Department of Energy
Office of Scientific and Technical Information
Post Office Box 62
Oak Ridge, Tennessee 37831

August 10, 2016

Re: OSTI-2016-01064-F

Dear Mr. Ravnitzky:
This is in final response to the request for information you sent to the Department of Energy (DOE), Office of Scientific and Technical Information (OSTI) under the Freedom of Information Act (FOIA), 5 U.S.C. 552 on June 22, 2016.

You requested a "copy of records, electronic, or otherwise, of each letter TO and FROM universities, companies, and organizations, from the OSTI 'cold fusion' documents collection." On July 11, 2016, you were emailed an interim response letter informing you of the need for OSTI to obtain release authorization from the Department of Energy. OSTI received notification to release the letters to you in their entirety on August 8, 2016. As a result, OSTI is releasing 72 cold fusion letters in this mailing on a CD-ROM because of the volume and file size of the PDFs.

In addition, there are approximately 13 letters that are currently being reviewed by the DOE's General Counsel Office (GC) for release or redaction. Upon receipt of guidance from GC, OSTI will release in whole or in part.

This decision, as well as the adequacy of the search, may be appealed within **90** calendar days from your receipt of this letter pursuant to 10 C.F.R. § 1004.8. Appeals should be addressed to Director, Office of Hearings and Appeals, HG-1, L'Enfant Plaza, U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, D.C. 20585-1615. The written appeal, including the envelope, must clearly indicate that a FOIA appeal is being made. You may also submit your appeal to OHA.filings@hq.doe.gov, including the phrase "Freedom of Information Appeal" in the subject line. The appeal must contain all of the elements required by 10 C.F.R. § 1004.8, including a copy of the determination letter. Thereafter, judicial review will be available to you in the Federal District Court either: 1) in the district where you reside; 2) where you have your principal place of business; 3) where DOE's records are situated; or 4) in the District of Columbia.

You may contact OSTI's FOIA Public Liaison, Charlene Luther, Office of Preservation and Technology at 865.576.1138 or by mail at the Department of Energy, Office of Scientific and Technical Information, 1 Science.gov Way, Oak Ridge, TN 37830 for any further assistance and to discuss any aspect of your request. Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services they offer.

The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, Maryland 20740-6001, e-mail at ogis@nara.gov; telephone at 202-741-5770; toll free at 1-877-684-6448; or facsimile at 202-741-5769.

If you have any questions about the processing of the request or about this letter, please contact Madelyn M. Wilson at

Sincerely,

Madelyn M. Wilson
FOIA Officer
DOE OSTI
1 Science.gov Way
Oak Ridge, TN 37830

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· Cold Fusion ·

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10 APR 97

Dr. Walter Polansky
Department of Energy
ER-16; F-240
Washington, DC 20585

Dear Dr. Polansky,

Enclosed is a copy of Drs. Arata and Zhang's latest paper on cold fusion. I think that their clear-cut measurement of an anomalously high helium-3/helium-4 isotope ratio in gases embedded in palladium following heat production will convince fellow physicists of the reality of lattice-induced nuclear fusion. Also they have had 6 successful excess heat runs out of 6 tries. Please let me know if ER becomes interested in cold fusion work. We sponsored Drs. Arata and Zhang's visit to the US last June, and I visited their laboratory in October. I have photographs of their lab. We are anxious to do some experimental work, but need some start-up support. Do you have a research need toward which such work could be directed?

I think we now have a pretty good understanding of cold fusion theory. Scott Chubb and I presented 3 talks at the March APS meeting in Kansas City, which were well received. Copies of the Abstracts are enclosed.

Thanks,

Talbot A. Chubb

Talbot A. Chubb
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O18.01

Abstract Submitted
for the MAR97 Meeting of
The American Physical Society

Sorting Category: 38.b

Paired-Particle Coherence in a Lattice S.R. CHUBB, T.A. CHUBB, *Oakton International Corporation, 5023 N 38 St, Arlington, VA 22207* — The many- body wave functions $\phi(r_1,...,rn)$ for non-interacting band state particles in an ordered solid preserve lattice symmetry: $|\phi(r_1+R_n,r_2+R_j....)|=|\phi(r_1,r_2...)|$ for arbitrary lattice vectors R_n and R_j. These states manifestly exhibit a form of coherence with respect to outside perturbations that preserve periodic order. When two, initially non-interacting band state particles are allowed to interact with each other, it is possible for their mutual Coulombic repulsion to be constrained in a manner that also preserves periodic order. Implications associated with the resulting coherence are discussed.

Scott R. Chubb
chubb@ccf.nrl.navy.mil
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[X] Prefer Oral Session
[ ] Prefer Poster Session

Special instructions: Please put in same session as T.A. Chubb and S.R. Chubb "2-Deuteron Wave Function" paper

Date submitted: December 6, 1996 Electronic form version 1.1

018.02

Abstract Submitted
for the MAR97 Meeting of
The American Physical Society

Sorting Category: 38.b

Small Crystals Aid Cold Fusion T.A. CHUBB, S.R. CHUBB, *Oakton International Corporation, 5023 N 38 St, Arlington, VA 22207* — The 1996 world meeting on cold fusion in Hokkaido, Japan (ICCF6) provided strong evidence that the nuclear product of radiationless cold fusion in a lattice is ^{4}He. Arata and Zhang[1,2] at Osaka University observed ^{4}He in thermal desorption studies of deuterided Pd powder that had produced 5 kWh/g excess heat; non-deuterided powder showed no ^{4}He. Gozzi et al.[3] at the University of Rome observed ^{4}He correlating with excess heat power over a thousand hour time period in the gas flow from an open-cell D_2O electrolysis cell, using a bundle of 150 0.25-mm Pd wires as the cathode. Arata and Zhang used a "double structure" cathode consisting of a Pd-metal bottle, evacuated and filled with Pd black (0.4 micron powder)[1,2]. They have recorded excess heat from 6 out of 6 cathodes. We attribute the cold fusion successes to use of small Pd grains. Deuterons coherently occupying ordered regions in a metal matrix are predicted to produce heat at higher power density with decreasing crystal size[4].

