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

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United States Patent [19]

Arata

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[54] **METHOD OF PRODUCING ULTRAHIGH PRESSURE GAS**

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[30] **Foreign Application Priority Data**

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[51] Int. Cl.[6] B01D 53/00; B01D 53/32

[52] U.S. Cl. 205/763; 205/765

[58] Field of Search 205/763. 764, 205/765

[56] **References Cited**

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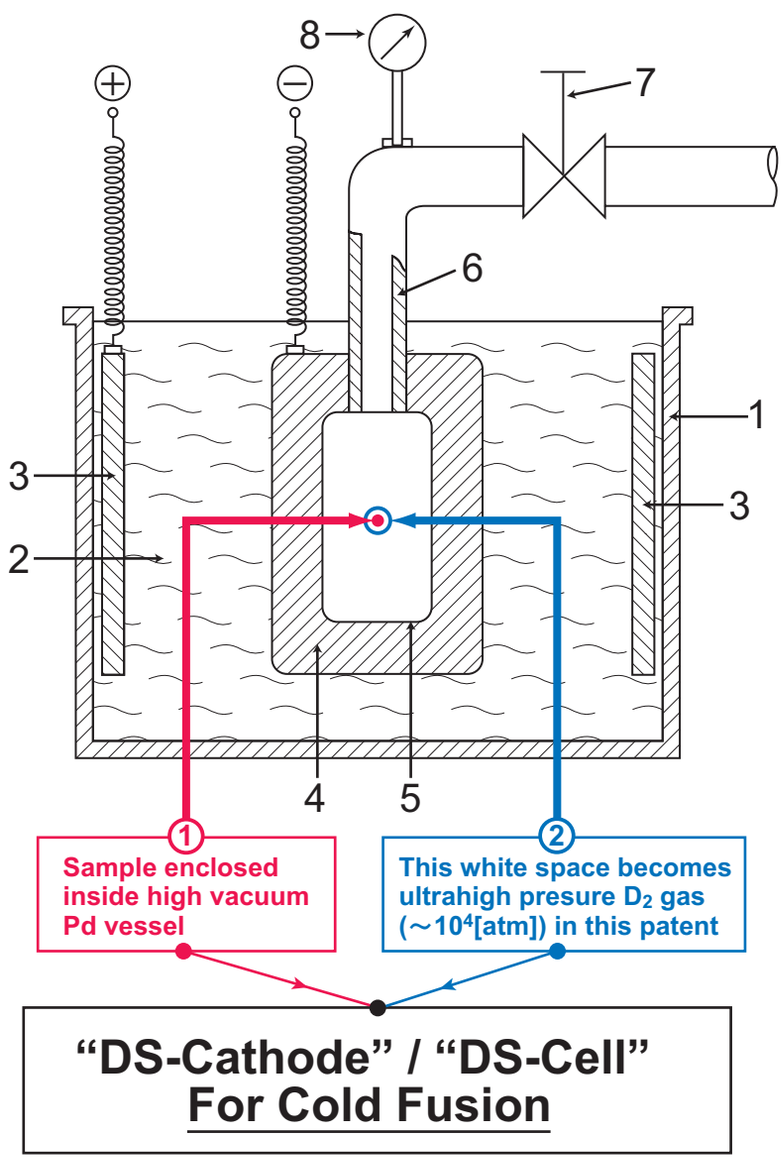
[57] **ABSTRACT**

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



Reaction between the patent of producing ultrahigh pressure and "DS-Cathode"

This is US-patented method of producing ultrahigh pressure; it is realized by extremely pure deuterium with ultra-high pressure (over ten thousand atmopheres) 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. We generated deuterium gas by the same system of this device, which I made by myself. This event was described in detail in a US magazine, 21st Century Science and Technology. I thought this device could be used for cold fusion, and I named it "DS-cathode"/"DS-cell." You can easily understand relation between this US patent and "DS-cathode" from this figure.

