FUSION facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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***Fusion Facts* Now Reports on Both Cold Fusion and Other Enhanced Energy Devices.**

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CONTENTS FOR DECEMBER 1991

COMING IN JANUARY, 1991 ISSUE
***Fusion Facts* "Fusion Scientist of the Year" Award**

A. COLD FUSION WITH LIGHT WATER

Courtesy of Dr. Robert T. Bush

Robert T. Bush (Physics Dept, Cal State Polytechnic U.), "A Light Water Excess Heat Reaction Suggests that 'Cold Fusion' is 'Alkali-Hydrogen Fusion'", *Fusion Technology*, accepted for publication, planned for May 1992 edition.

AUTHOR'S ABSTRACT

In a paper recently published in *Fusion Technology*, Mills and Kneizys [*Fusion Technology*, Vol 20, Aug 1991, p 65] present data in support of a light water "excess Heat" reaction obtained with an electrolytic cell highly reminiscent of the Fleischmann-Pons "cold fusion" cell. The claim of Mills and Kneizys that their excess heat reaction can be explained on the basis of a novel chemistry, which supposedly also explains "cold fusion", is rejected in favor of their reaction being, instead, a light water "cold fusion" reaction. If it is the first known light water "cold fusion" reaction to exhibit excess heat, it may serve as a sort of prototype to expand our understanding of "cold fusion". From this new hypothetical vantage point, a number of potential nuclear reactions are deduced including those common to past "cold fusion" studies. This broader pattern of nuclear reactions is typically seen to involve a fusion of the nuclides of the alkali atoms with the simplest of the alkali-type nuclides; viz., protons, deuterons, and tritons, respectively. Thus, the term "alkali-hydrogen fusion" seems appropriate for this new type of reaction with the three subclasses "alkali-hydrogen fusion", "alkali-deuterium fusion", and "alkali-tritium fusion". A significant part of the difference between alkali-hydrogen fusion and thermonuclear fusion is hypothesized to involve an effect which is essentially the opposite of the well-known Mössbauer effect. Transfer of energy to the lattice is shown to be consistent with the Uncertainty Principle and Special Relativity. The implications of alkali-hydrogen fusion for theoretical models for cold fusion are considered. Boson properties are suggested as unimportant for alkali-hydrogen fusion, apparently ruling out the prospect that a Bose-Einstein condensation could be involved in "cold fusion". In a

Postscript, a new three-dimensional Transmission Resonance Model (TRM) is sketched that avoids Jändel's criticism of the one-dimensional TRM. When the new TRM is coupled with the "alkali-hydrogen fusion" hypothesis for cold fusion it suggests a solution for the surface, or near surface, excess heat effect for cold fusion in the form of a reaction between Li^6 and a deuteron to produce He^4. A lattice effect essentially opposite to an "umklapp" [as used in solid-state work] process suggests that energy should be given to the lattice in the reaction. Finally, an Experimental Postscript reports on preliminary experimental evidence for a nuclear product [*] in support of the author's hypothesis of a light water nuclear reaction and "alkali-hydrogen fusion". In addition, the transmission resonance phenomenon of the author's new TRM (new "Transmission Resonance Model") appears to be strongly implicated, so that T.R.I.N.T. ("Transmission Resonance Induced Nucleon Transfer") also seems appropriate for the nuclear process.

[*] "Preliminary experimental results [Bush and Eagleton] support the production of calcium-40 via potassium-39 plus a proton", states Dr. Bush.

EDITOR'S COMMENTS

***Fusion Facts* is indebted to Editor George Miley of *Fusion Technology* and to Dr. Robert T. Bush for permission to share this important abstract with our readers.** *Fusion Facts* suggest that this is one of the most important cold fusion papers since the original Pons-Fleischmann paper in 1989. We commend the team of Dr. Bush and Dr. Eagleton and also Dr. Mills (and his co-workers) on their important work. Although these scientists have differing views and explanations for the observed excess heat (both teams have observed more than 2000% excess heat) their leadership is expected to engender further investigations and understanding of these complex phenomena. In a personal communication with Dr. Bush he pointed out that a great deal of credit must be given to Pons and Fleischmann for their work and to Mills and Kneizys for their excellent experimental work and the resulting papers. Bush's model and Bush and Eagleton's experiments have predicted and confirmed a variety of cold fusion events. In addition, this team set a record for the cold fusion generation of power per cubic cm of Pd in their Pd-plated Ag cathodes. We look forward to the published details of their work.

IMPLICATIONS OF THIS NEW MODEL

Dr. Bush's abstract suggests that alkali-hydrogen, alkali-deuterium, and alkali-tritium fusion reactions are possible. The abstract explicitly cites a lithium to helium-4 reaction. Dr. Melvin Miles (Navy, China Lake) experimental measurement of helium-4 from a cold fusion cell are consistent with this suggestion. In the appended sentence to the abstract (furnished by Dr. Bush) a potassium-proton nuclear reaction appears to produce calcium. Bush suggests that other alkali-hydrogen isotope combinations may be possible. Readers of the Mills-Kneizys paper ("Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion'", *Fusion Technology*, **Aug 1991**, Vol 20, No 1, pp 65-81.) will recall that improved results were obtained with the use of "pulsed" electrochemistry with a nickel cathode. This combination of models/experiments suggests that nuclear reactions with alkali metals and hydrogen isotopes can be expected to be produced in a surface or near-surface metal-lattice which acts a "nuclear catalyst" under specific electrochemical conditions. It appears that the "tuned-circuit nuclear catalytic" cold fusion age has dawned. DoE, please copy. As this issue went to xerography, at least one source stated that Dr. Mills and associates had a working, light-water, electrochemical cell producing one kilowatt of power.

For another view on how excess heat may be generated see the technical note on zero point energy (page 3).

B. 1991 IN REVIEW - HAPPY HOLIDAZE, TOO!

From the front pages of 1991's *Fusion Facts*, By Hal Fox

"Excess heat over one thousand percent," [1]
Didn't even cause DoE to repent.
But Liebert and Liaw to us it was clear
Were named "Fusion Scientists of the Year." [2]

Does NCFI know what they're doing?
Some think their work still needs reviewing.
Fritz Will assured all, "There's something to it,"
And all got good marks, but then we all knew it. [3]

"Helium-4 is the source of that heat
And the way we found out is really neat,"
Said China Lake's Dr. Melvin H. Miles. [4]
"Yes, we agreed," and cold fusion smiles.

Worledge from EPRI to Soviet did travel,
Their cold fusion work he tried to unravel.
Excess heat found from using gas plasma, [5]
But Soviets now suffer from freedom's miasma.

Srinivasan in India proclaimed that cold fusion
Is really new science and not just delusion. [6]
Eugene F. Mallove issued Fire From Ice
But cold fusion deriders were not very nice. [7]

Here are the facts -- we don't need more guesses --
Twenty-three countries have fusion successes!
The media is not as informed, it is true;
Peer-reviewed successes -- two forty-two. [8]

NCFI issued their final report.
They may play again, but they've now left the court. [9]
At the Como conference, many attended
And told of successes. Cold fusion's not ended! [10]

Zero-Point Energy is no delusion,
Yet skeptics have trouble -- worse than cold fusion.
To understand Coulomb is a cold fusion need -
While Shoulders pumps electrons into a bead. [11]

The bead is formed with high energy smack
And he now can get thirty times as much back.
"Its all very simple," Hal Puthoff discourses,
"We just tap into the Casimir forces." [12]

The news from **hot fusion** (with much money spent),
"Energy in -- returns eleven percent.
Five billion bucks more and our Paradise beckons,
We became radioactive in only two seconds." [13]

"Happy Holidays at last", we hear from Bob Bush,
"Eagleton and I haven't sat on our tush."
They've solved the problem. We knew they could do it.
They found the answer; they put their brains to it. [14]

The FF staff sees a Happy New Year.
Cold fusion is real, that's certainly clear.
Let's all print the truth, its scarce and its dear.
As cold fusion develops, we'll share it right here."

REFERENCES

[1] Bor Yann Liaw, Peng-long Tao, Patrick Turner, Bruce E. Liebert (U. of Hawaii), "Elevated Temperature Excess Heat Production Using Molten Salt Electrochemical Techniques," *Special Symposium Proceedings - Cold Fusion*, World Hydrogen Energy Conference #8, p 49-60, July 23-24, 1990, Honolulu, Hawaii. [See also *Fusion Facts*, Vol 2 No 4, Oct 1990, pages 1-14 for a reprint and an extensive review of all references.]

[2] Second Annual "Fusion Scientists of the Year" award given to Liebert and Liaw. *Fusion Facts*, January 1991.

[3] "A Scientific Review of NCFI," *Fusion Facts*, February 1991.