[1]Y. Arata and Y-C Zhang, *Proc. Japan Acad.* **71B**, 304 (1995).
[2]Y. Arata and Y-C Zhang, *Proc. ICCF6*, to appear (1997).
[3]D. Gozzi et al., *Proc. ICCF6*, to appear (1997).
[4]T.A. Chubb and S.R. Chubb, *Proc. ICCF6*, to appear (1997).

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[X] Prefer Oral Session
[ ] Prefer Poster Session

Date submitted: December 6, 1996 Electronic form version 1.1

018.06

Abstract Submitted
for the MAR97 Meeting of
The American Physical Society

Sorting Category: 38.b

2-Deuteron Wave Function T.A. CHUBB, S.R. CHUBB, *Oakton International Corporation, 5023 N 38 St, Arlington, VA 22207*
— The 2-particle wave function describing electrostatically interacting deuterons in an external field is a 6 degree-of-freedom function, describable in center-of-mass r_{cm} and separation r_{12} vector coordinates. Consider the case where the external field is periodic and r_{cm} and r_{12} can be treated as separable. Then, $Y(r_{cm},r_{12}) = F(r_{cm})\ g(r_{12})$. The function $g(r_{12})$ can be called a dimming function since, when r_{12} approaches 0, $|Y(r_{cm},r_{12})|$ approaches a minimum value. $g(r_{12})$ has a cusp in separation space at r_{12}=0. When $Y(r_{cm},r_{12})$ has lattice symmetry, $|F(r_{cm}+R_n)|=|F(r_{cm})|$, where R_n is any lattice vector. The question to be answered is whether lattice symmetry also requires $|g(r_{12}+R_m)|=|g(r_{12})|$, where R_m is any lattice vector, i.e., whether $g(r_{12})$ has a cusp in every unit cell in separation space. It can be shown that if $g(r_{12})$ has Bloch symmetry for band state deuterons in a metal crystal lattice and if the Coulomb repulsion interaction vanishes outside a screening radius r_{sc} less than half the edge of a unit cell, then the energy-minimizing 2-deuteron wave function provides d-d overlap and there is no Coulomb barrier to fusion.

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[X] Prefer Oral Session
[ ] Prefer Poster Session

Special instructions: Please put in same session as S.R. Chubb and T.A. Chubb "Paired-Particle Coherence in a Lattice" paper

Date submitted: December 6, 1996 Electronic form version 1.1

Helium ($^4_2$He, $^3_2$He) within Deuterated Pd-black

By Yoshiaki ARATA, M. J. A., and Yue-Chang ZHANG

Osaka University, 11-1 Mihogaoka, Ibaraki, Osaka 567

(Communicated Jan. 13, 1997)

Abstract: Authors have clearly proven for the first time that deuterium nuclear reaction was continuously generated inside a highly deuterated solid by showing both of the excess energy and corresponding amount of helium as the reaction product generated simultaneously. Whenever there is a nuclear fusion reaction inside a metal, helium generated is unable to escape to the surroundings and is trapped in a frozen state inside that metal. The concentration of the helium within the metal will rise with increasing rate of reactions. Pd-black is under such state as the sample used and sealed within the "closed QMS" developed by the authors (closed vessel including the Getter pump and the QMS). It is completely separated from the surroundings and the internal gases are removed to create super-vacuum. The reaction product released by the "Sample-Heating" process (room temp. $\rightleftarrows$ 1500[°C]) is thus the only matter which occupies the interior of the closed vessel and its detection by the QMS is assured. When the "closed QMS" works under the above mentioned-state, it was clarified that the "ash" or the reaction product of this fusion reaction within a solid is $^4_2$He and $^3_2$He and their ratio is $^4_2$He / $^3_2$He≈4. It can be concluded from the result that the main reaction product is $^4_2$He and it is created directly as an inherent feature of the solid-state nuclear fusion. Authors think that the reaction process responsible for the creation of $^3_2$He may be a different one from that creates $^4_2$He. One of which is the Rutherford reaction process and the other occurs based on the specific properties of solid, similar to the case of $^4_2$He. The existence of $^3_1$T will be required that the process is responsible for the generation of $^3_2$He as the Rutherford reaction. The proof for the existence of $^3_1$T within the "closed QMS", however, was not obtained in this experiments.

Key words: Helium ($^4_2$He, $^3_2$He); cold fusion; Pd-black; closed QMS; coupled spectrum.