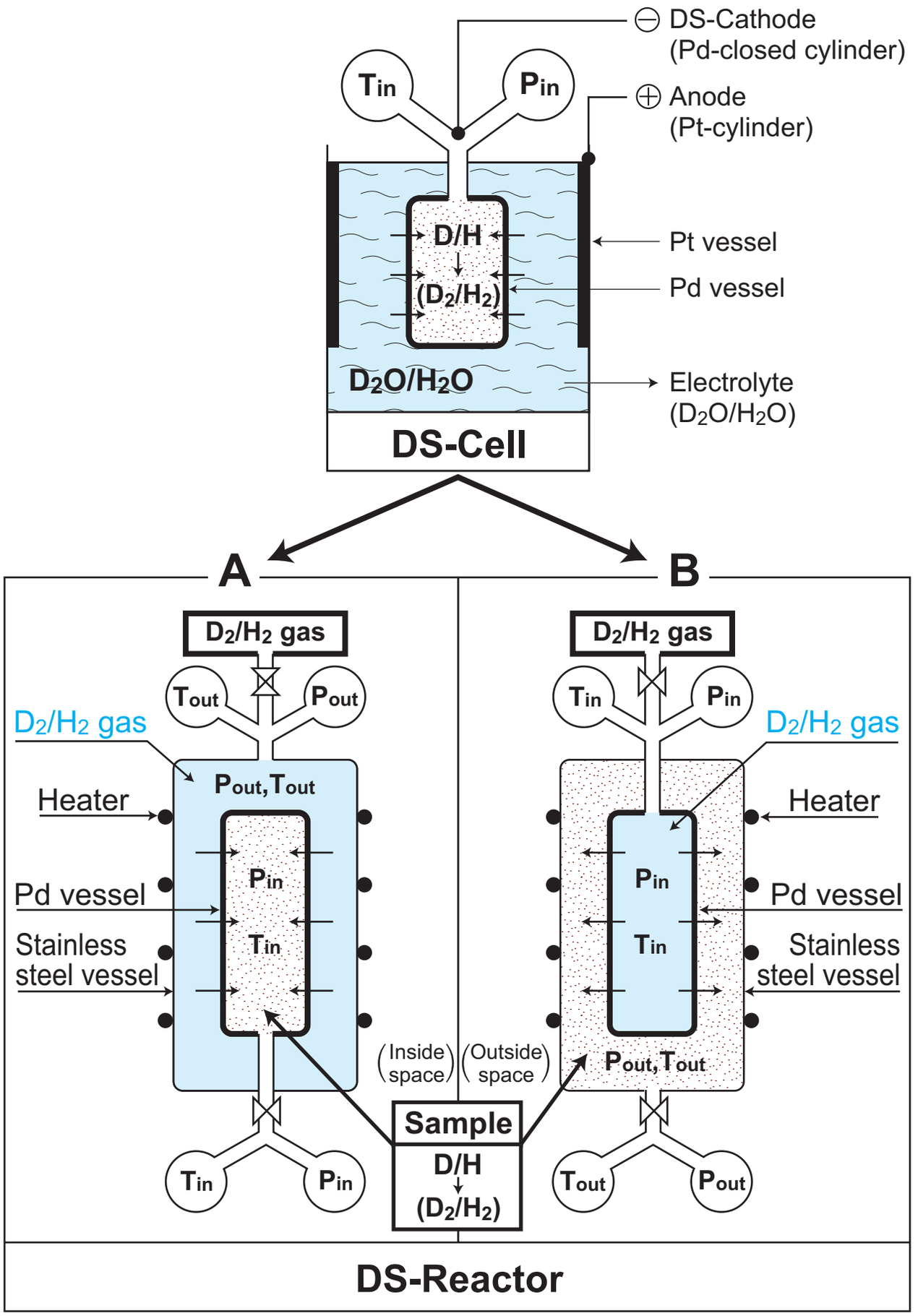


Fig [1] : “DS-Reactor” was developed based on the “DS-cell”, that is the same principle in both methodes. “DS-Reactor” corresponds to “DS-cell” without electrolysis, and it is consider “DS-Reactor” includes A and B Systems.

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 very poor 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.
D_2/H_2 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, (P_{out}, T_{out}) in A type Reactor and (P_{in}, T_{in}) 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.