[4] M.H. Miles, G.S. Ostrom, (Naval Weapons Center, China Lake) B.F. Bush, J.J. Lagowski, (Dept of Chem, U of Austin, Texas), "Heat and Helium Production in Cold Fusion Experiments," Proceedings of The Second Annual Conference on Cold Fusion, June 30-July 4, 1991, Como, Italy. See also *J. Electroanal Chem,* **304**, p 271, 1991. See *Fusion Facts*, March 1991.

[5] "Soviet cold fusion heats up" and "Russian scientists achieve excess heat from gas-plasma device," *Fusion Facts*, pg 1, April 1991.

[6] M. Srinivasan, "Whither Cold Fusion?" *Fusion Facts,* pg 1, May 1991.

[7] "Mallove's book reviewed. The best book yet on the scientific history of cold fusion", *Fusion Facts,* pg 3, May 1991.

[8] Michael Dehn, "Survey of cold fusion successes (23 countries, 242 references)," *Fusion Facts,* pg 2-22, June 1991.

[9] "NCFI final report issued," *Fusion Facts*, pg 1, July 1991.

[10] "Report on ACCF2, Como, Italy," *Fusion Facts*, pg 2-30, July 1991.

[11] "Enhanced Energy Devices," *Fusion Facts*, pg 1, August 1991.

[12] Hal Puthoff, "Zero Point Energy - An Introduction," *Fusion Facts*, pg 1, Sept 1991.

[13] "EC Achieves Nuclear Fusion," *Fusion Facts*, pg 1, November 1991. The news article states that after 1.7 seconds the unit was shut down due to rapidly-increasing radioactivity.

[14] Robert T. Bush's abstract page 1 this issue.

C. TECHNICAL NOTE ON EXCESS HEAT

SUGGESTION: HOW COLD FUSION CAN TAP ZPE

By Hal Fox

This technical note suggests that cold fusion events in a metal lattice may tap zero-point energy. **Critical comments are urgently requested from *Fusion Facts* readers.** Here are the logical steps and conclusion:

Logical Step 1. Kenneth Shoulders [1] has taught us that electron beads can be formed at the end of a sharply-pointed cathode positioned close to a dielectric surface when the cathode is supplied with a short high-voltage pulse. The patent teaches the reader many ways in which such electron beads or EVs can be formed, controlled, and used.

Logical Step 2. Dr. Hal Puthoff [2] has shown us that the Casimir force is sufficiently strong (proportional to $1/d^4$) to overcome the Coulomb force (proportional to $1/d^2$) when the distance is sufficiently small. Therefore, if one can place a large number of electrons into a small enough space in a short enough time, the Casimir force will overcome the Coulomb barrier and the Casimir force will collapse the electrons into an EV (electron vortex) or electron bead.

Logical Step 3. It has now been shown and confirmed (see Edmund Storms [3]) that a Pons-Fleischmann electrochemical cell can produce fusion events when the Palladium cathode is loaded with sufficient deuterons so that the Pd/D ratio is about 1.0 and other conditions are favorable. It is now accepted by many scientists that nuclear fusion events (such as d + d --> ^{4}He plus energy or ^{6}Li + d --> 2 ^{4}He) occur in the Pd lattice. Such nuclear events are extraordinarily energetic (as contrasted with chemical reactions) and may be the energy source for unusual events in the metal lattice.

Logical Step 4. In the PdD material, each Pd is surrounded by a cloud of some 46 electrons plus some itinerant electrons flowing through the PdD cathode (say at 600 mA per cubic cm of cathode surface area.) The

deuterons normally occupy a potential well between two Pd atoms. Another deuteron chooses to occupy the same space, overcoming the Coulomb barrier, fuses, and creates a highly unstable ^{4}He* (or similar description for Li reaction). This excited ^{4}He* is highly unstable and must quickly give up its excess energy (equivalent to 23.5 MeV).

Logical Step 5. In the immediate presence of an awesome amount of local energy the clouds of electrons surrounding the adjacent Pd atoms (in all six mutually orthogonal directions) it is suggested that some of these electrons are abruptly forced close enough together so that the electron Coulomb barrier is overcome by the Casimir force and a few small electron beads (EVs) may be formed.

Logical Step 6. In the presence of a conductor it is experimentally well understood that the EV is highly unstable (but somewhat stable on the surface of a dielectric) and would be short lived. Therefore, the energy added to the EV by "tapping the vacuum zero-point energy (ZPE)" or Casimir force is almost immediately recovered in the form of electricity, heat, and X-rays (as experimentally shown by Shoulders [1]).

Conclusion: Under appropriate conditions, a "cold fusion cell" can tap the energy of the vacuum continuum ZPE and release that energy to or in the vicinity of a PdD lattice. This tapped and released energy shows up as excess heat not accounted for by the measured nuclear byproducts of a d + d (or lithium) nuclear reaction.

CHALLENGE TO READERS

Please attack this logic and conclusions. If you agree that the logic has some degree of reasonableness, please provide the mathematical calculations or estimations by which we may measure the degree to which such a secondary event (caused by a nuclear reaction in a PdD lattice) could be expected to occur.

Note 1: It may be considered that dendritic formations on a Pd cathode may also be a source of energy concentration so that electron beads can be formed under conditions that, hopefully, our readers may suggest.

Note 2: Dr. Robert T. Bush has a paper accepted for publication by *Fusion Technology*, (scheduled for May 1992) [4] in which he suggests, by theory and experiment, that the Mills cell provides excess heat by nuclear reactions. If the potassium can combine with a proton and create a calcium atom, is there an expectation that part of the measured energy can also stem from tapping the ZPE? The Mills reaction appears to be a surface nuclear reaction in the presence of a nickel cathode, however Dr. Mills explains it as a new chemical reaction. While Bush measures calcium formation in the electrolyte, Mills does not. Both of these scientists are skilled experimenters. Is it feasible that the observed reactions that Mills and Bush record differently can both be accurate? Could it be that the change of some cell parameters favors nuclear reactions? Is there an alternative way in which the Mills cell can tap ZPE fluctuations in the absence of a nuclear reaction? At least one nuclear physicist suggests that both Mills and Bush are correct [5].

REFERENCES

[1] Kenneth R. Shoulders, "Energy Conversion Using High Charge Density", U.S. Patent Number 5,018,180, Date of Patent: May 21, 1991, 42 claims, 38 drawing sheets with 97 drawings, 40 pages of explanatory text.

[2] Hal Puthoff, "Zero Point Energy, An Introduction", *Fusion Facts*, **Sept 1991**, Vol 3, No 3, pp 1-2. This reference cites the following papers by Dr. Puthoff: "Everything for nothing', *New Scientist,* pp 52-55, (28 July 1990); "Where does the zero-point energy come from?', *New Scientist,* p 36, (2 December 1989); "The Energetic Vacuum: Implications for Energy Research", *Speculations in Science and Technology,* Vol 13, No 4, pp 247-257, (1990), 33 refs; and *Phys Rev A,* **40,** 4857, Errata, *Phys Rev A,* **44,** in press, (1 Sept. 1991).

[3] Edmund Storms (Los Alamos National Laboratory Nuclear Materials Technology Div), "Review of Experimental Observations about the Cold Fusion Effect", *Fusion Technology*, **Dec 1991**, Vol 20, No 4, pp 433-477, 3 tables, 5 figs, 359 refs.

[4] Robert T. Bush, personal communication concerning paper accepted for publication in *Fusion Technology*, with expected publication date of May 1992.

[5] Private communication with Mark Goldes, 12/3/91.

WHY THE CONCERN WITH ZPE?

In a fall 1991 meeting with Dr. Hal Puthoff, he mentioned that he thought that some of the excess energy being produced by cold fusion came from tapping zero-point energy or from ZPE fluctuations. The hunches of brilliant scientists should be considered. The above technical note is presented to be thought provoking and hopefully to trigger some innovative suggestions.

There appears to be an increasing number of scientists who are seriously considering the enormously energetic structure of space (energy potentials of 10^{90} to 10^{100} gms per cu cm.) and its fluctuations. Claims of methods to tap this energy (ranging from the seemingly absurd to some thoughtful scientific suggestions) are becoming increasingly popular. To date, the most appealing [to me]

are the explanations by Dr. Hal Puthoff as to how the Casimir forces can produce the Shoulders' electron beads.

This editor is in a most fortunate professional position of being acquainted with many eminent scientists; not concerned about tenure; and having no reputation to risk. Therefore, you are generously invited to attack, ridicule, or praise these modest efforts to engender creative thinking or speculation concerning enhanced energy devices. It is my technical judgement that we are dealing with phenomena that can solve the world's energy problems and contribute strongly to a cleaner, better world. Therefore, it is worth being concerned.