Introduction. Authors[1] have developed the "closed QMS" (Quadrupole Mass Spectrometer and Getter pump) and used highly deuterated Pd-black as the sample sealed within this closed vessel. The process in which helium ($^4_2$He) is suddenly released from this sample at high temperature was reported in detail in authors previous reports.[1] It was also identified that $^3_2$He is released at the same time and the ratio of the two is $^4_2$He / $^3_2$He≈4. Details were omitted and only results were mentioned in the previous report.[1] This report will look further into the process of that experiment.

Experiment. As stated in the previous report,[1] elements released from highly deuterated sample placed in the "closed QMS" with high vacuum ($\approx 3\times10^{-9}$ [Torr]) is trapped inside the apparatus indefinitely. Helium will continue to exist under the effect of the "Getter action", but the hydrogen series elements and others vanish or diminish to the limit of the "Getter action's" functional limit. Thus the existence of helium ($^4_2$He, $^3_2$He) is easily and accurately determined.

Fig. 1 is the experimental data which points out this fact. It shows the chronological change of the elements with mass M_4 and M_3 (=M / e) released from the highly deuterated sample within the "closed QMS". M_4 includes $^4_2$He and "D_2" (and also DH_2, TH but these elements ≪ "D_2" even if they exist), and M_3 includes $^3_2$He and "DH" (and also $^3_1$T, "H_3" ≪ "DH" even if they exist). It may be concluded that M_4 is "D_2" and $^4_2$He and that M_3 is "DH" and $^3_2$He.

M_3 is much common than M_4 and it is estimated that "DH" outnumbers D_2 at the starting Qs. The chronological change for the spectra of M_4 is shown in Fig. 2 (A). D_2 and $^4_2$He form a "coupled spectrum" and the process of releasing of these elements is observed clearly. D_2 diminishes rapidly as time passes and $^4_2$He increases gradually reaching a constant level after no

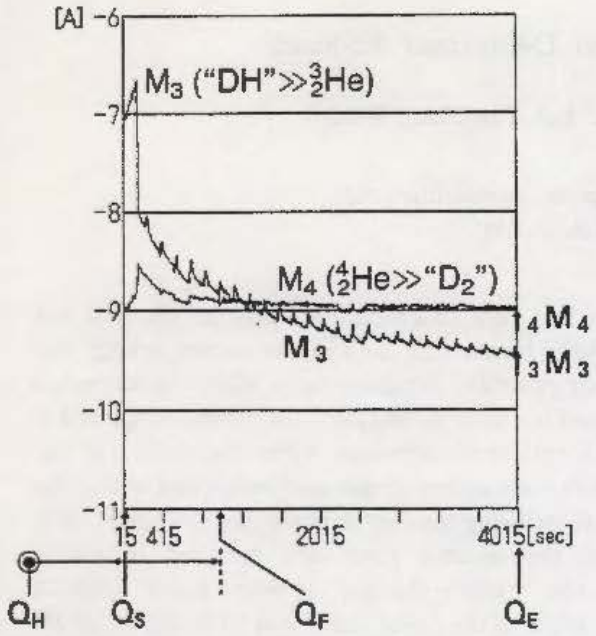


Fig. 1. Chronological intensity change of M_4 and M_3 inside "closed QMS". Note: Q_H: Sample was heated to 1300[°C] at high vacuum ($\simeq 3\times10^{-9}$ [Torr]) inside the closed vessel including only the sample and the Getter pump. Q_S: Starting point of measurement with the "closed QMS", that is 1[min] after Q_H, and the closed vessel is connected with the "QMS" in a high vacuum ($\simeq 3\times10^{-9}$ [Torr]). Q_F: "Sample-Heating" stops and the temperature drops from 1300[°C] to room temperature. Q_E: "Coupled spectrums" were measured at this point such as those in Fig. 2(B).

more $^4_2$He is released. The intensity of the spectra from M_3 and M_4 reverses as time passes and $M_4 \gg M_3$ is achieved. This is shown in Fig. 2 (B) as the chronological changes of coupled spectrums of M_4 and M_3, that is M_4 is comprised of $^4_2$He alone and M_3 contains both $^3_2$He and "DH".

Authors developed other method to verify the existence of helium ($^4_2$He, $^3_2$He) and their ratio ($^4_2$He / $^3_2$He). Elements of interest for this study are those with mass M_2, M_3 and M_4 described below:

A-group: M_2 ("H_2" ≫ D), M_3 ("DH" ≫ T even if it exists), M_4 ("D_2" ≫ TH even if it exists), (A)

B-group: M_2 (nothing), M_3 ($^3_2$He), M_4 ($^4_2$He), (B)

C-group in M_3 ("DH" in A-group and $^3_2$He in B-group). (C)

where A, B and C-groups are classified as follows, when their ionizing voltage are considered.