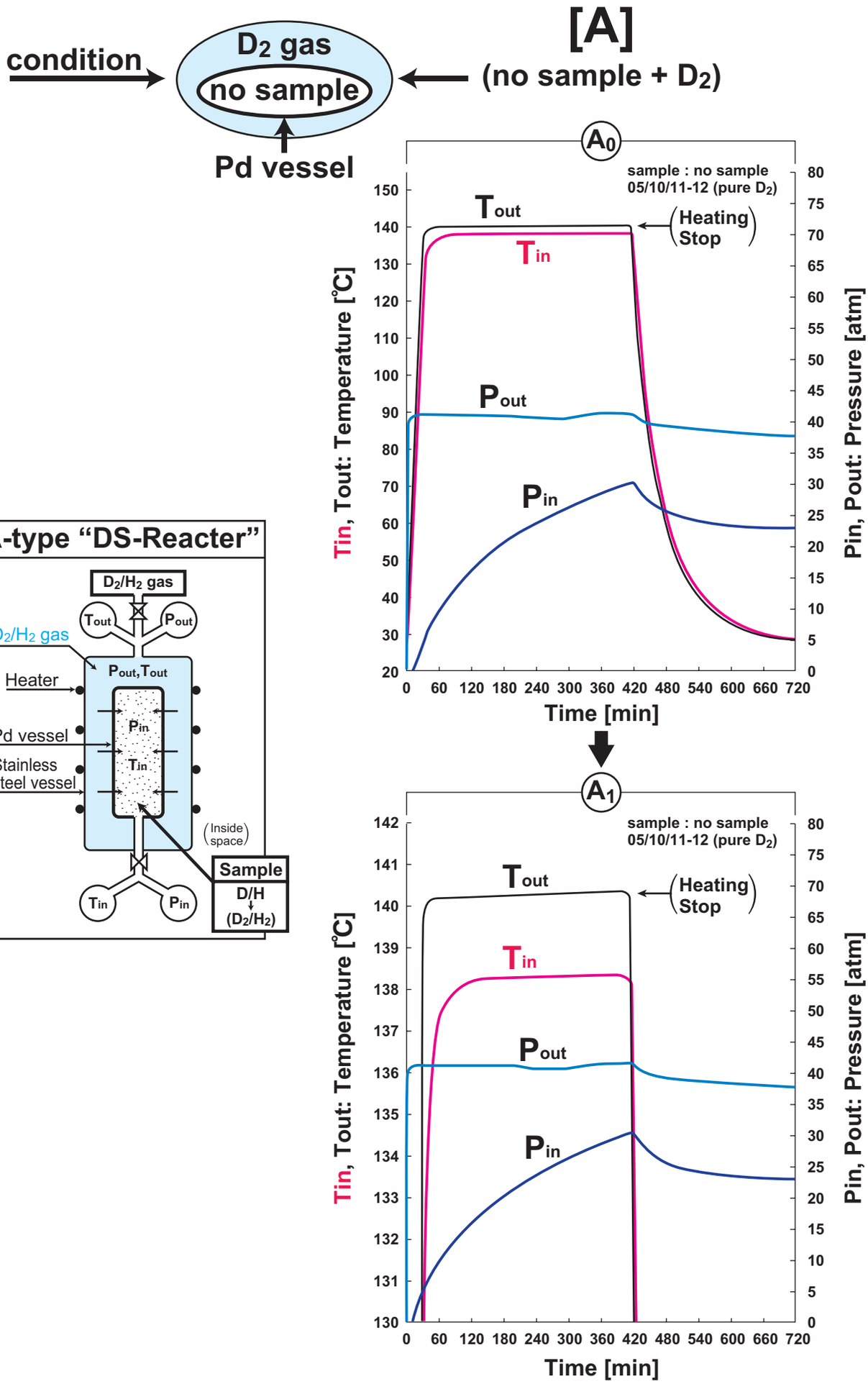


Fig [2] Characteristics of "DS-Reactor" without sample durring D_2 gas charge.

2. "Experiment-1" ([A]: no sample+D_2)

This is the first set of the experiment. "Experiment-1"; (A). In this case, inside the Pd vessel (white zone) is vacant and D_2 gas filling up with 40 [atom] as that P_{out} outside Pd vessel (blue zone) as the set-conditions before the experiment.
When D_2 gas under P_{out} of 40[atom] is heated to 140[℃] as the giving temperature (T_{out}=140℃), Pd vessel is heated by such D_2 gas. Accordingly, temperature of Pd vessel never goes higher than the D_2 gas. When Pd vessel reaches to 70℃～100℃, D_2 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+D_2(=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 Ⓐ$_0$ upper side in Fig [2] indicates that relation between D_2 gas pressure (P_{out}=40[atom]) and temperature (T_{out}=140℃) which were supplied into the outside Pd-vessel with blue zone and the penetrated inner D (D_2) 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 Ⓐ$_1$, only the scale of the temperature axis Ⓐ$_0$ shown in upper side is enlarged to give distinct difference between T_{out} and T_{in}.

