PROGRESS REPORT
STUDY OF PdD AS A HOST FOR LENR

Subject: Part 1. Description of the calorimeter
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INTRODUCTION

After Prof. Fleischmann and Pons (F-P)(*1*) claimed to generate extra energy by electrolyzing Pd in D_2O, over 3000 papers were written in an attempt to prove or disprove the claim. Hundreds of papers have tried to explain what has now been called Low Energy Nuclear Reaction (LENR). This study is being guided by the theory described by Storms(*2-6*) using the method of F-P.

Evidence for LENR is based mainly on producing more energy than can be accounted for by any known chemical process. Nevertheless, production of helium(*7*) has been correlated with energy production and tritium has been produced in excess of any source other than its creation by a nuclear process. In addition, elements not normally found in the material are detected on the surface after LENR has occurred.(*8*)

This study will focus on achieving significant energy production during which a correlation between emitted photon radiation and power production will be sought. The apparatus described here makes such a study possible.

The apparatus will be used to study those behaviors having a relationship to the Storms theory in an attempt to find support for the proposed ideas. The following predictions will be explored:

1. The hydrogen isotope composition achieved by the material only affects the rate of LENR by affecting the availability of hydrogen to the Nuclear Active Environment (NAE), with a significant rate being possible at low compositions when the amount of NAE is sufficiently large.
2. The rate of the LENR reaction is affected by temperature only as result of how temperature affects the diffusion rate of hydrogen through the material.
3. Photon radiation will be emitted when LENR occurs, with a particular relationship existing between the angle the surface makes with the detector.
4. The rate of the LENR reaction already underway can be increased by application of laser light, with an increased reaction rate being produced as the frequency of the light is increased. An enhanced effect can be expected when the frequency matches the dimension of an active crack.
5. Initiation of excess energy does not require extended electrolysis when the NAE is created in advance.

Each of these predictions will be described and justified in later reports where each is explored in detail.

DESCRIPTION OF THE APPARATUS

The calorimeter is a massive aluminum box cooled by constant temperature water flowing through channels machined in all sides. Figure 1 shows one side where

FIGURE 1. Front panel of the box before the two parts were glued together and

assembled into the final box. The hole allows laser light to enter the calorimeter.

channels (0.5"x 0.2") are machined in ½ inch thick aluminum. A second piece (1/8") of aluminum is glued on its surface to make a water-tight assembly. The water channels between the sides are connected using O-ring compression seals. Figure 2 shows the

FIGURE 2. Assembled box. The connectors in the side are eventually connected to the internal components.

assembled box. Water enters and leaves the box at the bottom and flows to and from the top through the hinges. The box is enclosed in a Styrofoam heat shield and is covered on the inside by 52 thermoelectric convertor panels (Custom Thermoelectric 12711-5P31-12CW). Figure 3 shows the open box with the components installed. The top of the electrolytic cell is in the center with the GM detector on the left and a DC fan on the right. The Pyrex cell can be rotated 90° to the right in order to align the cathode with the laser and to explore the direction radiation is leaving the surface.

FIGURE 3. View inside the calorimeter showing the components. The cell is in the center, the GM detector is on the left, and the fan is on the right.

The cell, shown in Fig. 4, contains a Pt anode, a Teflon clamp to allow the cathode to be easily removed, a glass covered resistor for calibration, a glass covered thermister to measure the cell temperature ($\pm 0.01°$ C), and a platinum mesh used as the reference electrode for open circuit voltage (OCV) measurements. The cell contains a catalyst to recombine any excess D_2 and O_2 and holds 30 ml of D_2O+LiOD. The cell is gas tight to allow the D content of the Pd cathode to be determined using the orphaned oxygen method (± 0.01 atom ratio). The only gas able to leave the cell is the small amount of excess O_2.

FIGURE 4. View of Pyrex electrolytic cell.

Pictures showing the overall system are identified as Figs. 5, 6, and 7. These pictures

FIGURE 5. Front view of the calorimeter assembly

FIGURE 6. Top view of calorimeter assembly

FIGURE 7. Seebeck box with the balance for measuring the oil weight, and with the laser assembly in its approximate position. The thermoelectric convertors have not been

applied to the top surfaces of the box.

show a switch that allows the calorimeter to be calibrated using the internal resistor and the same power supply and current measuring resistor as used when current is applied to the anode and cathode. This method eliminates one potential source of error. An additional switch applies power to the internal resistor while current is applied to the anode and cathode using a separate power supply in order to increase the cell temperature independent of applying current to the anode and cathode. This arrangement permits exploring the effect of cathode temperature.

The OCV is measured by switching, using a computer operated relay, the cathode from the power supply and connecting it as well as the reference electrode to the data acquisition system. When the OCV is measure, the voltage applied to the electrolytic cell is interrupted for less than a second.

The balance, shown on the right, is used to weigh the oil forced out of a reservoir by any extra oxygen created within the cell. This allows the D/Pd ratio to be determined in real time. The value obtained using this method is compared to the D measured as a weight increase of the sample after the study. This method allows the sample to be removed from the cell, studied in other ways, and then returned to the cell for further measurements, without loss of information about the D content.

Measurements are made and stored every 6 minutes. These measurement include the voltage generated by the thermoelectric convertors (SBV); cell voltage, measured at the calorimeter boundary, and current; the resistor voltage and current; the fan voltage and current; OCV; radiation count rate; cell temperature; Seebeck temperature; and room temperature. Evidence for extra energy is based on the relationship between applied power from all sources and the SBV. Additional, support for large amounts of power can be obtained using the calibrated difference between the cell temperature and Seebeck temperature, while being used as an isoperibolic calorimeter.

A laser assembly is shown in its approximate location in the pictures. This assembly can be heated to change the laser frequency, rotated to change the polarization, and shifted to explore the effect at different locations. A second laser spot can be superimposed on the first. A variable magnetic field can be applied to the cathode. An optical spectrometer is used to measure the laser frequency.

The data are acquired using a Mac running NI hardware and LabView software.

SUMMARY

A calorimeter and associated equipment have been assembled to explore the production and study of cathodes made using alloys of Pd. Evidence of LENR will be sought while using an electrolytic cell containing $D_2O+LiOD$. The work is guided by and designed to test the theory of Storms. The tool has been designed to be as versatile as possible to allow a wide variety of behaviors to be explored with high precision.

References

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