A-group: hydrogen-series=(H,D, T), (H_2, D_2, T_2), (DH, TH, DT), (D_2H, DH_2, T_2H, TH_2, T_2D, TD_2), (H_3, D_3, T_3), (D)

B-group: helium-series=($^3_2$He), ($^4_2$He), (E)

C-group: mix-series of A and B-groups. (F)

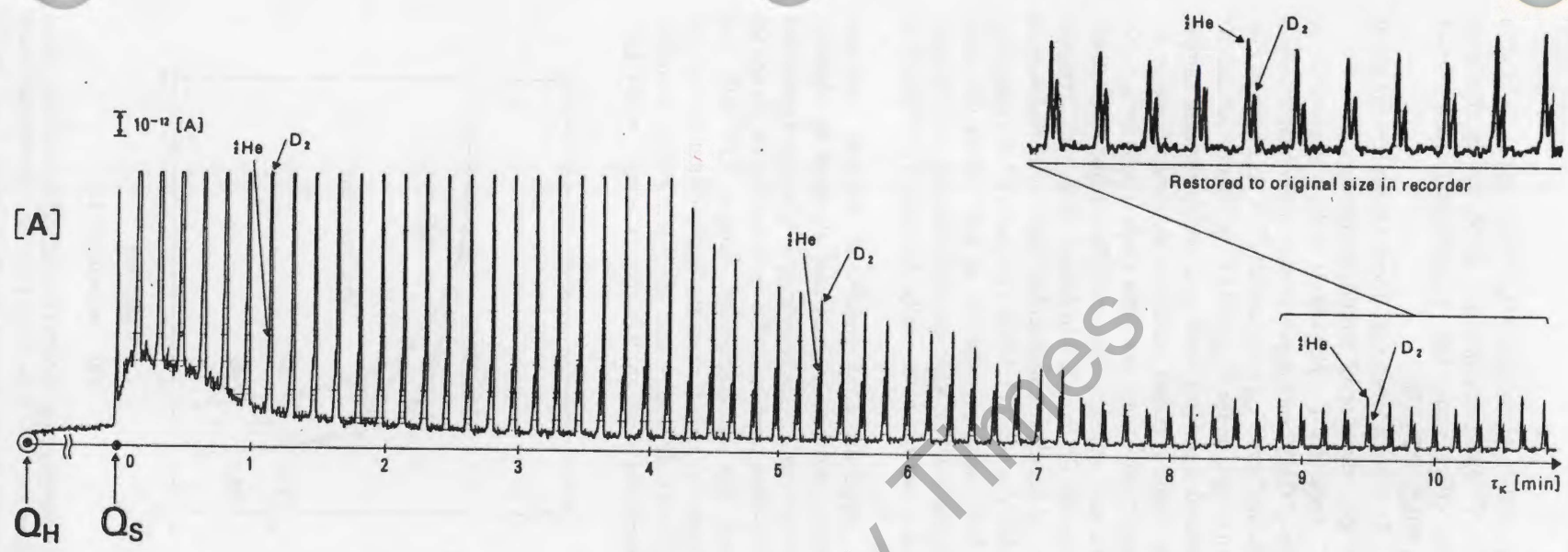
It is well known that when applied voltage (V_{app}) is lower than their ionizing volgate (Vi) for the A and B groups, QMS cannot detect them. For instance, if $V_{app} \leqq 24$ [V], then A group (Vi≃13.5 [V]) are clearly detected but B group elements (Vi≃24.5 [V]) are not detected at all. This made it possible to separate A and B groups as curve A and curve B in Fig. 3. We called "Vi-effect", in brief, for this method inside "closed QMS".

Using "Vi-effect", C group also include both A and B groups and is logically described as curve C in Fig. 3. Characteristics of curve C depends on the ratio of A and B (b / a), and their quantity a and b (a+b=c=1), and the ratio b / a can be obtained from the diagram. When using the "Vi-effect" for M_3 and (M_2, M_4), a="DH", b=$^3_2$He and $^4_2$He / $^3_2$He is easily obtained because the "extended curve C" such as curve $\widetilde{x_0, x_2, y_1, z_1}$, forms a same curve with the curve A. Authors actually applied "Vi-effect" for M_2, M_3 and M_4, and obtained similar results to Fig. 3, that is Fig. 4 (A) and (B) were obtained when V_{app} in the closed QMS" was gradually changed from 70[V] to 20[V] (70 ⇄ 20[V]). (A) is the actual experimental data and (B) is the normalized result of (A).

It is a startling fact that both Fig. 2 and Fig. 4 clearly demonstrates the existence of $^3_2$He as released helium and the ratio $^4_2$He / $^3_2$He≃4 was obtained.

If $^3_2$He comes out of Rutherford type reaction process, then the existence of tritium (which will almost always be found in the form of compounds inside QMS) in similar quantity to that of $^3_2$He must be found. In order to clarify whether or not tritium exists, "Vi-effect" with constant V_{app}=25 [V] was used because the "closed QMS" can detect only the above mentioned A group (hydrogen series (D)) without helium and doubly charges elements (such as C^{++}, CH_x^{++}, N^{++}, etc.). Comparison between released elements inside "closed QMS" under V_{app}=70 [V] and V_{app}=25 [V] is explained in detail in Appendix 1.

Fig. 5 was obtained under such situation (V_{app}=25 [V]). This diagram can be used to make a comparison between non-deuterated and highly deuterated samples for the intensity of spectra from hydrogen-series elements with same mass released from the samples. Following results can be derived. (M°, M: symbol of mass for elements released from before and after deuterated) (1) $M_2^\circ \simeq M_2$, $M_3^\circ \simeq M_3$, $M_6^\circ \simeq M_6 \simeq M_7^\circ \simeq M_7$ (this means T_2, T_2H, TD_2, etc. no-exist). (2) $M_4 \gg M_4^\circ$, $M_5 \gg M_5^\circ$, (there exist large



a) M_4 at point $_4M_4$ in Fig. 1.

b) M_3 at point $_3M_3$ in Fig. 1.

