Fifth International Conference on Cold Fusion
9-13 April, 1995 - Monte Carlo, Monaco
ICCF5 ©1995

# ELECTROLYSIS OF HEAVY WATER WITH A PALLADIUM AND SULFATE COMPOSITE

G.NOBLE, J.DASH, M.BREILING, and L.McNASSER
Physics Dept.,Portland State University
Box 751, Portland, OR 97207

## Abstract

It appears excess heat can be produced during the electrolysis of heavy water with a palladium and sulfate composite. Experiments seem to show that when this composite is coated on Platinum, and used as a cathode, excess heat similar to that generated with solid Pd results.

## 1. Introduction

During the summer of 1994, electrolysis experiments were conducted using small [about 25 ml] glass electrolytic cells with Teflon caps and connected in electrical series. The C [control} cell had a Pt foil anode and cathode, a recombination catalyst, and an electrolyte containing light water with 0.06 mol fraction sulfuric acid. The D cell was the experimental cell. It had a Pt foil anode, a cold rolled Pd cathode 0.35 mm thick, a recombination catalyst, and an electrolyte containing heavy water with 0.06 mol fraction sulfuric acid. Thermocouples on the outside of the cells were used to measure cell temperatures during electrolysis. A constant current source was used, and cell voltages were monitored. The schematic arrangement is shown in Fig. 1.

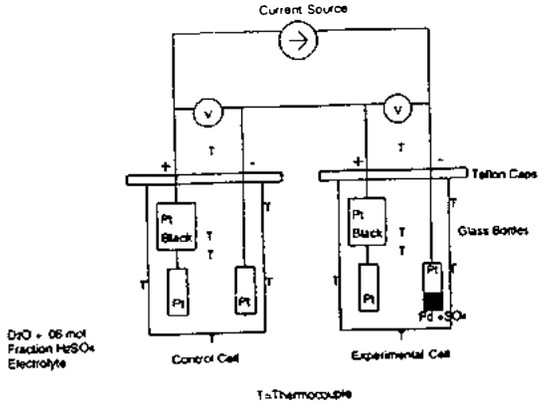


Figure 1. Heavy water electrolysis experimental arrangement.

## 2. Methods and Results

A series of three to five hour experiments was conducted in which a significantly higher average temperature was observed for the D cell. This occurred even though the power input to the C cell was greater. The

experiment dated 6-29-94 was the third experiment of the series, and the results are shown in Fig. 2. The average temperature was 9 C higher for the D cell with 0.52 W greater average power input to the C cell. Both cells lost electrolyte through the escape of vapor. The loses were identical for the two cells in the experiments preceding 6-29-94.

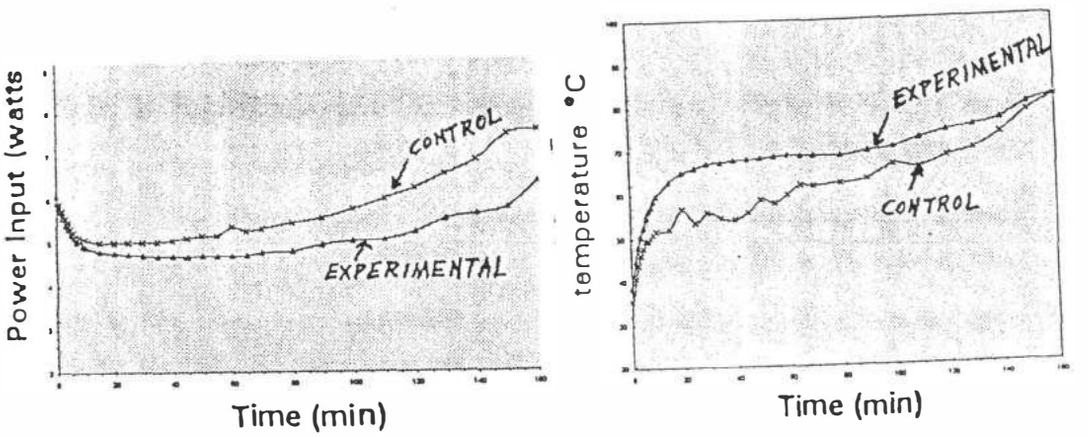


Figure 2. Power input and temperature for the experiment dated 6-29-94.