D. NEWS FROM THE U.S.

CALIFORNIA - IMPACT FUSION CONFIRMED
From Chemical Abstracts, Nov 18, 1991

Y.K. Bae, D.D. Lorents, S.E. Young (Mol Phys Lab, SRI), "Experimental confirmation of cluster-impact fusion," *Phys Rev A*, **1991**, Vol 44, No. 7, pp R4091-4.

AUTHORS' ABSTRACT

We have investigated d-d fusion induced by impact of $(D_2OP)_N^+$ and $(H_2O)_N^+$clusters with n = 1-150 on deuterated polyethylene targets at energies of 135-225 keV. Both the energy dependent and magnitude of the fusion yield measured with $(D_2O)_{115}^+$ clusters confirm the results of Beuhler et al (1990). Furthermore, the size dependence of the $(D_2O)_N$ fusion yields measured at the impact energy of 225 keV for small (N < 10) clusters follow the thermonuclear model proposed by Carraro et al. (1990) rather than the thick-target model. For H_2O^+ and $(H_2O)_2^+$ clusters at 225 keV, the yields roughly agree with the knock-on model by Carraro et al. No fusion event was observed for $(H_2O)_N^+$ clusters with N = 4-50; however, N = 115 clusters produced an observable fusion rate. The ratio between fusion rates of $(H_2O)_{115}^+$ and $(D_2O)_{115}^+$ is 5% ± 2%, in close agreement with result, approx. 5%, measured by Beuhler et al. at 300 keV.

CALIFORNIA - MAXWELL'S EQUATIONS
Courtesy of Dr. Samuel Faile

Charles M. Hill, "Maxwell's Equations in Moving Coordinates", *Galilean Electrodynamics*, **Jan/Feb 1991**, Vol 3, No 1, pp 13-15, 2 Refs.

AUTHOR'S ABSTRACT

When describing electromagnetic waves propagating through free space, Maxwell's equations are applicable only if the wave speed can be treated as a constant, and this restricts the choice of coordinates. The constraint can be overcome by some relatively simple modifications of the equations for propagating fields, and such modifications are described herein.

EDITOR'S COMMENTS

This paper is included because Maxwell's equations are sometimes used in cold fusion theories. The following statement by the author in his conclusions are pertinent: "The extended equations show promise when dealing with EM waves in free space, but they do not yet provide a complete electromagnetic theory for moving systems. In such systems, it is also necessary to find acceptable models for non-propagating EM fields along with those for waves in moving material media and second order velocity effects. The reader is invited to join the hunt."

CALIF. & USSR - REVIEW OF UTAH CONFERENCE

V.A. Tsarev (Lebedev Phys Inst, Moscow) & D.H. Worledge (EPRI, Palo Alto), "New Results on Cold Nuclear Fusion: A review of the Conference on Anomalous Nuclear Effects in Deuterium/Solid Systems, Provo, Utah, October 22-24, 1990," *Fusion Technology,* **Dec 1991,** Vol 20, No 4, pp 484-508, 21 Figs, 6 Tables, 65 Refs.

AUTHORS' SUMMARY

[After an excellent review of the meeting the following summary is provided:]
Summarizing the conference in his final speech, Worledge underlined the following items:

1. The phenomena observed are not "normal" D-D fusion.
2. Theory is not yet sufficiently oriented by experiment.
3. The quality of many experiments had improved considerably.
4. There are many very different experiments, but the results seem to be broadly similar.
5. The research field under development has every right to its existence and deserves support.

[Worledge could have stated for 2 that the experiments have not provided sufficient orientation for the theorists.]

MASSACHUSETTS - FUSION NEEDS T

L.C. Case (Eltron, Inc.), "The Reality of 'Cold Fusion'," *Fusion Technology,* **Dec 1991,** Vol 20, No 4, pp 478-480, 7 Refs.

AUTHOR'S ABSTRACT

Despite the unreproducibility, doubt, and controversy involved in the question of the "cold fusion" of deuterium, enough good data have been published to clearly indicate the reality of some sort of nuclear fusion. Yamaguchi and Nishioka reported a thrice-repeated event in which large amounts of heat and definite bursts of neutrons evolved simultaneously with considerable out-gassing of absorbed deuterium. These results are consistent with nuclear fusion and not with a chemical reaction. A detailed mechanism is proposed that is consistent with these events and that also generally explains many of the scattered indications of cold fusion that have been reported. There must be an adventitiously large enough presence of tritium to initiate the nuclear reaction. The results of previously successful experiments cannot now be reproduced because currently available D_2O (and D_2) is so low in adventitious tritium as to preclude initiation of the nuclear reaction.

MICHIGAN - LETTER TO MILEY

Frederick J. Mayer (Mayer Applied Research, Inc.), "Comments on 'Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion," *Fusion Technology,* **Dec 1991,** Vol 20, No 4, p 511, 1 Ref.

EDITOR'S SUMMARY

Mayer cites Mills & Kneizys, Fusion Technology, 1991, Vol 20, p 65. Mayer suggests that the author's overlooked the role of ^{40}K in their experiments. This potassium isotope is a beta-radioactive isotope with beta endpoint energy of 1.3 MeV. Mayer points out that this source of energy must be included before any excess heat can be claimed. Mayer cites that the control using sodium carbonate has no beta emitter. If the report is valid that Mills et al. have now achieved 1,000 watts output for their cell, Mayer's correction may not be a significant factor.

NEVADA - ZPE ENERGY
Courtesy of Dr. Samuel P. Faile

F. Winterberg (U. of Nevada), "Wheeler's Geometrodynamics and the Zero Point Energy," *Galilean Electrodynamics,* **Jan/Feb 1992**, Vol 3, No 1, pp 3-4, 5 Refs.

AUTHOR'S ABSTRACT

Wheeler's claim that the zero point vacuum energy of quantum gravity, having a mass density of 10^{95} gms per cu cm, can be compensated by the negative gravitational energy in between Planck-length fluctuations, is shown to be untenable.

NEW MEXICO - LOS ALAMOS REVIEW
Courtesy of the author

Edmund Storms (LANL), "Review of Experimental Observation About the Cold Fusion Effect," *Fusion Technology,* **Dec 1991,** Vol 20, No 4, pp 433-477, 5 Figs, 3 Tables, 359 Refs.

AUTHOR'S ABSTRACT

The experimental literature describing the cold fusion phenomenon is reviewed. The number and variety of careful experimental measurements of heat, tritium, neutron, and helium production strongly support the occurrence of nuclear reactions in a metal lattice near room temperature as proposed by Pons and Fleischmann and independently by Jones.

[One of the best reviews of the literature to date! Ed.]

NEW YORK - DISBELIEF FROM IBM
Courtesy of Dr. Samuel P. Faile

Richard L. Garwin (IBM Res Center), "Fusion: The Evidence Reviewed," *Science,* **Nov 29, 1991**, Vol 254, p 1394-5.

EDITOR'S COMMENTS

Garwin reviews Mallove's book, **Fire from Ice**, and editorializes on cold fusion. Garwin states, "If the cold fusion phenomenon were real, its explanation would likely involve some coherent phenomenon that would increase the reaction rate by a factor involving the number of deuterons in some macroscopic region, but no such proposal has persuaded anyone other than its author." Garwin reflects on polywater and relates that he would have no trouble with astonishing concepts, "if only they were demonstrable and durable." Garwin states that in preparing for this review he visited several cold-fusion investigators, however, he cites only meetings from June and July 1989. Here again, is a scientific reviewer who apparently is greatly behind the times in terms of reading the literature of cold fusion. But then if he had been positive about cold fusion, he might have had problems getting his review published. To be kind, he does give Mallove high marks for his "written in a lively fashion and provides interesting glimpses of the personalities and concepts involved in the cold fusion furor."

PENNSYLVANIA - LIGHT WATER PATENT

Randell L. Mills (Inventor), Patent Title: "Energy/Matter Conversion Methods and Structures", Intn'l Publication No.: WO 90/13126; Publ. Date: 1 November 1990; Priority Date: U.S. 21 and 28 April 1989.

ABSTRACT

Methods and structures of energy/matter conversion according to the present invention provides applications including the generation of power according to controlled relatively low temperature nuclear fusion by selective annihilation of the coulombic forces present in the fusion material atoms. The selective annihilation of electron orbital energies is provided according to a novel model of the atom described herein, which further provides the composition of superconductor materials by selective combination of matter to provide the conditions necessary to provide superconductivity. Furthermore, the present invention provides selective energy absorption, as illustrated by photon absorption and the creation of additional material according to the novel model of the atom described herein, which overcomes limitations of prior models and is consistent with basic principles, such as Maxwell's equations.

TENNESSEE - H & D REACTIONS WITH Pd

Courtesy of Dr. Samuel Faile

G.L. Powell, J.R. Kirkpatrick (Oak Ridge), & J.W. Conant (Los Alamos), "Surface effects in the reaction of H and D with Pd-macroscopic manifestations," *J. of the Less-Common Metals,* **Aug 30, 1991**, Vol 172-174, pp 867-872, 3 Figs, 13 refs.