Fig. 2. "Coupled Spectrum" at some important points (Q_S, Q_E) in Fig. 1. Note (1): [A] shows chronological change of "Coupled Spectrum" of mass M_4 (^{4}He: D_2) generated at point Q_S due to "Sample-Heating" inside "closed QMS". (2): [B] shows chronological change of "Coupled Spectrum" of mass M_4 and M_3 spectrums at point Q_E ($_4M_4$ and $_3M_3$) in Fig. 1.

difference of almost a figure one place between before and after deuterated). (3) M_2, M_3 and $M_4 \approx f(Q_p)$; $M_5 \approx f(Q_p^2)$, where $f(Q_p)$, $f(Q_p^2)$, represent H_2, D_2, T_2, DH, TH, DT, etc. and H_3, D_2H, etc., respectively, and Q_p is gas pressure inside "closed QMS". Consequently,

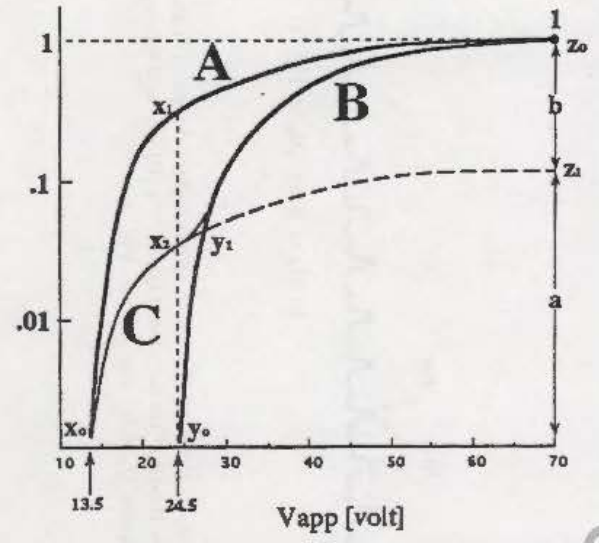


Fig. 3. Separation method for $^3_2$He and the pollutant "DH" using "Vi-effect" inside the "closed QMS". Note: Curves A, B and C indicate A, B and C groups respectively. When curve A and the "extended curve C" form same curves, the ratio b/a can be obtained precisely, where curve A ($\widehat{x_0, x_1, z_0}$), curve B ($\widehat{y_0, y_1, z_0}$), curve C ($\widehat{x_0, x_2, z_0}$), "extend curve C" ($\widehat{x_0, x_2, y_1, z_1}$).

M_2 ("H_2"), M_3 ("DH") M_4 ("D_2") and M_5 ("D_2H") (if "DT" exist, the intensity of M_5 will be displayed with $f(Q_p)$, but the experimental data shows $M_5=f(Q_p^2)$="D_2H").

It is considered that above results are not proof for the existence of tritium compounds.

Appendix 1. *Pollutants to be generated inside "closed QMS" with supervacuum under both "Sample-Heating" and V_{app} (=70 and 25 [V]).* As shown in Fig. 6 although, under V_{app}=70 [V], pollutants A* and B* released from only surface of non-deuterated sample and inside included surface of deuterated one in b), respectively, these are same kinds of pollutants, while their each quantity only are different from each other. Pollutant C* in c) is a hydrogen series only irrespective of non-deuterated and/or high deuterated sample under V_{app}=25 [V]. When pollutants C* are compared in both samples, whether or not tritium (its compounds) exist or what elements released from deuterated sample can be easily detected as indicated in Fig. 5.

Appendix 2. *Comparison between non-deuterated and highly deuterated Pd-black by electron-micrograph.* These micrographs show an appearance of Pd-black used inside DS-cathode. Photos. (a) and (b) show the non-deuterated sample ([D]*)=0) and Photos. (c) and (d) show the highly deuterated sample ([D*]≈1). It seems that the particle size is mainly distributed 0.02 to 0.06 [μ] (average: ≈0.04 [μ]).

