Self-Polarisation of Fusion Diodes: From Excess Energy to Energy

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Abstract

Conventionally, the cold fusion reaction produces heat. (1),(2) The authors have sought a different approach, wherein the device has no input energy, relying on the energy produced by cold fusion in the device. The device consists of diodes fabricated as powder, with a large surface junction made up of a semiconductor in contact with palladium charged with deuterium.

The apparent fusion reactions take place in the junction between the semiconductor and the Palladium powder, which produces an excitation which is transmitted to the electrons. This excitation increases their energy and allows them to cross the bandgap of the semiconductor and pass into the conduction band, as in a photovoltaic cell. This energy very quickly appears as a spontaneous potential difference which can reach over 0.5 volt per junction.

The potential drop concentrates on the junction region, and at a nano scale the electric field reaches considerable values, higher than the megavolt per meter, which constrains the deuterium nuclei and increases the probability of deuterium fusion. (3),(4)

Experimental Device

Diodes comprising of a stack of junctions were made, making it possible to obtain over 1 volt at the poles of a very compact device of a few centimetres long. The power generated by the device remains very low for the moment, but it should be noted that it is in the form of directly usable electrical energy, and not thermal energy. The authors compare the density of energy obtained in their device, with the density of energy released by the first atomic pile produced by Fermi in Chicago. The levels of energy are very comparable to the fusion diode. The authors describe the various devices experimented with and used during this work over the last two years.

As part of this work, an extremely sensitive calorimetry device was built. The authors present the principle of this device, as well as a project for detecting of neutrons from very weak sources. This neutron counter records the particles emitted in all the directions of space, and can be scaled to the size of the neutron source.

Our concept considers that before transforming itself into heat, the energy released by fusions of the deuterium initially will produce an excitation of the atoms. It is the same thing when a photon of visible light hits a solid, initially electrons of the atoms of the solid are excited, and after this first step, the energy is decayed into heat.

It is possible to take this energy away before its transformation into heat: in a photovoltaic cell. A solar cell is a diode with a large surface. When photons fall on the junction zone, certain atoms are excited, and electrons pass from a low energy level to a higher energy level.

The photons are absorbed by the silicon atoms, it is why this material is dark. In a crystal of silicon, or in a black paint, the energy is converted into heat. In a silicon solar cell, or in a dyed organic solar cell, part of this energy is transformed into electric current. It appears a voltage between the poles of the cell.

In our experiment, we tried to replace the light with fusion energy.

Materials and Methods

The following materials are used to make these devices:

Palladium powder (Sigma)
Gas Deuterium (Sigma)
Silicon powder (Sigma)
Other semiconductors (Sigma)

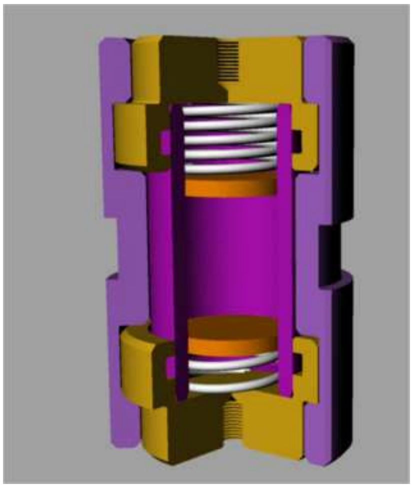

Figure 1. Fusion cell

We built our Fusion Diode by mixing palladium powder and semiconductor powder, in order to obtain a decreasing silicon gradient, and a increasing palladium gradient throughout the tube. This forms a zone of contact (junction) between the semiconductor and palladium. This zone of contact generates a very a large contact surface. Importantly it will be noticed that not only a voltage appears, but that this voltage is concentrated in a thin zone, the junction zone. If the junction thickness is 0.5 micrometer, and the voltage 0.5 volt, the field equals one million volts per meter.

We propose that in this field of one million volts per meter, the deuterium fusion reaction occurs.

Our first diodes were made in glass tubes. At the base of these tubes (0.7 cm in diameter) is welded a platinum wire. Palladium powder is packed around this wire. The powder is then packed using a glass push rod. Finally a glass fibre stopper is put in place to retain the powder but allow the gas to flow. A copper connection passes through this stopper. The glass tube is then placed in a pressure vessel with an electrical connection. See Figure 2.