AUTHORS' ABSTRACT

The reaction of hydrogen and deuterium with palladium has been investigated using pressure composition temperature (PCT) measurements at very low hydrogen and deuterium concentrations in palladium powder having a surface area of 1.03 sq m per gram to determine the nature of a surface "film" that affects the diffusional uptake of hydrogen by palladium. PCT isotherms measured on the palladium powder indicated the presence of a two-phase region having an equilibrium pressure of less than 0.5 Pa and a stoichiometry of approximately one monolayer at 299 K. At 421 K, the stoichiometry had decreased by half with a twofold increase in the equilibrium pressure. These isotherms are presented in terms of the experimental PCT curves and those calculated for the "surface hydride". The equilibrium pressure for deuterium was lower than that for hydrogen for this "surface hydride", having an Einstein temperature estimated to be 1600 K.

EDITOR'S COMMENTS

This work should provide a better understanding of loading Pd for cold fusion experiments. Unfortunately the work was done with Pd powder. The following closing comments by the authors are of interest, "...The free energy differences between the formation of the surface and bulk hydrides, interpreted through a simple **zero-point-energy** model with the Einstein temperature of $PdH_{0.63}$ taken as 650 K, indicates that at 299 K the ground state of the surface hydrogen lies 1200 K below that of $PdH_{0.6}$ and that for the surface deuterium lies 1700 K below that of $PdD_{0.6}$ or 1900 K below that of $PdH_{0.6}$ yielding 1600 K for the Einstein temperature of the surface hydride which is comparable to that for hydrogen dissolved in body-centered-cubic metals.

NOTE: Vol 172-174, August 30, 1991, of the Journal of the LESS-COMMON METALS contains about 500 pages of articles on hydrogen and metals. The articles are grouped under the following headings: 6. Hydrogen pairing in metals; 7. Hydrogen diffusion, hydrogen permeability and muon motions; 8. Hydrogen in thin metal layers and superlattices, 9. Surface reactions affecting hydrogen absorption; 10. Amorphous M-H systems; 11. Miscellaneous. Beginning with October 1991, this Journal has changed its name to *Journal of Alloys and Compounds.* Ed.

E. NEWS FROM ABROAD

CHINA - DEUTERIUM EVOLUTION

Guogand Qin, Qingzhi Peng, Jishi Fu, Lizhu Zhang, & Bosui Zhang (Dept Physics, Peking Univ) *Wuli Xuebao*, **1991**, Vol 40, No 6, pp 943-8, (In Chinese).

AUTHORS' ABSTRACT

Hydrogen and deuterium were introduced into palladium cathode in an electrolysis process for 150 h with light and heavy water as electrolyte, respectively. The palladium cathode used had been quenched or annealed after a thermal treatment at 950 degrees. The variation of diffraction pattern and lattice constant of beta phase of palladium-hydrogen system in air with time were measured by x-ray diffraction method. The distribution of hydrogen in the surface layer of palladium-hydrogen system was measured by the nuclear reaction $^{1}H(^{19}F,a\ gamma)^{16}O$. Comparing a quenched palladium cathode with annealed palladium cathode, it is shown that the former has higher initial concentration of hydrogen and faster evolution velocity than the latter after the electrolysis. The concentration of hydrogen reaches maximum at the surface of palladium hydrogen system and its minimum at a depth of several hundred angstroms from the surface.

CHINA - LORENTZ TRANSFORMATION

Courtesy of Dr. Samuel Faile

Xu Shaozhi & Xu Xiangqun (Beijing Control Device Res. Inst.), ""A Re-examination of the Lorentz Transformation," *Galilean Electrodynamics,* Vol 3, No 1, pp 5-8, 1 Fig, 16 Ref, In English.

AUTHORS' ABSTRACT

Using a new form of linear transformation comparable to and including the Lorentz transformation, it is shown that, *ceteris paribus*, there is an infinity of forms of linear transformations comparable to the Lorentz transformation. In addition, an unsuspected flaw is revealed, namely that the so-called "Lorentz-invarient form" is incompatible with the postulates of the Special Relativity Theory (SRT). This throws strong doubt on the validity of the SRT.

[Editor's note: Does the new science of cold fusion provide evidence that any parts of the Special Relativity Theory, the General Theory of Relativity, or Quantum Dynamics needs revision?]

ENGLAND - FLEISCHMANN ON COLD FUSION

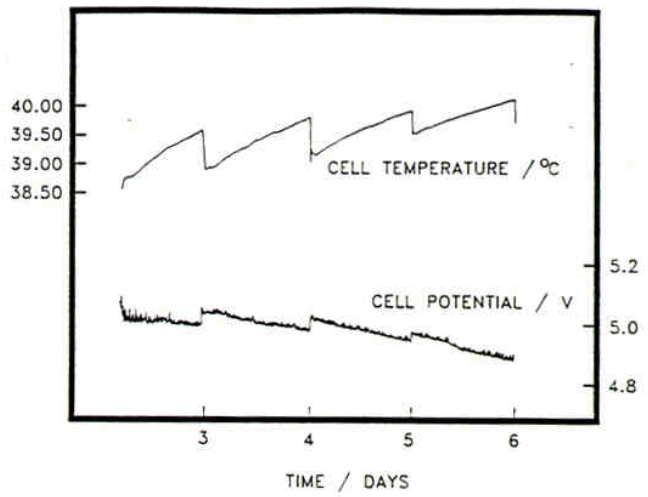
Courtesy of the author.

Martin Fleischmann (with much assistance by Guiliano Preparata and Stanley Pons), "The Present Status of Research in Cold Fusion," *The Electrochemistry Newsletter*, **October 1991**, No 71, pp 1-14 of insert, 1 Fig.

AUTHOR'S INTRODUCTION

In the development of any new area of research (and especially in one likely to arouse controversy!) it is desirable to achieve first of all a **qualitative demonstration** of the phenomena invoked in the explanation of the observations. It is the **qualitative demonstrations** which are **unambiguous:** the **quantitative analyses** of the experimental results can be the **subject of debate** but, if these **quantitative analyses** stand in **opposition** to the **qualitative demonstration**, then these methods of analysis must be judged to be **incorrect**. {Note: This principle, which should be self-evident, is usually overlooked in the unseemly haste to develop research. It may come to be known as the Pons' and Fleischmann's first principle (designed to irritate the scientific public general and nuclear physicists in particular). We have some even more irritating principles but will save these for a later discourse.}

Research in the area of Cold Fusion affords an excellent illustration of this principle. Contrary to popular belief it is relatively easy to shown **qualitatively** that Pd cathodes polarized in LiOD solutions in D_2O generate excess enthalpy over and above that of the enthalpy input to the electrochemical cell. All that is required is that a sufficient number of electrodes of sufficiently well-controlled properties be polarized for a sufficiently long time in D_2O having a sufficiently low content of H_2O and using calorimeters of sufficient sensitivity (signal/noise ratio) in a sufficiently well-controlled environment. (Note: The explanation of the term "sufficient" in each of these contexts is beyond the scope of this article; these points can be taken up by correspondence.) It will then be found that a proportion of the experiments will show temperature-time and cell potential-time plots of the form



illustrated in Fig. 1 below:

Fig. 1. Cell temperature (upper) and cell potential (lower) vs. time since cell was started for the electrolysis of D_2O in 0.6 M Li_2SO_4 solution of pH 10 at a Pd rod cathode (0.4 dia x 1.23 cm). The cell current was 400 mA, the water bath temperature was 30.00 C, and room temp was 21 C. The rate of excess enthalpy generation at the end of each day was 0.045W (day 3), 0.066W (day 4), 0.086W (day 5), and 0.115W (day 6). The accumulation of excess enthalpy for this period was on the order of 26KJ.

We also make the following observations about this particular type of experiment:

(i) the current efficiency for the electrolysis of D_2O is virtually 100%; there is no additional chemical source of enthalpy in the system;

(ii) heat transfer from the cell to a surrounding thermostat is controlled by radiation and the heat transfer coefficient for the particular cell is virtually independent of time; and

(iii) our experiments in H_2O do not show this effect.

How then are we to explain an **increasing thermal output** of the cell coupled to a **decreasing thermal input**? The first law of thermodynamics requires that there be a source of enthalpy in the system and the strength of this source increases with time during the period illustrated [in Fig 1]. Such observations were valid in 1989 (they were valid before then!), these were valid in 1990 and they are valid now.

