Neutron Monitoring on Cold Fusion Experiments

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ABSTRACT

A helium-3 proportional detector was equipped with the experiment of Liaw-type electrolytic cell contained eutectic LiCl-KCl molten salt saturated by LiD electrolytic to collect the informations of the rate and the energy distribution of possible neutron produced during the electrolysis processes.

For long time monitoring, the significant reproducible neutron bursts appeared at several runs of cells during electrolytic processing. The neutron counting rate increased about a factor of two above the level of the background measurement. The pulse height signals were verified of neutron energy ranging from thermal up to 350 keV.

1. Introduction

Since the first report of discovery the neutron emission from cold fusion reaction by Jones et al. [1]. After that at least seven groups[2] have claimed both detections of neutron emission and excess heat production in the cell at room temperature. However, none of them has detected neutrons emission as well as both neutron emission and heat generation at elevated temperature.

In this report, we attempt to detect neutrons produced in LiCl-KCl molten salt saturated by LiD electrolytic at cell temperature about 400 °C.

2. Experimental Arrangement

The investigation of possible neutron esission has been carried out with similar to Liaw's LiCl-KCl molton salt saturated by LiD electrolytic. The cell design as shown in Fig. 1, the eutectic LiCl-KCl molten salt saturated with LiD electrolyte was filled in an aluminum can cathode with a Pd anode. An independent AC power driven furnace provided the reference temperature before the DC current

FRONTIERS OF COLD FUSION

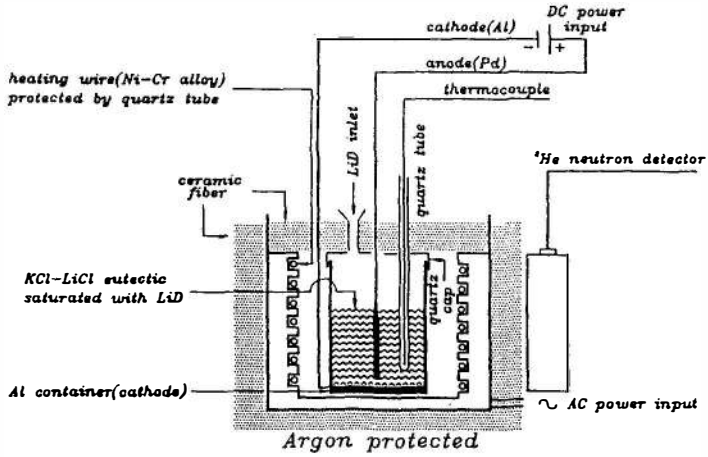

Fig. 1 A schmeatic configuration of the molten salt cell.

applied for electrolysis. A K-type thermocouple was used for the cell temperature measurement. The Pd anode immerged in the salt with surface area of about 3.8 - 5.7 cm^2. The whole experimental setup was operated in a glove box purged with Ar gas. The LiCl-KCl eutectic mixture was firstly melted by the AC power, which was kept the cell to get a stable reference working temperature, 390 °C. The cell then runing by applying a DC current for electrolytic process after LiD was added. Two grams of LiD were lasted up to 5 to 20 hours of electrolysis depending on the DC current applied. The duration for each addition of LiD is called a cycle of the process. A run in a cell usually contains 5 to 10 cycles. A helium-3 detector was also employed for continuous monitoring of neutrons. The detector efficiency was calibrated with a ^{239}Pu-^{13}C source of neutron emission rate $1.17X10^5$ ns^{-1}. Thus the efficiency of about 0.01% was obtained of this arrangement.

3. Results and Conclusions

For the neutron emission studies on LiCl-KCl molten salt experiments, several runs of different Pd diameter anode have been studied. The neutrons emission was obsevered on a 6 mm diameter Pd anode experiments, at 30 hours right after the DC charging current applied to the cell. The neutron counting rate jumped about twice higher then the background level. As indicated in Fig. 2, the cell runing about 215th to 270th hours (30 hrs. after the DC charging current applied), the neutron counting rate jumped from bockground level 5.51±0.44 cpm, to a higher value, 12.02±0.56 cpm. The cell temperature and the DC power applied in the cell compared with the neutrons during the electrolytic processing was shown in Fig. 3. From this figure it indicates that once the neutron emission is triggered the neutron counting rate is rather low relationship corresponding to the applied DC power. The cell temperature increase

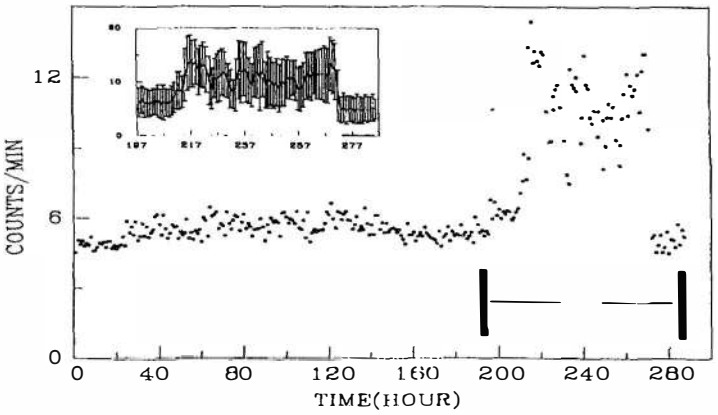

Fig. 2 Neutron counting rate of a 6 mm diameter Pd anode during electrolytic process.