The terminals of the diode are connected to a datalogger.

This vessel is evacuated, and then filled with deuterium gas.

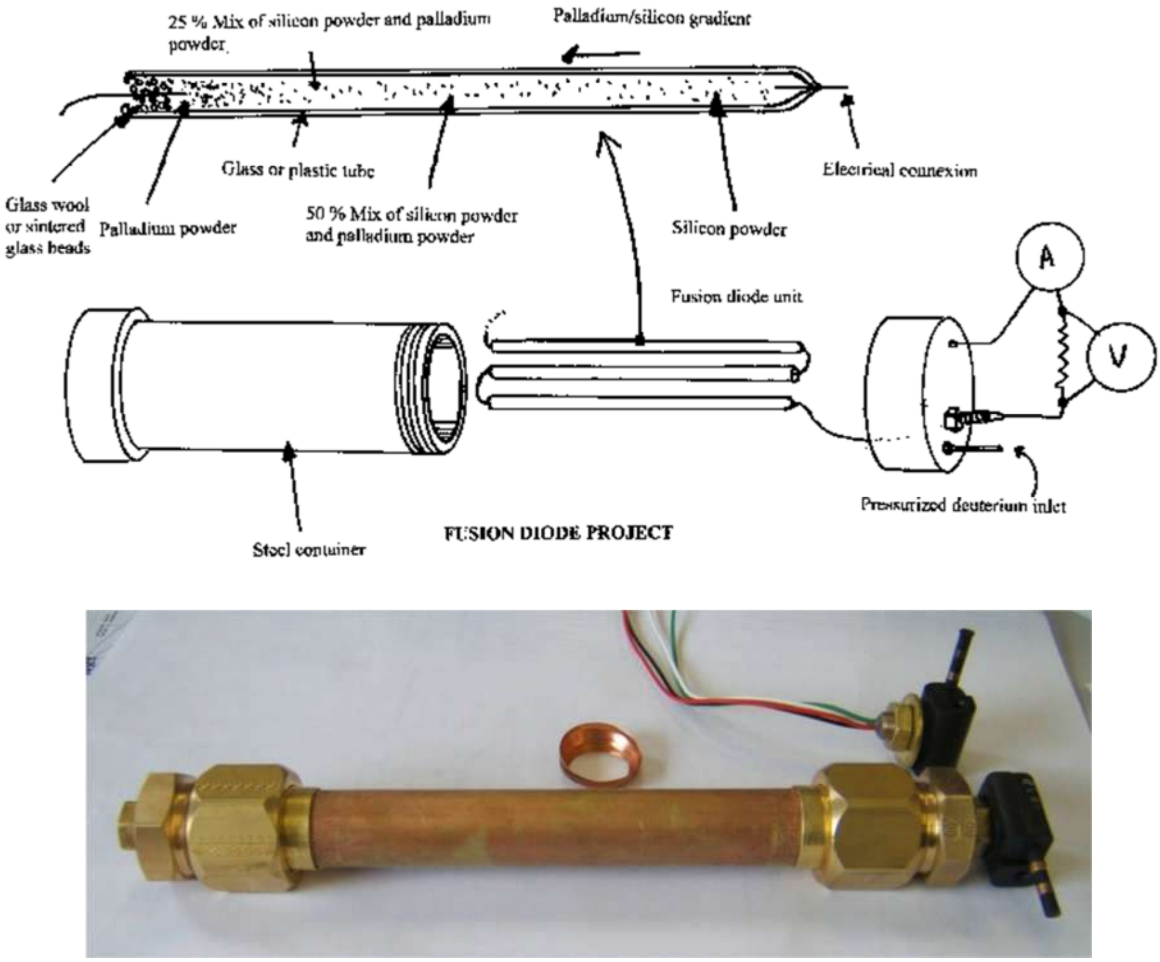

Figure 2. First generation diode and pressure vessel

Figure 3. Diode being prepared.

We developed another procedure using a nylon plastic tube with brass end fittings. Each metal cap contains a strong spring, which compress the powder. The whole device is protected by another polypropylene tube (Fig. 1).

We used Swagelok ™ valves at each end.

Figure 4. Second generation devices.

