Development of "DS-Reactor" as the practical reactor of "Cold Fusion" based on the "DS-cell" with "DS-Cathode"

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METHOD OF PRODUCING ULTRAHIGH PRESSURE GAS

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ABSTRACT
A method of producing ultrahigh pressure gas statically and stably without using a dynamic driving unit such as a pump. A container formed with a closed space is made of a palladium, which is a metal having a high permeability to hydrogen and deuterium. A solution present around the container is electrolyzed by producing an electric field between the container which serves as a cathode and an anode. The gas element produced by electrolysis penetrates into the container body, so that the hydrogen/deuterium ion concentration in the container increases. The solid-air equilibrium reaction is carried out until the ion concentration increases to a level at which the pressure in the closed space reaches a predetermined ultrahigh level. Thus, an ultrahigh pressure gas is produced in the closed space of the container.

3 Claims, 6 Drawing Sheets

Sample enclosed inside high vacuum Pd vessel
This white space becomes ultrahigh pressure D₂ gas (~10⁴ atm) in this patent

"DS-Cathode" / "DS-Cell" For Cold Fusion
Reaction between the patent of producing ultrahigh pressure and "DS-Cathode"

This is US-patent, method of producing ultrahigh pressure; and it is realized by extremely pure deuterium with ultra-high over ten thousand atmospheric pressure using electrolytic method. 50 years ago, in 1933, for the first time in Japan, we started the thermonuclear fusion experiment by generating several million centigrade degree with a current of several million Ampere, which were the highest current and temperature in the world at that time. But Japanese could not buy deuterium gas in the market place at that time. Then, we generated deuterium gas by the same system of this device, which I made by myself. This event was described in a US-magazine of the twenty-first (21st) century science and technology in detail. Then, I thought this device could be used for cold fusion, and I named it "DS-cathode"/"DS-cell", then you can easily understand relation between this US patent and "DS-cathode" from this figure.
Fig [1]: “DS-Reactor” was developed based on the “DS-cell”, that is the same principle in both methodologies. “DS-Reactor” corresponds to “DS-cell” without electrolysis, and it is considered “DS-Reactor” includes A and B Systems.
1. Principle of "DS-Reactor" (Relation between "DS-cathode" and two types of "DS-Reactors")

It is well known that "DS-cell" with the "DS-cathode" established completely the evidence on the existence of solid-state nuclear fusion ("cold fusion") through the generation of reaction products (helium and excess energy). In this case, however, the excess energy could not exceed the input energy to the DS cell, so that it is difficult to be used as practical reactor; that is, it has so bad "efficiency" as a reactor.

Consequently, because we had an idea that most of the input energy was consumed inside the electrolyte as energy loss, we proposed a new concept which is a new DS-cell with no electrolyte.

We call this new type DS-cell with no electrolyte as "DS-Reactor". But the principle is the same as shown in Fig. 1. "DS-Reactor" exhibited nice results as we expected.

Two types of "DS-Reactors" as shown in Fig. 1, are invented from "DS-cell". Upper side figure shows the usual "DS-cell" and the lower side describes A-type (left side) and B-type (right side) of "DS-Reactors". Both "DS-Reactor" are constructed with stainless vessel as outside vessel and Pd vessel as inside vessel as shown in the lower-side diagram.

D₂/H₂ gas is supplied to the blue zone space with high vacuum conditions as indicated in A-type/B-type DS-Reactors and kept to pressure (P [atom]) and Temperature (T [°]), that is, (Pout, Tout) in A type Reactor and (Pin, Tin) in B type Reactor. Samples are set to in the white color zone space in both reactors, and after that, the samples and white space are kept in high vacuum condition with the same condition in white zone of DS-Cell (upper-side diagram).

Recently, we performed four kinds of experiments using the A type "DS-Reactor". I will explain the detail of these experiments now. We changed experimental conditions by setting different samples in the inside vessel with white zone and different gases in the outside vessel with blue zone.
Fig [2] Characteristics of "DS-Reactor" without sample during D₂ gas charge.
2. "Experiment-1" ([A]: no sample+D₂)

This is the first set of the experiment. "Experiment-1"; (A). In this case, inside the Pd vessel (white zone) is vacant and D₂ gas filling up with 40 [atom] as that P_out outside Pd vessel (blue zone) as the set-conditions before the experiment.

When D₂ gas under P_out of 40[atom] is heated to 140[°C] as the giving temperature (T_out=140°C), Pd vessel is heated by such D₂ gas. accordingly, temperature of Pd vessel never goes higher than the D₂ gas. When Pd vessel reaches to 70°C ≤ 100°C, D₂ molecules passing through the wall of Pd vessel as D⁺ and enter inside the Pd vessel as D atom and becomes to mixed gas (D+D₂(=D+D)) as time passes.

As a final result, inner temperature of Pd vessel (white zone), T_in, never exceed the temperature outside of the Pd vessel (blue zone), T_out, that is T_out > T_in. These results were exactly confirmed by the experiment shown in Fig [2], Namely. experimental results upper side in Fig [2] indicates that relation between D₂ gas pressure (P_out=40[atom]) and temperature (T_out=140°C) which were supplied into the out side Pd-vessel with blue zone and the penetrated inner D(D₂) gas pressure (P_in) and temperature (T_in) inside the Pd vessel with (white zone), In other words, (P_in, T_in) never exceeds (P_out, T_out): P_in < P_out and T_in < T_out.