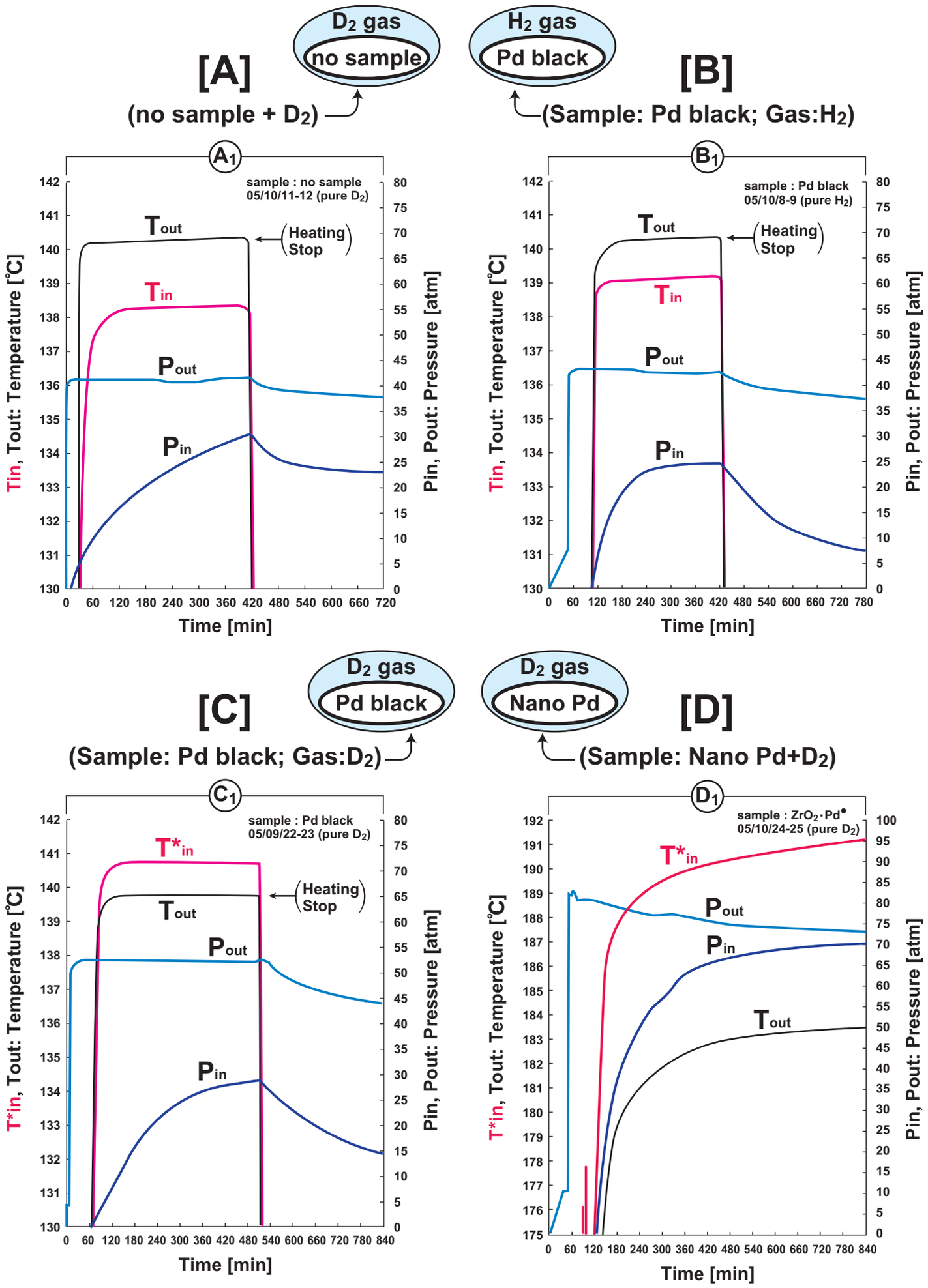


Fig [3] Comparison between Figs [A], [B] [C] and [D].

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 140℃ inside the blue zone, H atoms penetrated into the Pd vessel are absorbed inside the Pd black, and at this time, temperature difference ΔT 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 (A1) and (B1) in diagram Fig. [3].
As a result, inner temperature T_{in} was always lower than given temperatue 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;

$$T^* > T_{out}.$$

Experiment's data can be compared with (C1) in "Experiment-3"; (C) and (B1) 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 (D1) in "Experiment-4"; (D) and (C1) in "Experiment-3"; (C), and T_{in} becomes considerable higher than T_{out} in case of (D1) experiment against (C1) experiment.
It is concluded that "DS-Reactor" will be workable as a "practical reactor".