AUTHOR'S CONCLUSIONS

This short account has been based on only a small part of the information available. It is probably too soon, for example, to attempt a comprehensive explanation of the formation of high energy tritons (approx 5 MeV) and neutrons (3 to 6 MeV) except to say that they certainly cannot arise in simple two-body collisions. We also note that other explanations of the phenomena have been put forward: we have simply chosen the one which at this time is most free from objections and which also has the essential advantage that it leads to predictions for the outcome of novel experiments. Future surveys will have to cover the much wider range of observations already at hand and may well have to include the strange patterns of behaviour of compressed deuteron plasmas which are being reported in related fields of research such as in the application of Plasma Focus devices. It is our view that the scientific interest of the subject has now been amply established; the scope of technological applications remains to be evaluated. However, to date, it has certainly been true that all aspects of electrochemistry, no matter how esoteric, eventually find some practical use.

EDITOR'S COMMENTS

The author cites typical values (for successful experiments) to be in the range of 2-6 watts per cu cm of Pd and excess enthalpies in the range of 15-45 MJ per gm mole of Pd. It is obvious that these levels can not be explained by any known chemical processes. In their careful experimental work, Pons and Fleischmann have reached the conclusions that the lattice has an important effect on nuclear processes, that the processes are essentially aneutronic, and that heat is the main nuclear byproduct. The author comments about work done since March 1989 under the following headings: Tritium Generation; Neutrons; Excess Enthalpy Generation; Miscellaneous Observations; Theory; and Conclusions. Several reviews of cold fusion are cited.

This article was written and published prior to Dr. Fleischmann becoming aware of the recent work of Mills and of Bush and Eagleton in which they report excess enthalpy using light water. In a TV interview with Ed Yates (Science specialist of Salt Lake City's channel 5), Dr. Fleischmann was asked about the Bush report (see page 1 of this issue). Dr. Fleischmann's comments were most appropriate. He stated that the experimental result were harder to believe that those he and Pons had announced, but that cold fusion is a new science and dramatic new findings are to be expected. When asked for an evaluation of Bush's report, Fleischmann properly replied that it would be more appropriate to interview Dr. Bush.

GERMANY - Pd-h & PdAg-H SYSTEMS

Courtesy of Dr. Samuel Faile

H. Züchner & T. Rauf (Inst for Physical Chem, U. Münster), "Electrochemical isotherm measurements on the Pd-H and PdAg-H systems," *J. ofLess-Common Metals*, **Aug 30, 1991,** Vol 172-174, pp 816-823, 7 Figs, 7 Refs.

AUTHORS' ABSTRACT

The bielectrode technique has been used to measure directly hydrogen solubility isotherms of the Pd-H and PdAg-H systems. By applying small constant current densities, thin palladium or PdAg foils can be loaded continuously and homogeneously with hydrogen from one side in the electrochemical double cell, while at the other side the open-circuit potential is followed as a measure for the logarithm of pressure. For PdAg alloys the p-c isotherms obtained electrochemically agree well with those obtained from gas volumetric measurements. For the Pd-H system, however, anomalies occur when current densities greater than 1 mA are applied. The beta phase boundary seems to be shifted to smaller concentration values, where coexistence of the two phases (alpha and beta) is expected. This shift, which depends on the sample preparation conditions and the current densities applied in the experiment, is obviously due to a favoured growth of beta phase crystallites in the diffusion direction.

AUTHORS' CONCLUSIONS

A comparison of electrochemically obtained isotherms and gas volumetric ones shows that the electrochemical method is well suited for measuring isotherms if specific conditions are satisfied. The essential point is to keep the concentration difference between the entrance and the measuring side as small as possible. It is necessary therefore to choose thin foils for the measuring samples and to apply sufficiently small current densities, especially if a phase transition occurs in the system to be investigated. The anomalies in the electrochemical isotherms of the Pd-H system have directly to do with the formation of the beta phase hydride and are therefore not observable in isotherms for PdAg alloys with more than 30% Ag, where no alpha to beta transition occurs at room temperature.

EDITORS' COMMENTS

Readers may also want to review Dr. James Hunter's work with Pd and Ag in the development of the special PdAg alloy sold by Johnson-Matthey for hydrogen-gas purifications. See *Fusion Facts*, August 1991, page 17, for further information from Dr. Hunter.

GERMANY - DEUTERON PHOTODISINTEGRATION
From Chemical Abstracts, Nov 18, 1991

K.M. Schmitt, P. Wilhelm, & H. Arenhoevel (Inst Kernphys, Johannes-Gutenberg U.), "Deuteron photodisintegration at low energies," *Few Body Syst*, **1991**,Vol 10, No 3, pp 105-133, 72 refs, in English.

AUTHORS' ABSTRACT

All presently available experimental data on d photodisintegration < 40 MeV (i.e., total and differential cross sections, photon asymmetry and n polarization) are collected and carefully compared with the present status of the conventional theory (i.e. in the framework of meson-theory, or semiphenomenological N-N potentials including subnuclear degrees of freedom and relativistic corrections). No significant evidence for a failure of the conventional theory is found within the present experimental accuracy.

GERMANY - SOURCES OF FAILURE
From Chemical Abstracts, Dec. 2, 1991

Rainer W. Kuehne (W-3300 Brunswick), "Possible explanations for failures to detect cold fusion," *Phys Lett A,* **1991**, vol 159(4-5), pp 208-12, in English.

AUTHOR'S ABSTRACT

In a series of experiments S.E. Jones, et al. (1989, 1990) have detected neutron excesses having indicated some fusion processes within deuterated metals. However, most efforts to reproduce their experiments have failed. Possible sources of failure of later experiments are discussed.

INDIA - COHERENT THEORY

S.N. Vaidya (Chem Div, BARC), "On the Possibility of Coherent Deuteron-Deuteron Fusion in a Crystalline Pd-D Lattice," *Fusion Technology,* **Dec 1991,** Vol 20, No 4, pp 481-483, 14 Refs.

AUTHOR'S ABSTRACT

A coherent interaction mechanism is proposed for the enhancement of the deuteron-deuteron fusion reaction rate in a crystalline Pd-D lattice.

EDITOR'S COMMENTS

The author cites, "Bush proposed that deuterons can tunnel through the Pd-D lattice when the periodicity is alpha = (2n + 1) (gamma/4), and this process can lead to cold fusion. Our approach, however, considers interactions between the itinerant deuterons **and** the lattice deuterons and does not invoke any exotic mechanism." In the last paragraph, the author states, "To summarize, coherent enhancement of d-d fusion reactions in a crystalline Pd-D lattice is a consequence of the dual nature of the deuterons in the lattice, and it can be exploited to achieve very high fusion rates. By matching the lattice periodicity and the de Broglie wavelength of mobile lights nuclei such as neutrons, protons, deuterons, or tritons in a crystalline metallic lattice, the rate of nuclear reactions can be enhanced enormously to make nuclear reactions in atomic lattices a serious proposition for various purposes."

ITALY - NEUTRON EMISSION
From Chemical Abstracts, Dec. 2, 1991

T. Bressani, D. Calvo, A. Feliciello, C. Lamberti, F. Iazzi, B. Minetti, R. Cherubini, A.M.I. Haque, R.A. Ricci (Univ Turin), "Observation of 2.5 MeV neutrons emitted from a titanium-deuterium system," *Nuovo Cimento Soc. Ital. Fis. A,* **1991,** Vol 104A, No 9, pp 1413-16, In English.

AUTHOR'S ABSTRACT

The results of a measurement of the neutron emission from a Ti (metal)/D (gas) system by means of a spectrometer based on double scattering are reported. A approx 2.5 sigma signal corresponding to an emission of (1.3 +/- 0.5) neutrons per second per g was observed.

ITALY - COULOMB SCREENING
From Chemical Abstracts, Dec. 2, 1991

G. Stoppini (Univ. Pisa), "Coulomb screening in superconducting palladium monohydride," *Nuovo Cimento Soc Ital Fiz, D,* **1991**, Vol 13D, No 9, pp 1181-88, in English.

AUTHOR'S ABSTRACT

The electron pairs stability in superconducting PdH(D) requires a superscreening of the proton (deuteron)

Coulomb potential. This superscreening is evaluated and discussed. It is conjectured that it can have the effect of producing detectable DD nuclear fusion events in superconducting PdD.

JAPAN - LATTICE DEFECTS
From Chemical Abstracts, Dec. 2, 1991

Ryukiti R. Hasiguti (U. of Tokyo), "Materials aspects, especially lattice defects of cold nuclear fusion," *C-MRS Int. Symp. Proc. 1990*, publ **1991**, Vol 1, pp 183-8, in English, Edited by Kong & Huang, North-Holland, Amsterdam.

AUTHOR'S ABSTRACT

The so-called cold nuclear fusion is a phenomenon which can be considered to be the nuclear fusion around the room temperature. This was observed in the electrolysis of heavy water containing some impurities, and was first reported by two groups of researchers almost simultaneously in March 1989. Fusion rates reported heretofore are too high to be explained by the conventional nuclear reaction theory. It is generally accepted that some additional factors, which are not yet clear, must be considered. The present author considers that materials aspects, esp. lattice defects aspects of cathode materials, as the above mentioned additional factors, are important, and proposes to consider interstitial D dynamic crowdions and multi-D atoms trapped at vacancies.