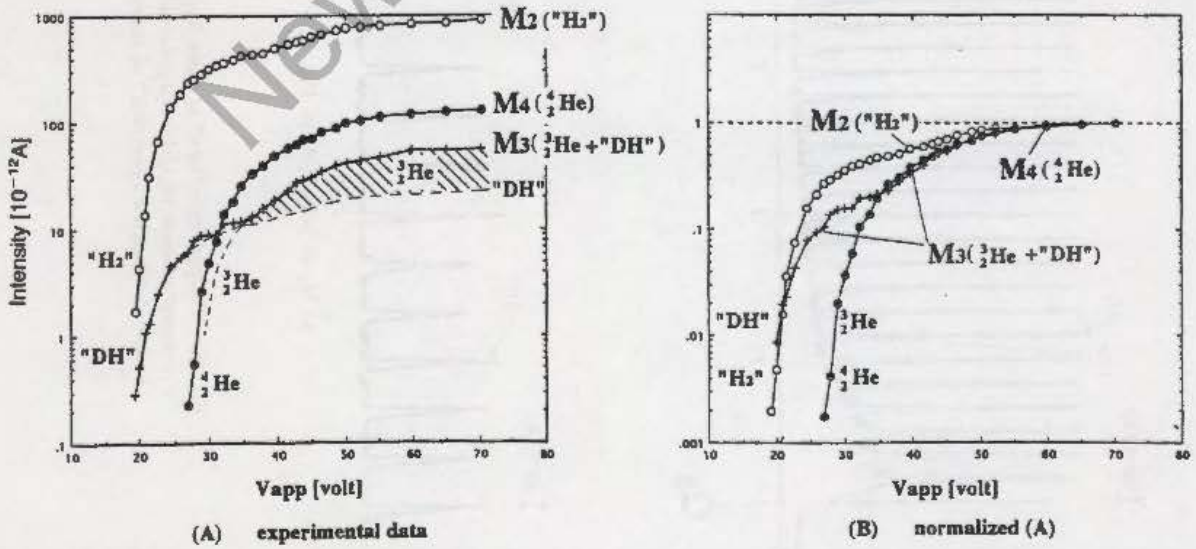
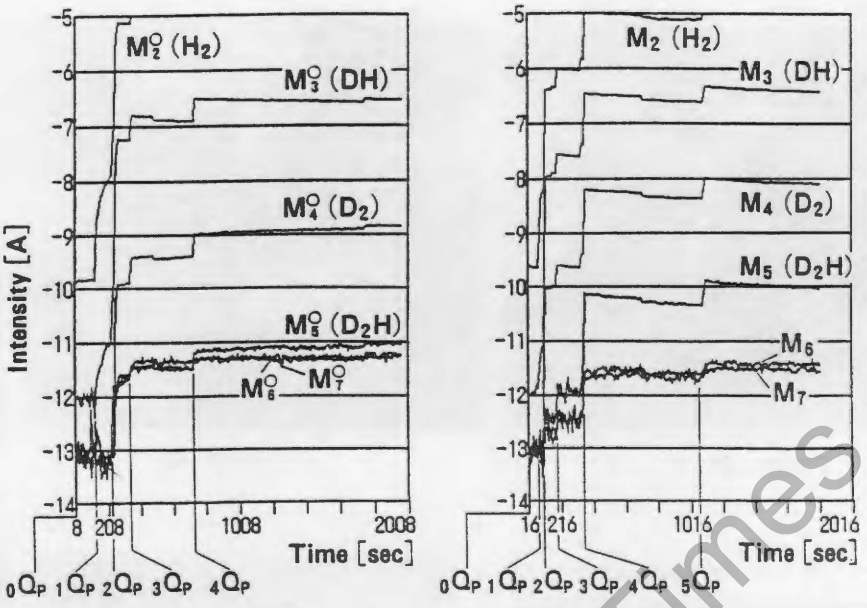


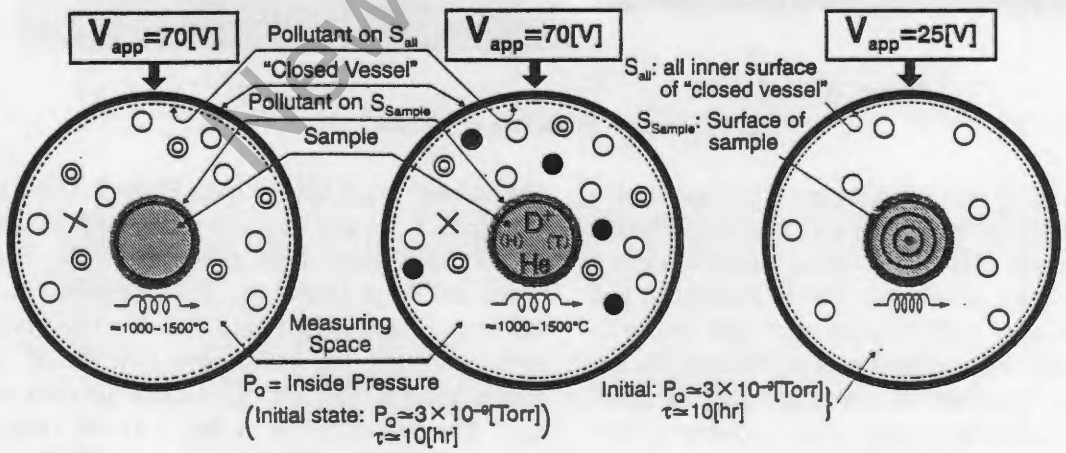
Fig. 4. Relationship between mass M_2, M_3, M_4 and the applied voltage changing from 70 to 20 [V] (70 ⇄ 20 [V]) inside the "closed QMS". Note (1): The elements with mass M_2 M_3 and M_4 are the same gases with those at Q_E in Fig. 1 and Fig. 2 since they are sealed inside the "closed QMS". (2): (A) is the actual experimental data showing relation between the applied voltage (V_{app}) and the spectrum intensity of the ionized gases at the point Q_E in Fig. 1. (B) is the normalized result of (A), and corresponds to Fig. 3.