“Summary”

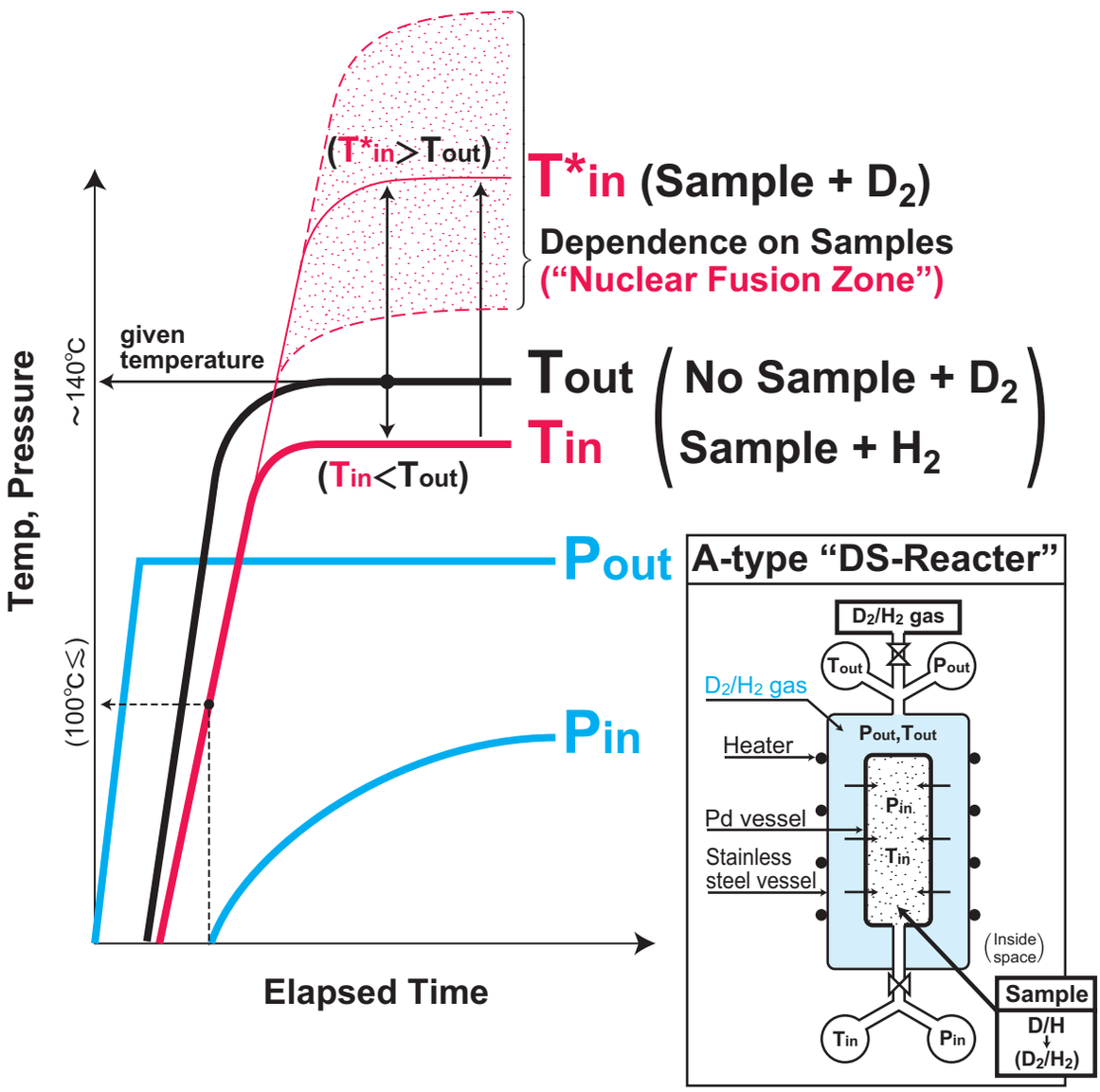


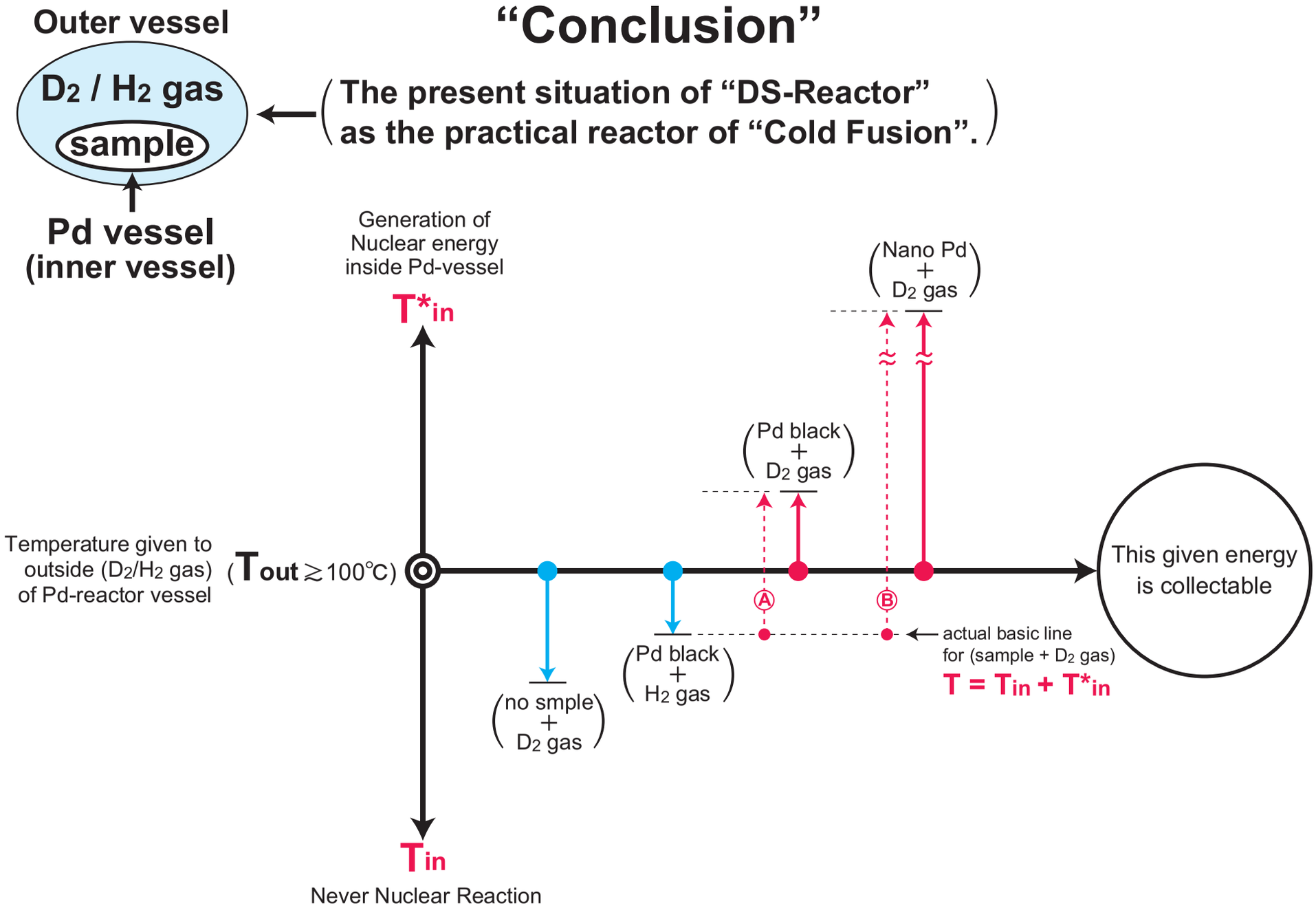
Fig [4] Illustration of fundamental characteristics between gaseous tempereture (Tin, Tout) and pressure (Pin, Pout) in “DS-Reactor”.

5. Fudamental 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 temprature 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”


Outer vessel
D2 / H2 gas
sample
Pd vessel
(inner vessel)
The present situation of “DS-Reactor”
as the practical reactor of “Cold Fusion”.
Generation of
Nuclear energy
inside Pd-vessel
T*in
(Nano Pd
+
D2 gas)
(Pd black
+
D2 gas)
Temperature given to
outside (D2/H2 gas)
of Pd-reactor vessel
(Tout ≳ 100℃)
This given energy
is collectable
A
B
actual basic line
for (sample + D2 gas)
T = Tin + T*in
(Pd black
+
H2 gas)
(no smple
+
D2 gas)
Tin
Never Nuclear Reaction

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!