ROMANIA - Pd THIN-FOIL FUSION
Courtesy of Dr. Samuel P. Faile

Evelina Palibroda, P. Glück (Inst of Isotopic & Molecular Tech), "Cold Nuclear Fusion in Thin Foils of Palladium, Part I," *Journ Radioanal Nucl Chem Lett,* 6 pg manuscript, 2 figs, 7 refs.

AUTHORS' ABSTRACT

Positive evidence for cold nuclear fusion in an electrochemical cell with a palladium thin foil cathode was obtained. After introduction of thiourea in the cell, seven successive emissions of neutrons (detected as thermal neutrons) alternating with inactive periods were registered. The maximum intensity (300 times background) and duration (12.7 hours) were attained in the fifth emission.

EDITOR'S COMMENTS

The Pd foil of 20 microns thickness and 0.35 grams, was rolled as a spiral around the anode. Before use, the Pd was washed with tap water, rinsed with distilled water and calcined in an open methane flame. The Pt anode was both in the middle of the Pd foil and also an added part of the anode on the outside of the foil. No anomalous neutron counts were recorded until after an induction period of over 500 minutes. The authors note in the conclusion of their paper, "A tentative explanation for these events is the spontaneous poisoning of the surface of the palladium due to accumulation of some impurities or in an aleatory mode. We call attention to the fact that the same quantity of palladium was involved in all three cases [of neutron emission]. We think that our conclusions are valid for small current densities, at higher values of this parameter the poisoning of the surface of palladium many be unnecessary.

SPAIN & ARGENTINA - H in Pd
Courtesy of Dr. Samuel Faile

R.C. Salvarezza, M.C. Montemayor, E. Fatas (U. Autonoma de Madrid), & A.J. Arvia (U. Nacional de La Plata), "Electrochemical study of hydrogen absorption in polycrystalline palladium," *J. Electroanal Chem*, **1991**, Vol 313, pg 291-301, 7 Figs, 14 Refs.

AUTHORS' ABSTRACT

The hydrogen reactions on polycrystalline Pd in 0.1 M NaOH at 25 C have been studied by using transients at constant potential, and by impedance spectroscopy and X-ray diffraction techniques. At potentials, E_S, more positive than the reversible potential, E_R, for the H_2 evolution reaction, the current-time response and the impedance data indicate H atom diffusion into the bulk Pd. The X-ray diffraction pattern of electrodes cathodized during 20 min at these potentials are similar to those obtained for Pd. At $E_S < E_R$, the current transients exhibit a current maximum which increases at E_S moves in the negative direction. The Nyquist plot for the rising part of the transients indicates the H atom diffusion into the bulk metal and H_2 evolution on the Pd surface at high frequencies. The X-ray diffraction pattern of the electrodes cathodized at $E_S < E_R$ shows the presence of the beta PdH phase and Pd. The experimental results indicate that different reaction take place simultaneously in this potential range: (i) H_2 evolution, (ii) H diffusion into the bulk Pd, (iii) nucleation and diffusion-controlled growth of the beta PdH phase. Taking into account the contribution of these reactions, a model, which is able to reproduce the experimental current transients, is presented.

EDITOR'S COMMENTS

This work was inspired by the increasing interest in cold fusion. The author's state, "The purpose of the present work was to study the early stages of cathodization of a

palladium electrode in a base electrolyte. A kinetic analysis of the various processes occurring during the formation of the alpha PdH and beta PdH phases is presented. The results from potentiostatic current-time transients, impedance measurements and X-ray diffractometry show that nucleation and growth models seem to be applicable to the phase changes involved in these reactions." Their work shows reasonable correspondence with the kinetic model they describe.

UKRAINE - ELECTRON SCREENING
From Chemical Abstracts, Dec. 2, 1991

V.M. Dmitrenko, I.P. Dryapachenko, M.V. Sokolov (Inst Yad Issled, Kiev), "Possibility of electron screening in three-particle nuclear reactions," *Ukr. Fiz. Zh. (Russ Ed.),* **1991**, Vol 36-7, pp 993-9, In Russian.

AUTHORS' ABSTRACT

In connection with recent works on cold fusion of D nuclei the problem of screening of the nucleus field by atomic and molecular electrons was discussed and analyzed on the basis of existing experimental data. This screening leads to an increase of the reaction cross section at low energies of 0-10 keV (and may catalyze the fusion.) The screening was studied in the reactions involving 3 particles in the final state, i.e. in the process: d + D --> n + p + d.

USSR - Pd PHASE TRANSITIONS
From Chemical Abstracts, Dec. 2, 1991

A.N. Varaksin, A.A. Zhivoderov, N.B. Bondarenko, V.F. Shipitsin (Nauchno-Proizvod. Maloe Predpr., Firma "SORUZ"), "Computer modeling of phase transitions in palladium deuteride (possible mechanism of cold nuclear fusion)," *Fiz Met. Metalloved.*, **1991**, No 9, pp 30-4, in Russian.

AUTHORS' ABSTRACT

A molecular dynamics method was used to study the behavior of D during alpha-beta phase transitions in Pd deuteride. During beta-alpha transitions, high-energy (E_D > 10 eV) atoms of D are formed, which during collision with other D atoms form contiguous pairs in one of the interstices of the Pd lattice. The minimum distance r_{DD} between the D atoms, observed in these molecular dynamic calculations, as 0.7 Angstrom (the normal distance r_{DD} in Pd deuteride is of the order of 3 Angstroms.) The conditions were found under which the beta-to-alpha transition must generate a maximum number of contiguous pairs of D atoms. The alpha-to-beta transitions leads to a significantly lower number of contiguous pairs (D-D), than does the beta-to-alpha transition. If the presence of contiguous pairs (D-D) is a prerequisite for a cold nuclear fusion reaction, then one can expect that the beta-to-alpha transition leads to a significantly more intense reaction than does the alpha-to-beta transition.

USSR - NUCLEAR FUSION

R. Davidonis, G. Duskesas, R. Kalinauskas, K. Makariunas, J. Pertauskas, V. Remeikis, B. Ruzele (Inst. Phys., Vilnius, USSR), "Experimental evaluation of cold fusion probability, *Liet. Fiz. Rinkinys*, **1990**, Vol 30, No 6, pp 727-731, In Russian.

AUTHORS' ABSTRACT

The upper limits of the values of feasible n and gamma quanta fluxes were experimentally evaluated in the process of heavy water electrolysis. The velocity of the low temperature nuclear fusion reaction is found to be at least 10^5 times lower than that reported by M. Fleischmann and S. Pons (1989).

F. SHORT ARTICLES FROM READERS

TRADING VIEWS ON WHAT WORKS (SOMETIMES)
By Dr. Dennis J. Cravens

Cold fusion has been interesting and often frustrating. The most common difficulty has been in replicating heat and tritium production at will. For some reason, even among "identical" pieces of palladium, only a few seems to work well. In the first few months after the P&F announcement, many researchers rushed out and tried to produce a working cell with only a single scrap of metal. This metal used may be just what happened to be laying around the lab. Some worked, most did not. Even now there is a bit of artistry in finding just the correct piece of palladium which gives the best results. I personally believe that the variations among pieces of palladium is due mostly to their crystal lattices. (Although a small amount of Li is often claimed to be beneficial.)

The selection of catalytic and electrolytic metal samples is an art, however, it was not generally known to many physicists trying to duplicate the early work. In the first few weeks following the P&F announcement, certain subjective selection of

electrode material seemed to give better results. In those early days, we used very slow loading of D (and Li) into the metal lattice. This often took from several weeks to a month at current density around 60 ms per sq cm. I still use very long loading times in hopes that it will put more Li into the metal lattice.

If the current is turned off momentarily during this loading, you can notice that different metal samples out-gas (D bubbles back out of the sample) at different rates. The cathodes that out-gas the most seem to give the best final results. **YOU MUST, AT LEAST, GET THESE BUBBLES OR YOU ARE NOT CLOSE TO THE PROPER LOADING RATIO.** (At atmospheric pressure the energetic outgassing occurs around 0.7 D/Pd ratio.) After loading, you may even notice that some electrodes "swell" more than others. The larger volume changes, likewise, seem to be indicators of the expectation of better results. The problem with this is most people just don't notice these differences unless they are loading a large number of electrodes and can, therefore, compare the out-gassing and swelling (or have other researchers with whom to compare results.) For those "in the know" (experienced cold fusion experimenters) this selection is obvious. It is still one of the indicators I use to predict a good or poor metal sample before I start the heat measurements. Another approach is to monitor the sample's electrical resistance during the loading. The samples that change the most are usually the OK samples. The ones that go through an inflection point seem to be the best. The inflection point in resistance is around 0.8 D/Pd. If you have first seen the bubbles, you are generally on the right side of the resistance peak.