Results

A. Self-sustained voltage

Once the D_2 is introduced to our device, voltage quickly rises from zero to 0.5V.

To exclude environmental noise, we first use argon as the cell gas and log the cell for a week, following the argon the cell is evacuated, then filled with H_2, and left for a second week. The H_2 is then removed from the cell, which is evacuated and then filled with D_2, and run for a week. The results are shown in Fig. 5.

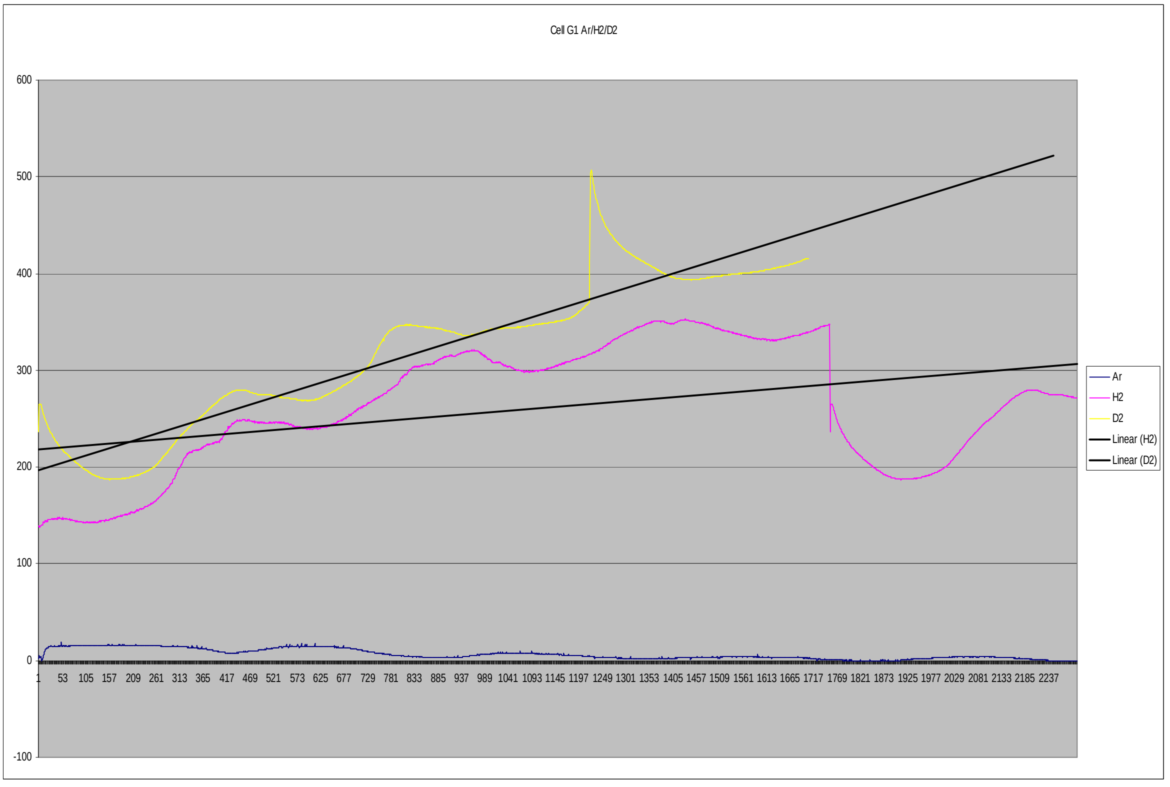

Figure 5. Voltage rise with D_2 and H_2

We conducted a triple-blind test with each diode. The triple-blind results on the chart followed a three week test period. A week on Argon, during which no voltage was observed, a week on H_2, which showed a level of voltage, and a week of D_2 which showed a higher level of voltage.

The argon experiment demonstrated that factors such an external electrical energy, or some galvanic action between the powders of the cell are not the reason for the voltage. However obviously, as a voltage was seen with the H_2 some hydrogen oxidation can not be ruled out.

We know that the H_2 is impure, and there is always 0.03% deuterium present in the gas (mainly in the form of HD molecules). In the palladium, HD dissociate, and we think that the voltage observed with H_2 is the sign of the fusion of the deuterium nuclei. At the end of several weeks, the deuterium stock would disappear and the voltage should decrease.