(a) Non-Deuterated ([D*]=0)

(b) Highly Deuterated ([D*]≃1)

Fig. 5. Comparison between non-deuterated and highly deuterated samples for intensity of "released gases" inside "QMS" under V_{app}=25 [V]. (M^0, M: mass of elements released from the former and latter samples, respectively). Note (1): S_p and Q_p show gas pressure inside each isolated sample vessel and "QMS", respectively. (2): Numbers of ①, ②, ③, ④ indicate the order of "closed QMS" operation as follows, ①: $_0S_p \simeq 3\times10^{-9}$ [Torr], $_0Q_p \simeq 3\times10^{-9}$ [Torr]; initial pressure inside each isolated sample vessel and "QMS", respectively. ②: $_1S_p > 10^{-4}$ [Torr]; "released gases" pressure after "Sample-Heating" at 1300[°C] inside isolated sample vessel. ③: $_1Q_p$, $_2Q_p$, $_3Q_p$, $_4Q_5$, $_5Q_p$: "released gases" pressure inside isolated "QMS" when it is introduced stepped-state from sample vessel. ④: (a) diagram; $_1Q_p \simeq 1.5\times10^{-7}$, $_2Q_p \simeq 3\times10^{-6}$, $_3Q_p \simeq 6\times10^{-5}$, $_4Q_p \simeq 8.7\times10^{-5}$, (b) diagram; $_1Q_p \simeq 2\times10^{-7}$, $_2Q_p \simeq 2\times10^{-6}$, $_3Q_p \simeq 4.0\times10^{-6}$, $_4Q_p \simeq 4.2\times10^{-5}$, $_5Q_p \simeq 6.2\times10^{-5}$. It was verified that both M_6 ($\simeq M^0_6$) and M_7 ($\simeq M^0_7$) change with only noise-level, and $M_5 = D_2H$ (without DT), $M_3 \simeq M^0_3$, $M_2 \simeq M^0_2$. This means that the existence of tritium compounds can not be recoginized.



a) Non-deuterated Sample
A* { ○: Hydrogen series (without $^3_1$T)
◎: Carbon series
×: Others

b) Deuterated Sample
B* { ○: Hydrogen series
◎: Carbon series
×: Others
●: Helium series

c) Both Sample
C* { ○: Hydrogen series
(H, D, T), (H_2, D_2, T_2), (DH, TH, DT),
(D_2H, DH_2, T_2H, TH_2, T_2D, TD_2), (H_3, D_3, T_3) }

Fig. 6. Comparison between both samples before ([D*]=0) and after ([D*]=1) deuterated for elements released under "Sample-Heating" only. Note: It is very important in substance that pollutants A*, B*, and C* are released from sample only under "Sample-Heating" without coming from inner all surface of closed-vessel inside "closed QMS" with super-vacuum.

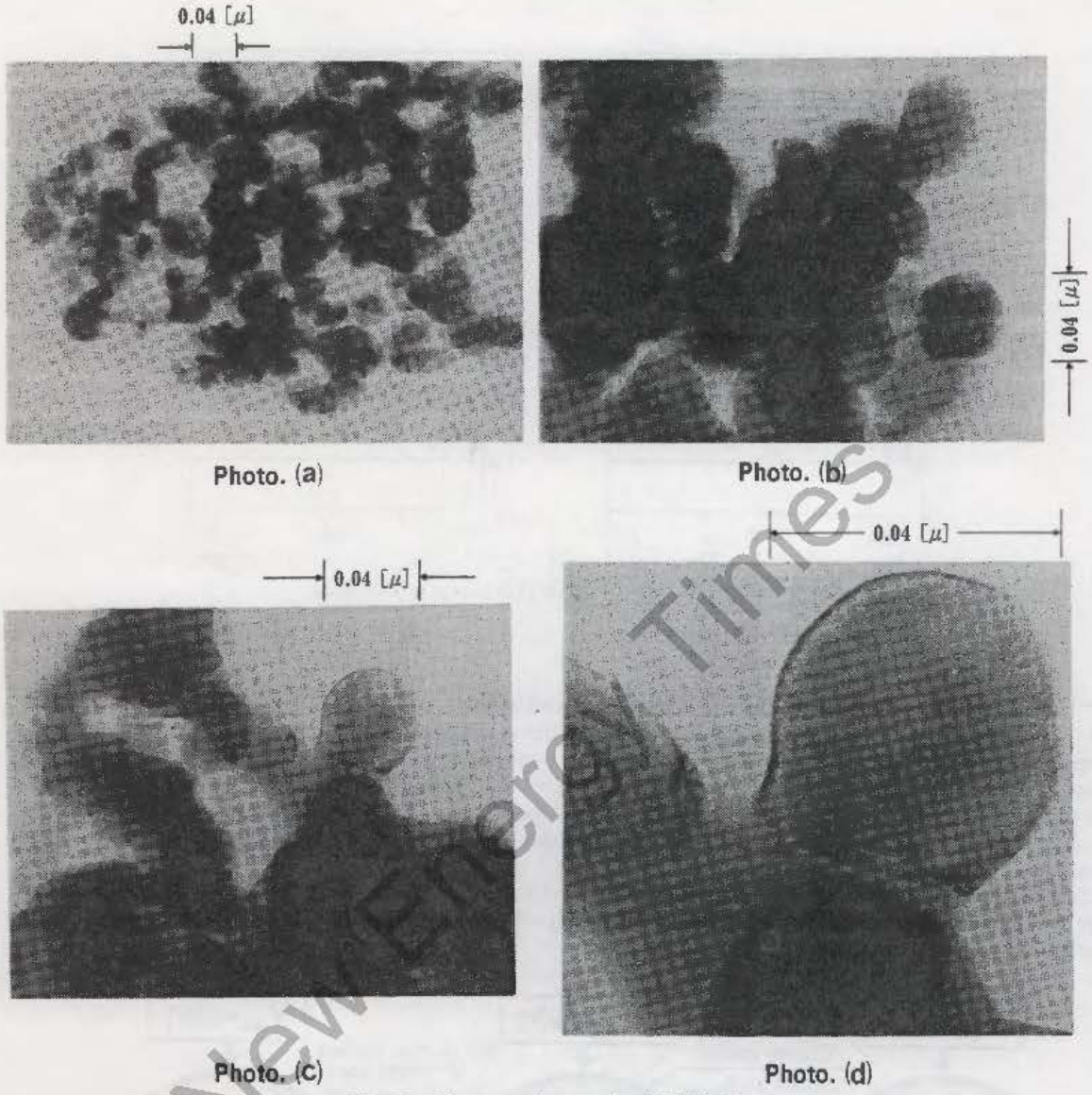


Fig. 7. Electron-micrograph of Pd-black.