Chemical analysis of good and poor electrodes normally show very little difference. Early work seems to indicate that palladium from Johnson and Matthey were better than other suppliers, but no real difference was ever seen in the chemical analysis of the metal. (Some experimenters have implied that the carbon crucibles contaminate the surface of the Pd and prevent loading.) In fact, a single rod cut into pieces may produce only one good electrode and several poor ones. Work from India showed that a single block of Ti could be turned to small chips and only a few out of a thousand chips produced much tritium. My personal view is that some samples have better crystal structure. Since Pd and Ti are highly paramagnetic, the individual crystal grains within the metal can be highly magnetic. I believe that D (and Li) ions migrate primarily between the grain boundaries. If the thermal conditions are just right (see R. Bush's theory) it seems reasonable to increase populations within a given Bose energy state. As the D passes down the grain boundaries, they can be subjected to very intense and inhomogeneous magnetic fields created between adjoining paramagnetic grain boundaries. This separates specific nuclear spin states (acts as a miniature Stern-Gerlach machine.) The result is the production of pure energy and spin states bringing Bose statistics into play which makes reaction between two identical deuterium nuclei more probable. Further, it greatly enhances the available nuclear reaction channels. The parity and spin states of the products is limited by the spin alignment of the reacting particles. This leads to non-standard product ratios with very few neutrons. I am still unsure of the exact nuclear events. However, I am now checking the path

$$D + {}^{6}Li \rightarrow {}^{8}Be^{*} \rightarrow 2\ {}^{4}He.$$

I was drawn to this conceptual model by the following:

1. Autoradiographic photos seem to show the hottest spots along grain boundaries.

2. Paramagnetic alignment of grains is one of the few possible variations between two metal samples from the same rod with identical elemental analysis.

3. Separation of spin states by locally intense magnetic fields is one of the few possible ways to alter nuclear reaction pathways.

4. Changes of results after work-hardening and annealing can be explained.

5. Migration along grain boundaries explain variation in D uptake. And

6. Ortho and para-hydrogen can be easily produced as hydrogen reacts in or on paramagnetic materials (see a standard Cotton and Wilkinson Advanced Inorganic Chemistry text) which shows a nuclear alignment of the adsorbed hydrogen.

There are some other factors a starting experimenter may want to be cautious of. Hydrogen-1 (normal isotope) seems to lead to failure (Mills work ignored). Your Pd, Li, and D_2O should be shielded from contamination by normal water. In fact, I anneal my Pd for several days at 300-500 C in vacuum, nitrogen, or oxygen. The goal is to get out as much H-1 as possible before loading. Some times I even anneal-load-anneal-load ... etc., in attempts to flush out any normal H in the Pd lattice. I personally think this process also increases the Li content within the Pd lattice, which I believe increased the ultimate D/Pd ratios you can achieve (no proof, just my thoughts at this time.) Once you anneal the Pd you should store it under D_2O or protect if from water. You may think it is an unusual precaution but, I don't expose anything or open anything when it is raining or humid. Anyone who has ever made divinity candy understand that humid weather can destroy a perfectly good recipe. **YOU MUST KEEP NORMAL WATER AWAY FROM THE SYSTEM.**

THE SURFACE OF THE Pd IS IMPORTANT. The first 1 to 20 microns seem to be critical to the functions of the Pd cathode. Pd plating on other metal seems to promote cold fusion, if you have every thing just right. People trying this should start with Ag. The other substrate that I have tried eventually causes the plating to flake off. I may be doing something incorrect [in terms of plating] but it seems that Ag, (and sometimes Ni, and Ni-Mg alloys) seem to work and the others don't. Before you plate an electrode or just run straight Pd, I would advise you to clean the surface by running it as an anode. Then you are ready to start loading the Pd cathode or Pd-plated cathode. I have had the best results by the old slow and steady charging using Pt anodes (60 mA per sq cm - although you may want to try the quicker method of adding Pd salts to plate Pd on the surface followed after loading by small amount of Pt salts.) It seems that the small amount of Pt on the surface of the Pd is beneficial. This [platinizing of the Pd cathode] takes either time or tricks of adding Pt. I sometimes pulse the current in hopes of increasing the deposition of Pt on the Pd and "slosh" the deuterium in and out of the electrode to help flush out any possible remaining ^1H.

The geometry of the cell will also effect the loading. In general try to **KEEP THE ANODE TO CATHODE DISTANCES UNIFORM**. Be careful of using glues and other seals that have not fully cured -it is easy to poison the surface of the cathode and thereby slow the loading process. You want to make the loading very easy and then after loading, increase the potential at the surface that must be transversed by the deuterium. For example, Li in the lattice seems to help the loading but it also helps the deloading (off gassing). You want to first get as much deuterium as possible into the lattice, then keep it there. If you try to over coat the electrode with Pd, Rh, or a surface poison, **FIRST LOAD THE ELECTRODE, THEN COAT IT.** This process may save you months of waiting. If it is not loading (bubbles when turned off) after a week or so, then the surface is probably not clean. You may want to try to run it as an anode to clean it or try some other procedure. After the Pd cathode is loading you will notice that the surface gets blackened by the Pt and other things. Don't expect to get much cold fusion effect until you get that Pt build up which is what gives you the proper over potential. However, **IF THE CATHODE HAS NOT TURNED BLACK YOU SHOULD NOT SAY YOU DON'T GET ANYTHING.**

The static loading levels of the Pd seem to be just part of the puzzle. I think that there must first be a large D/Pd ratio and then a dynamic or non-equilibrium condition to cause mobile deuterium to move through the loaded lattice. There are several ways to do this. For example: 1. change the temperature; 2. change the pressure, or 3. alter the current (i.e. the overpotential.) I use the latter because it is the easiest. Remember you want to retain a certain minimal current density (say 500 mA per sq cm) to keep the electrode loaded. This means that the use of electrical pulses should be increases in the current density by, say, 10% above the minimum level. I use pulses that increase the current density by about 10% above the working level and ramp pulses in cycles from 0.1 to 200 sec with about a 20% duty cycle. The idea is to cause some dynamic movement of the mobile deuterium within the loaded metal lattice.

The difficulty of controlling crystal grains within a metal sample is a common problem in metallurgy. An experimenter may wish to try creating micro-crystalline samples by quenching in liquid nitrogen (or cooling in a degaussing or gaussing field) or

increasing grain sizes by repeated temperature cycles. Also I am experimenting with selecting wire samples by passing the wire over a tape player head and listening (and watching an oscilloscope.) This measure gives me some indication of the crystal grains. However, in the final analysis there does not seem to be a good way of producing a good electrode except by screening out the poor ones and always treating the electrodes with respect and care from the beginning. Just start with as many electrode samples as you can afford. The small ones are quicker to load. Start them loading for a few weeks. **BE PATIENT**. Check the electrodes for the "right stuff" and make sure you "treat them right." Select only the ones that out-gas a lot when you turn off the current for a few seconds and the ones that "swell up" a little. As for the others, hit them with a hammer, run them for awhile as an anode, anneal them, cook them, melt them, drop them into liquid nitrogen, irradiate them with x-rays ... or do something that shakes up their crystal grain lattices, reforms their surface, or cleans out the normal hydrogen. Then try them again until you can get them to out-gas like the rest. I know this sounds strange, but it is the only way I know. If someone else knows a better way, they are not talking, but I would like to hear from them.

[See the following short note from Dr. Cravens on the use of an IR visual aid to visually determine what may be going on with your experimental cell.]

HOT SPOTS ON ELECTRODES

by Dr. Dennis Cravens, Vernon, Texas.

The primary signature of cold fusion is the production of heat. It has already been reported that only certain titanium chips from a group of chips produce most of the observed tritium (work in India) [1]. In the Salt Lake City conference, Thompson [2] announced that analysis of heat-producing cold fusion cathodes got hot enough to alter the crystal lattice. Hoffman [3] has noticed a wide variation of helium [and tritium] levels from different sections of the same rod taken from cold fusion cells.

I have observed hot regions of a rod during operation in an electrochemical cell by using a near-IR viewer. This viewer was the type used to locate heat loss from buildings. In a specific case, the IR image appears to show a hotter region in the lower fourth of the rod. The observations were made using a LiOD cell with a Pd cathode treated with a slight over coating of Rhodium. The cathode is a 0.4 mm wire which was slowly loaded with deuterons at 20 milliamps per sq cm and then operated at 600 milliamps. The IR image seems to indicate that only one side of one region is actively producing heat. I cannot yet rule out the possible effects of unequal electrical or fluid currents.

The important point is that as I would pulse the current through the cell above the base current of 600 milliamps, the IR image shows the warm region to be less localized. This observations seems to indicate that more areas of the cathode can participate in heat production as the current is pulsed.