In the lower side , only the scale of the temperature axis of upper side is enlarged to give distinct difference between T_out and T_in.
Fig [3] Comparison between Figs [A], [B], [C] and [D].
3. "Experiment-2" ([B]: sample+H$_2$) (Pd black)

This is the second set-condition, "Experiment-2"; (B).
This means Pd black is set as a sample inside the Pd vessel (white zone) and kept under high vacuum condition, and H$_2$ gas filling up with 40 [atom] as the P$_{out}$ outside the Pd vessel (blue zone) as the set-conditions before experiment.
The experiment was performed under the same process of "Experiment-1"; (A).
When H$_2$ gas is given with P$_{out}$ of 40 [atom] and T$_{out}$ of of 140 $^\circ$ inside the blue zone, H atoms penetrated into the Pd vessel are absorbed inside the Pd black, and at this time, temperature difference $\Delta$T as T$_{out}$-T$_{in}$ becomes a little smaller than that in "Experiment-1"; (A) as shown in experimental date compared the relation between date A and B in diagram Fig. [3].
As a result, inner temperature T$_{in}$ was always lower than given temperature T$_{out}$; T$_{out}$ > T$_{in}$.
And both temperatures were never reverted. This result is extremely important.

4. "Experiment-3"([C]: sample+D$_2$) and "Experiment-4"([D]: sample+D$_2$) (Pd black) (nano-Pd)

This is the third set-condition, "Experiment-4" ; (D), with sample Pd black+D$_2$.
This means D$_2$ gas is used instead of H$_2$ gas under the same condition as "Experiment-2"; (B).
As a result, wonderful phenomena were produced that temperature inside Pd vessel (T$_{in}$*) becomes higher than the giving temperature, T$_{out}$, when the D$_2$ gas supplied into the blue zone (outside of Pd vessel), that is;
T$_{in}^*$ > T$_{out}$.

Experiment's data can be compared with C and B in "Experiment-3"; (C) and A in "Experiment-2"; (B). That is, compared with the functions of H$_2$ gas, D$_2$ gas induced "temperature inversion" inside the Pd vessel (white zone) against the giving temperature (T$_{out}$) when the D$_2$ gas supplied to outside Pd vessel (blue zone). This result means generation of "pycnodeuterium nuclear reaction" inside Pd vessel (white zone).
This is the forth-set condition, "Experiment-4"; (D) with Sample of "nano Pd"+D$_2$.
We have already reported that D$_2$/H$_2$ gas can be much more absorbed inside nano Pd than Pd black and innumerable "pycnodeutrium" can be included inside nano Pd.
We have expected that nano Pd is better than Pd black as a sample because we have obtained that nano Pd generated excess heat with much higher rate than that of Pd black using "DS-cell" with "DS-cathode". Experimented date can be compared with P in "Experiment-4"; (D) and C in "Experiment-3"; (C), and T$_{in}$ becomes considerable higher than T$_{out}$ in case of D experiment against C experiment.
It is concluded that "DS-Reactor" will be workable as a "practical reactor".
Fig [4] Illustration of fundamental characteristics between gaseous temperature (T_{in}, T_{out}) and pressure (P_{in}, P_{out}) in “DS-Reactor”.
5. Fundamental Characteristics between (T_{in}, T_{out}) and (P_{in}, P_{out})

This is the summary of the experimental data of the temperatures and the pressures demonstrated through "Experiments-1, 2, 3, and 4".

Without D_{2} or without sample such as Pd fine powder, T_{in} never went higher than the given temperature T_{out}. On the other hand, when the samples absorbed pycnodeuterium, then T_{in} was always higher than T_{out}, that is temperature inversion. It is also noted that the degree of this excess of temperature depends on the type of the host material; that is whether the host materials can absorb much pycnodeuterium or not. In other words, "DS-Reactor" certainly displayed the same basic characteristics as "DS-Cell" but it gave the excellent characteristics as the fusion reactor much more clearly.
“Conclusion”

The present situation of “DS-Reactor” as the practical reactor of “Cold Fusion”.

Generation of Nuclear energy inside Pd-vessel

\[ T = T_{in} + T^{*}_{in} \]

Temperature given to outside (\(D_2/H_2\) gas) of Pd-reactor vessel \(T_{out} \geq 100^\circ C\)

Never Nuclear Reaction

This given energy is collectable
6. "Conclusion"

This is conclusion of the experiments already described, and demonstrates the present situation of "DS-Reactor" as the practical reactor of "Cold-Fusion". From the left side, these dots correspond to "Experiments-1, 2, 3 and 4" on the horizontal line. The vertical axis represents the $T_{in}$, which is inner temperature in the blue zone of the DS-reactor.

For "Experiments 1 and 2", $T_{in}$'s are lower than $T_{out}$, that is, the efficiencies were always negative. For "Experiments 3 and 4", $T_{in}$'s are higher than the given temperature $T_{out}$. This means that efficiency was always positive because almost of the input energy was collectable.

It is emphasized that $T_{in}$ for Experiments 1 and 2 are lower than $T_{out}$ and higher for "Experiments 3 and 4". The excess energy obtained with the experiments 3 and 4 should come from deuterium nuclear fusion reaction.

I would like to ask you;

Other than fusion, what else explanation would you think of this result?

I my self conclude that this should be from fusion. And I think the "DS-Reactor" demonstrated to reach the practical level with high efficiency.

Principles of the DS-Reactor is the same as that of DS-cell with "DS-cathode". In DS-cell, electrolyte is used essentially then most of the input energy is absorbed inside the electrolyte itself. Consequently, "DS-cell" is an excellent system to demonstrate exactly the existence of cold fusion but gives a bad "efficiency" as a reactor and "DS-Reactor" which is "DS-cell" with no electrolyte will be utilized as a practical reactor, I hope. Thank you!