During the 6-29-94 experiment, the electrolyte turned black and a dark material collected on the Pt electrode. The Pd electrode lost 0.1 g from the electrolyzed portion, which appeared to have melted. However, it was later realized that the polarity of the cell was inadvertently reversed making the Pd electrode the anode and causing it to dissolve. The Pt was then the cathode. The black substance that deposited on the cathode is shown in Fig. 3.


Figure 3. Sample of material that collected on the Pt cathode during experiment 6-29-94.

The spectra in Figs. 4a and 4b were taken with an energy dispersive spectrometer. Both show the presence of Pd, S, and O.

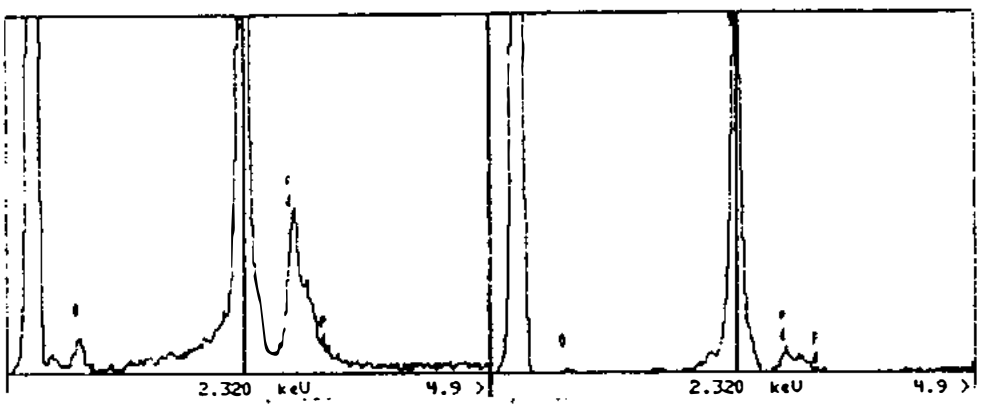


Figure 4. EDS area spectra of black substance show Pd,S, and O.

X-ray diffraction patterns were taken for the black substance and commercially available $PdSO_4$. The patterns do not match. The black substance appears to be hygroscopic but not to the same extent as the $PdSO_4$. Although believed to be palladium and sulfate composite, full characterization is not yet complete.

In another series of experiments, Pt foil cathodes were coated with palladium and sulfate by electrolyzing in a cell with a Pd anode. These cathodes were then electrolyzed with a Pt anode, a heavy water electrolyte with 0.06 mol fraction sulfuric acid, and a recombination catalyst. A control cell was connected in series, as described above. Fig. 5 shows the results of an experiment performed on 2-17-95. Each point on the graph represents the average of six thermocouple readings at the locations shown in Fig. 1. The average power input to the [C] control cell was 0.15,W greater than to the experimental [D] cell but the average temperature was more than 1 C greater on the D cell. The electrolyte loss was the same for both cells.

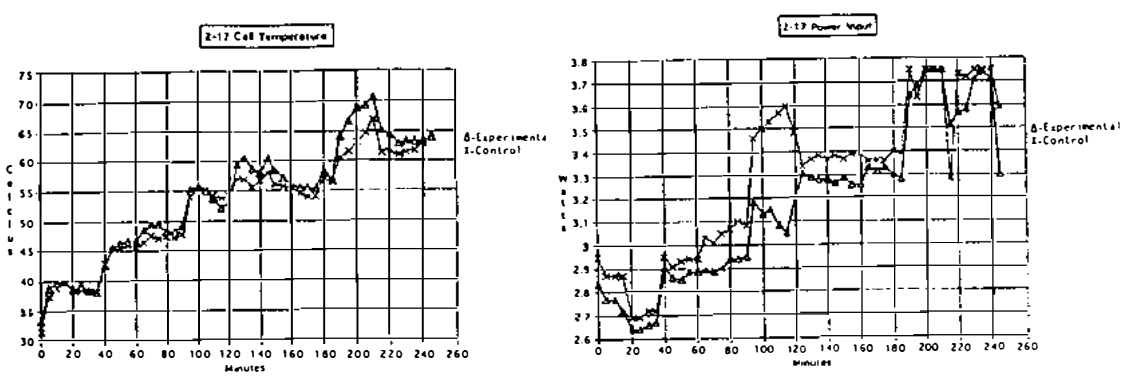


Figure 5. Temperature and power for experiment 2-17-95.