We get 0.5 volt with D2. Connected to a resistor of the same range than the internal resistance of the diode (some hundred of kilo ohms) we have recorded a power in the microwatt range. After several weeks, the power began to reduce, because there were leaks of deuterium through the "Swagelok" valves.

Summary measurement of radioactivity

Gamma ray measurements. We tested our device with two types of Geiger counters and semiconductor radiation meter. We did not detect any significant radioactivity.

Quick look for neutrons. To look for neutrons, we included some Cadmium into the cell mixture. We placed the cell against a Geiger counter but we did not detect any gamma rays. We were looking for the reaction: $^{113}Cd + n \rightarrow {}^{114}Cd$ + gamma ray

Experiments in progress

We are not sure that what we are seeing is Cold Fusion. We have some indications, but we do not wish to jump to hasty conclusions.

We built a new differential calorimeter, and we hope that this apparatus will be sensitive enough to correlate measurements of current and electric tension (electrical power) with measurement of calorific release.

Here is the principle of our differential calorimeter: Two similar Dewar flasks contain distilled water. Two similar resistance heaters heat the water to 100°C. The water is raised to boiling in both Dewars. The two resistance heaters are placed in series. The fusion device is placed in one of the Dewar flasks, a weight of the same mass in the other one.

Both Dewar flasks are placed on electronic weight scales (Fig. 6). We record the difference of the mass during the experiment. If the atmospheric pressure drops, or if the temperature of the laboratory varies, or if the electric current of heating varies, the variation will be the same in the both Dewar flasks. The device is self-correcting.

Of course, the resistances and the two Dewar flasks are never completely identical, which is why a variable resistance is placed in parallel with one of the flasks. This makes it possible to zero the system before the diode is introduced into the device. The diode is sealed in a glass tube.

Figure 6. Differential calorimeter

Conclusion

For nearly two decades, cold fusion researchers have tried to prove the existence of cold fusion on the basis of empirically produced excess heat. Many mainstream scientists have rejected this, claiming that heat alone is inconclusive. The authors have developed a different approach, in which the device has no input energy, producing energy spontaneously. The diodes are fabricated as powder diodes, with a large surface area of a semiconductor in contact with palladium and charged with deuterium.

The apparent fusion reaction takes place in the junction between the semiconductor and the palladium powder. This produces an excitation which is transmitted to the electrons. This excitation increases their energy and allows them to cross the bandgap of the semiconductor and pass into the conduction band, as with a photovoltaic cell. The energy very quickly appears as a spontaneous potential difference, which can reach over 0.5 volt per junction.

The potential drop concentrated in the junction region (at nano scale) reaches considerable values, higher than a megavolt per meter. This constrains the deuterium nuclei and increases the probability of deuterium fusion. Our observations are compatible with the theories which were presented by the majority of the eminent theorists who have worked on the subject for years. We can quote some: Resonant Tunnelling, Condensates of Bose-Einstein, Diafluidity, Erzions, Polyneutrons, Monopoles, etc...(5),(6) A diode, comprising of a stack of junctions was made, producing over a volt. While it may be possible to obtain many volts with a very compact device, of a few centimetres length, we have never tried this. The released power remains very low for the moment, but it should be noted that it is directly usable electrical energy, not low temperature thermal energy.

The energy density produced by this devices is comparable to that of the first atomic pile at the University of Chicago in 1942 (Chicago-Pile 1): the Fusion Diode has 1 g of palladium, and had an electrical power in the range of the microwatt, giving a mass/power ratio of 10^{-6} W/g. Chicago-Pile 1 weighed 864,000 pounds (nearly 431 tons) and produced 100 W of thermal energy. This was probably peak power, because the reactor was not shielded, and most of the scientists of the Fermi team managed to live to a ripe old age. The Chicago-Pile 1 had a power to weight ratio of 0.25×10^{-6} W/g.

It is important to note that palladium is not the only effective material to obtain fusion reactions. There are other possibilities we have yet to explore. We expect to find in the future other materials which may be even more favourable to the establishment of fusion reactions. We think that we are at the dawn of a new era, such as when Kamerlingh Onnes discovered superconductivity. At that time, the only super conductor was mercury, which loses resistivity at 4 K. With mercury it would be impossible to build the magnets of ITER and of the LHC.

Acknowledgement

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