liquid scintillator which was used as a neutron detector was shielded with 30cm thickness of lead and paraffin. In order to regulate the background, n- γ discriminator was well adjusted, and put to the test of stability for several days. The equipments worked quite stably. The average counting rate for background was about 75 counts/hour.

The experiment lasted for five days. The electrolysis current is about 130 mA. The sorrounding temperature always kept at 21° C$\pm$1° C. During the experiment, the temperature measured for reaction cell was shaking around 23° C.

3. Results and Discussion

Experiment results are interesting. Anomalous neutron burst has been observed in this experiment. The details of neutron burst detected were listed in table 1. It is obvious that the counting rates were higher than the average counting rate of background, the variables were beyond the statistical

fluctuation. Compared with previous experiment results[3] , the burst pulses lasted too short time. Amount of neutron detected was significantly small.

Table 1. The details of neutron burst

Event No.	Time (a)	Counting rate (n/min)
1	20 h 05 m	37
2	38 h 02 m	17
3	39 h 12 m	9
4	40 h 09 m	19
5	42 h 39 m	14

a. referred to starting time of electrolysis (t=0).

An increase in tritium concentration was found in the electrolyte after electrolysis with heavy water and palladium cathode. The measurement was taken by comparison between two samples. Sample 1 was 10 ml electrolyte which was taken before the electrolysis. Sample 2 was get from reaction cell after electrolysis. A scintillation counter PACKARD 2250 was used to measure the concentration of tritium in electrolyte. The measurements for two samples were performed under the same conditions and repeated for several times. The data showed that tritium concentration in sample 2 was systematically higher than in sample 1. The average deviation between two samples was about 3 percent, then the statistical error was 1 percent. Quantitative analysis has not been carried out.

We wanted to make a discussion considered with previous experiment results. In our laboratory, electrolysis experiments with heavy water have been done for more than fifty times, using different cathode materials. There were only four experiments (including this one) that we have observed anomalous neutron bursts (among them, there was some doubt for one experiment). Although the behaviours observed for neutron burst are different, one interesting point is that the palladium

tubules were from same type, and were used as deuterium gas filters for a long time. Another point is that if we compared our experiments with others, the time is different when anomalous neutron burst happened. In our experiments, the first burst happened about 20 hours later after electrolysis starting. It was much shorter than others. It led us to presume that whether those palladium tubules have already concentrated deuterium in lattice since it laid in deuterium gas for a long time. If it is so, a new experiment design have to be done. However, it seems to be early to conclude this question. Systematically and critically analyzed experiments will require to make a true understanding of the phenomena.

4. Reference

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