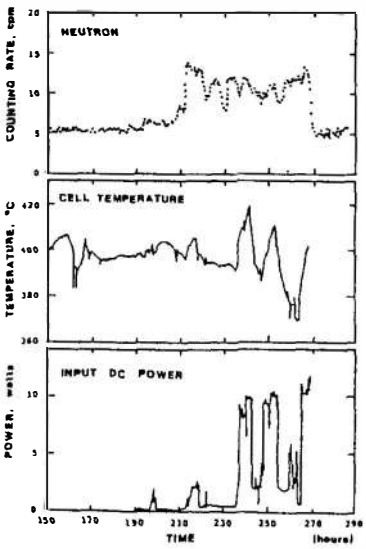

Fig. 3
(a) Neutron counting rate vs time.

(b) The cell temperature, power gain is estimated about 5 to 108 times of the input power.

(c) Input power of the cell, the cell started to electrolyze at hrs. 190, the current density was applied 18-800 mA/cm^2.

depends on the applied DC power. The estimated power gain in this case was about 5 to 108 times of the cell input power.

The neutorn emissions of an another experiment with the same anode diameter was shown in Fig. 4. The cell ran about 114th to 170th hours, the neutron counting rate also jumped from background level, 4.67±0.52 cpm to 7.43±0.62 cpm. The pulse height distributions of both background and cell run measurements were shown in Figs. 5(a) and 5(b), respectively. As comparsion with the background and the cell runs measurements, the counts from channel number 40 to 58 of figure 5(b) were significantly different from the the distribution of the background one. There was verified that the neutorns with energy above thermal up to 350 keV were collected during the cells were in electroytic processing. Above channel 58 the counts recorded on each channel fell almost the same level equivalent to the back-

ground.

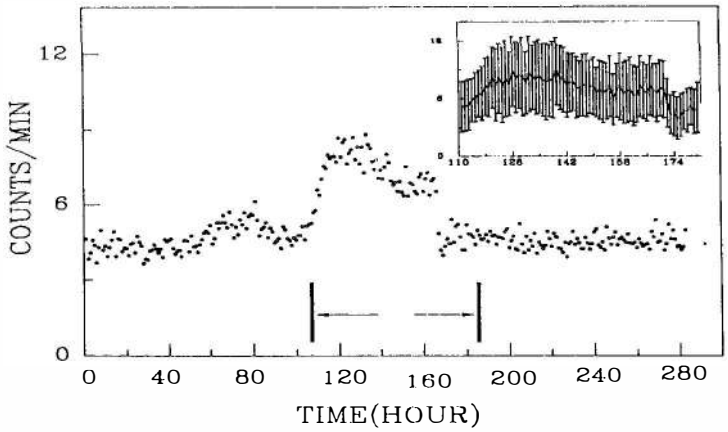

Fig. 4 Neutron emission of an another 6 mm diameter Pd anode was collected about 114th to 170th hours during electrolysis.

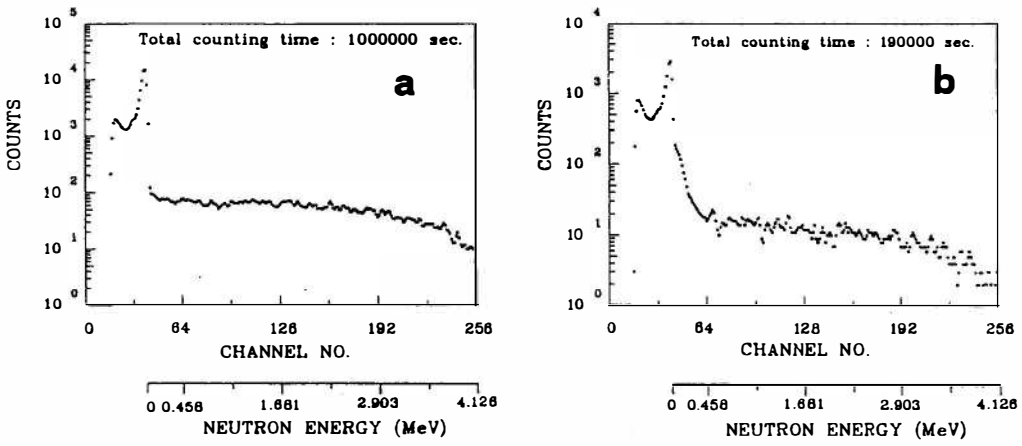

Fig. 5 (a) The pulse height distribution of neutron signals collected from background measurement, (b) from cell electrolysis.

At least three full runs of 6 mm diameter Pd anode electrolytic processes had neutron emissions being detected with equivalent same shape of neutron pulse height distribution. But in case of smaller diameter Pd anode e.g. 4.5 mm, was only large excess heat generation was observed. The neutron emission had not been detected yet in our experiment.

4. References

1. Jones, S. et.al., 1989, Nature, 338, 737.
2. Mallove, E., 1991, "Fire from Ice", Wiley, New York.