Fig. 6 shows the results for an experiment performed on 3-16-95. There was a 0.7 g greater electrolyte loss from the C cell than from the D cell. The power input to the C cell averaged 0.32 W more than to the D cell but the D

cell temperature averaged 2 C higher than the C cell.

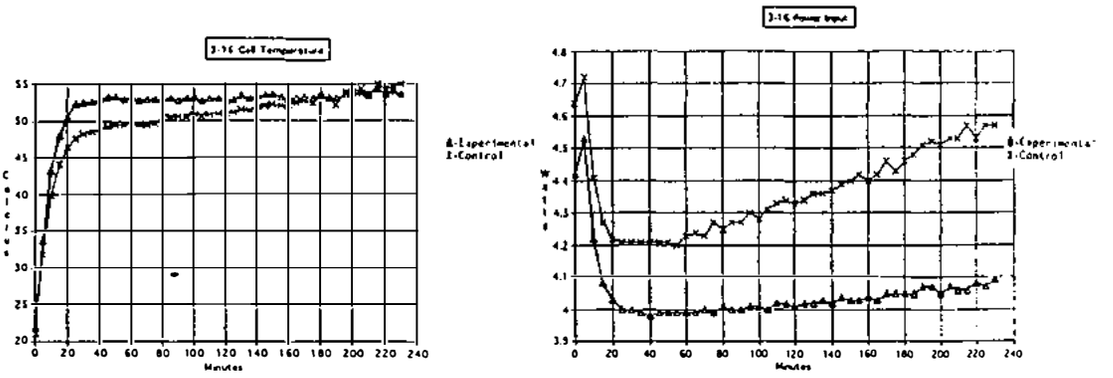

Figure 6. Temperature and power input for experiment 3-16-95.

In the final experiment in the series, the cell tops were interchanged. This resulted in the D cell losing 0.7 g more electrolyte than the C cell. Fig. 7 shows the results of this experiment performed on 3-29-95. The power input to the C cell averaged 0.062 W higher than to the D cell and the C cell averaged 1 C higher temperature than the D cell.

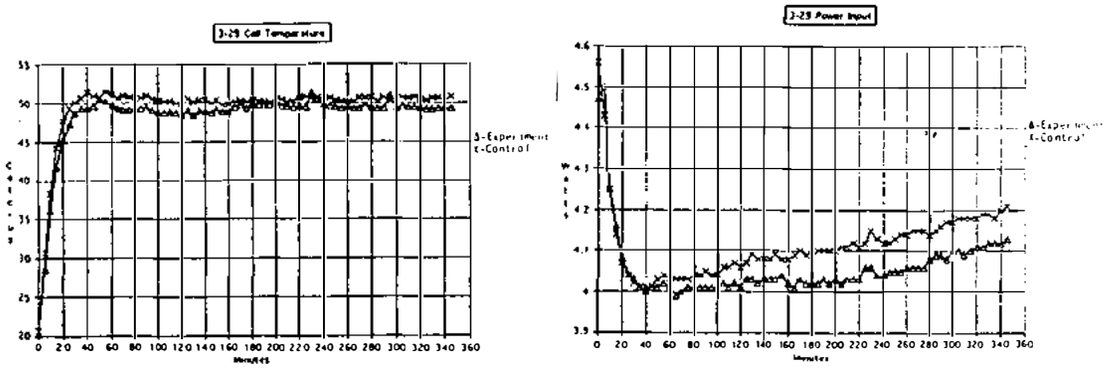

Figure 7. Temperature and power input for experiment 3-29-95.

It appears that excess heat in this experiment was carried with the net vapor loss from the D cell. The amount of excess heat may have been about 5000 J, depending on the composition of the vapor which escaped.

## 4. Conclusion

It appears that excess heat is produced during the electrolysis of heavy water with a palladium and sulfate coated cathode. The amount of this excess heat seems comparable to that produced with a pure palladium cathode.