Photos. (b) and (d) magnified (a) and (c), respectively. A scale of 0.04 [μ] is inserted in each photo. In Photos. (a) and (b) many of particles with a squarish surface isolated from each other exist. But in Photos. (c) and (d), there exist no particles with such appearance as Photos. (a) and (b), and almost of much particles are connected and they seem to be mixing with each other. The highly deuterated sample was heated to a very high temperature and it generated huge excess energy. It is startling that no crystal damages seems to exist. (These photographs were taken by K. Hiraga; Prof., Inst. for Materials Research, Tohoku Univ.)

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Reference

1) Arata, Y., and Zhang, Y.-C. (1996) Proc. Japan Acad. 72B, 179–184.

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OAKTON INTERNATIONAL CORPORATION

Dear Reader,

This latest publication by Drs. Arata and Zhang [Y. Arata and Y.-C. Zhang, *Proc. Japan Acad.* **73B**, 1 (1997)] is sent courtesy of Oakton International Corporation.

Drs. Arata and Zhang have published time history data on 6 electrochemical runs in which they have observed major quantities of excess heat from palladium deuteride PdD_x [Y. Arata and Y.-C. Zhang, *Proc. Japan Acad.* **70B**, 106 (1994); *Proc. Japan Acad.* **71B**, 98 (1995); and *Proc. ICCF6*, 129 (1997)]. In these runs D atoms were plated onto the external surface of a vacuum-sealed palladium bottle. The inside of the bottle was packed with fine Pd powder called palladium black. During electrolysis D atoms diffused through the wall of the bottle and immersed the Pd powder in pure D_2 gas at pressures that have been measured to exceed 800 atmospheres. This latest paper describes the composition of gases driven off powder that had previously produced excess heat. The paper shows the presence of the 2 isotopes of helium, ^4He and ^3He, neither of which was present in the same powder that had not been exposed to D_2 gas. This paper is important because it shows that a nuclear reaction occurred within the Pd powder, producing heat without accompanying neutron or gamma ray emission. The paper confirms the cold fusion process first announced by Drs. Fleischmann and Pons in 1989.

The reader's attention is directed to Figure 1 of the latest paper. Gases were driven off Pd powder as it was heated to very high temperature. These gases were captured in a very clean, sealed-off section of a vacuum system which contained 2 mass spectrometers and a getter pump. The getter pump removes hydrogen from the gases by chemical reaction, leaving the helium content unaffected. The high resolution mass spectrometers repetitively scanned across the Mass-4 and Mass-3 peaks of the mass spectrum. The mass-4 peak contains the signals from D_2^+ and $^4He^+$ ions, as shown in Figure 2. Similarly the Mass-3 peak contains signals from DH^+ and $^3He^+$ ions. H_2 is present in the desorbed gas as an impurity. Part of the H was embedded in the powder prior to generation of heat. Figure 1 shows that the mass-4 peak M_4 quickly decays to a constant amplitude, while the mass-3 peak more slowly decays towards a stable amplitude that had not been reached by the end of the plot. The stable M_4 value is shown in Figure 2 to be a measurement of pure $^4He^+$, while the end value of $^3He^+$ is shown to be half $^3He^+$ and half HD^+. The difference in the rates at which D_2 and DH disappear inside the sealed system is a result of the following processes: Both D_2 and DH are removed by the getter pump at equal rates, but the D_2 is also lost by the surface reaction D_2 + surface-H → 2 DH. This reaction occurs on all metal surfaces within the sealed-off vacuum system.

This paper is a second and independent proof of the presence of a nuclear reaction product in Pd black that has produced heat. A year earlier Drs. Arata and Zhang showed that the ^4He was created in the heat release process [Y. Arata and

Y.-C. Zhang, *Proc. Japan Acad.* **71B**, 304 (1995)]. The product ^{4}He was strongly trapped in the powder, requiring >800°C temperatures to drive off the gas. No ^{4}He was in the powder that had not produced heat. The new data confirms the earlier result, but shows that ^{3}He also was formed with a ^{3}He/^{4}He ratio exceeding 0.1. Since the natural abundance ratio of ^{3}He/^{4}He is 0.00013, there is no possibility of sample contamination by leaks. The only possible source of the ^{3}He is by nuclear reaction. Since the reaction energy for production of ^{4}He is 23.8 MeV, compared with a reaction energy for production of ^{3}He of 5.45 MeV, more than 97% of the heat came the lattice reaction D + D → ^{4}He. Radiationless lattice-induced nuclear reactions can be understood as interaction between ion band states [T. A. Chubb and S. R. Chubb, *Fusion Technol.* **20**, 93 (1991)], and subsequent publications]. The ^{3}He is likely produced in an ion band state version of the Schwinger reaction D + H → ^{3}He.

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