It is suggested that other researchers observe their cells using IR-imaging devices. The method seems to be a relatively quick and easy way to see what is happening to the cathode. An experimenter may be able to borrow such IR devices from law enforcement, National Guard, energy conservation groups, or hunters. Well-funded experimenters may purchase such devices.

[1] M. Srinivasan et al. (BARC), "Observation of Tritium in Gas/Plasmas Loaded Titanium Samples", AIP Conference Proceedings 228, Anomalous Nuclear Effects in Deuterium/Solid Systems, pp 514-534, Provo, Utah 1990.

[2] Dr. Coupland et al. (Johnson Matthey), "Some Observations Related to the Presence of Hydrogen and Deuterium in Palladium" Proceedings of the First Annual Conference on Cold Fusion, March 28-31, 1990, pp 299-307. This paper was presented by Thompson on behalf of the Johnson-Matthey Technology Center. The paper reports that there were regions on the spent 2 mm rods which indicated that some regions of the rods reached temperatures in excess of 300C as witnessed by recovered grain structure.

[3] Dr. Nathan Hoffman in an announcement at the Provo, Utah meeting concerning the results of analysis of the University of Hawaii molten salts electrodes. The ^{4}He was preliminarily found in only

some sections of the rods and only in one quarter of some rod sections.

EDITOR'S COMMENTS

Fusion Facts is pleased to publish this short article from Dr. Cravens. Dennis has been an excellent source of experimental suggestions for those working under very limited budgets. This IR-observing approach should greatly increase the speed at which certain types of experiments can be carried out. Higher quality IR-imaging equipment should be able to show considerable temperature difference between electrolyzed gases above a hot spot than below a hot spot. Experimenters may want to provide viewing ports in their high-pressure cells. In some cases, the hot spot observation may be enhanced by turning off the stirrer.

NOTES ON THE POSSIBILITY OF IMPACT FUSION WITH AMPERE FORCES

By Dr. Peter Graneau, Northwestern Univ.

1. What did Helene Guillemot ("The Forgotten Ampere Force," *Science et Vie*, Dec 1990) mean when she wrote:

"If Ampere force is real, then, as pointed out in a recent paper in *Physics Letters* published by the two French physicists already quoted, it compromises the success of experiments in controlled thermonuclear fusion which have anyhow been disappointing."

In Tokamak fusion reactors a circular plasma current is pinched away from the walls of a doughnut-shaped enclosure pipe. When one mega-ampere of current flows in the plasma, the resulting Ampere-tension, trying to disrupt the current flow, should be of the order of 200,000 newton. If this tension did really exist it would not be surprising that enormously strong electromagnets have to surround the plasma loop to stabilize the current and keep it from crashing into the pipe walls. But we have no proof at the present time that Amperes's force law does apply to the dilute plasmas of Tokamak fusion reactors.

2. Now that the National Cold Fusion Center has closed its doors, we should look at another stunning fusion experiment in the spring of 1989. Two scientist from the Electric Power Research Institute (EPRI) called it lukewarm fusion (M. Rabinowitz, D.H. Worledge, *Fusion Technology*, **1990**, Vol 17, p 344.) They referred to the cluster-impact fusion experiment performed at the Brookhaven National Laboratory (Beuhler et al., *Phys Rev Letters*, **1989**, Vol 63, p 1292.) At Brookhaven tiny droplets of heavy water (D_2O), containing no more than 1300 molecules, were fired at a deuterium containing titanium metal target to produce D-D fusion. The process did not involve the hundred million degree temperatures required for thermonuclear fusion. It is correctly described by **impact fusion**. According to the EPRI scientists, the Brookhaven experiment produced "anomalously high fusion rates based on conventional wisdom," and "apparently it has taken only one experiment to establish low-energy cluster-impact fusion as a scientific fact."

The Brookhaven experiments are significant for two reasons: (1) They involve quite low nuclear energies of about 100 eV per heavy water molecule. This is two orders of magnitude smaller than the nuclear energies contemplated for the thermonuclear fusion. (2) The experimentally measured collision cross-section of low-energy deuterium nuclei was fifteen orders of magnitude larger than originally believed. These two facts put a new complexion on impact fusion which has normally been deemed to have no chance of becoming a commercially viable process (R.F. Post, *Review of Modern Physics*, **1956**, Vol 28, p 338.)

3. More than 40 years of controlled fusion research have revealed many fusion reactions which were definitely not thermally induced. An early example of this were the pinch effect studies started at the Berkeley Radiation Laboratory in 1948. Results reported ten years later (O.A. Anderson et al., *Physics Review*, **1958**, Vol 110, p 375), and involving D-D reactions, contained the statement:

"Most of the measurements seemed consistent with thermonuclear reactions at the time, except that the neutron yield rose to many orders of magnitude larger than our simple calculations predicted. In the end we were able to show by measurements of the neutron energies that the reaction did not occur in a high-temperature plasma, but rather that approximately 10^{14} deuterons per pulse were accelerated along the axis of the discharge tube to

energies of about 2 x 10^5 electron volts, probably in the very strong electric fields produced transiently by m+0 (sausage-type) instabilities."

In other words, impact fusion was already observed in the early Berkeley discharge tube experiments. Complex MHD theory, based on somewhat uncertain assumptions, explained the impact phenomena by plasma instabilities. The possibility that longitudinal Ampere forces were involved cannot be ruled out. In view of the 1989 cluster-impact work at Brookhaven, it is unrealistic to dismiss any kind of impact fusion as commercially uninteresting.

4. Young, et al. (*IEEE Transactions on Nuclear Science*, **1973**, Vol NS-20, p. 439), exploded 0.0013 cm diameter tungsten wires, connected to a 0.5 cm diameter CD_2 pellet mounted in an aluminum anode. The current pulse amplitude was 1.2 MA. This action liberated 10^7 neutrons from the anode. The investigators reported:

"Positive evidence has been obtained in exploded wire discharges for the collective acceleration of deuterons in a direction opposite to the applied voltage."

This finding suggests the presence of longitudinal Ampere forces in the wire (P. Graneau, *Physics Letters*, **1983**, Vol 97A, p 253.) These forces can propel positive ions against the applied electric field.

5. Young et al. of the Naval Research Laboratory in Washington, D.C. also produced fusion reactions with deuterium-impregnated plastic fibers suspended in vacuum between metallic electrodes. Discharges sliding over the surfaces of the dielectric fibers must have initiated the MA-current pulses. The object was to cause thermonuclear reactions in the hot and dense plasma channel, using pinch forces for magnetic containment. The neutron yield was greater than anticipated. In the end the investigators doubted that predominantly thermonuclear reactions had occurred because the neutron yield did not scale correctly with the deuterium concentration in the fibers. Impact fusion may have been a factor.

6. The discovery of 'capillary fusion' by Lochte-Holtgreven (*Atomenergie-Kernphysik*, **1976**, Vol 28, p 150) was also motivated by the wire explosion phenomena. Instead of wires, the Kiel University group used a solution of lithium in heavy ammonia ($Li(ND_3)_4$ consisting of 70 atomic percent of deuterium. Each liquid filament, which was encased in a block of glass, seemed to explode just like a metal wire. That is to say, the first stage of the explosion was **transverse striation** (stack of coins in metal wire explosions.) Precisely at the moment of striation, which lasted for a number of nanoseconds, the neutrons were released within a current pulse which lasted for 20 microsecs. The only explanation which has so far been proposed for wire striations is the existence of Ampere tension (Graneau). The repulsion of positive ions from the **liquid** fracture faces could give rise to impact fusion in each crack. In these experiments the glass prevented surface flashover, but the dissolved lithium permitted electronic conduction through the capillary. At the moment of neutron emission, the current was only 1,000 A. It later rose to 10kA, but no further neutrons were produced. This indicates that the striations were necessary for impact fusion to take place. The low current ruled out heating to thermonuclear temperatures.

7. Several laboratories have produced fusion reactions with plasma-focus devices, as reviewed by Haines (*Philosophical Transactions of the Royal Society of London*, **1981**, Vol A300, p 649.) The construction of these devices is similar to the water-arc gun shown in the *Science et Vie* article which refers to it as Ampere's posthumous bomb. When this small gun is filled with saltwater and a current pulse of kilo-amperes is passed through it, water is expelled at high velocity. The generation of superheated steam and Lorentz forces have failed to explain this phenomenon. Is it conceivable that the Ampere propulsion forces of the water-arc gun also account for impact fusion when the water is replaced by deuterium gas?

8. If 100 eV of kinetic energy of a heavy water molecule can produce impact fusion, as indicated by the Brookhaven cluster-impact experiments, then heavy water droplets colliding with each other at a relative velocity of 30 km/s should result in many D-D fusion reactions. Such a collision could probably be achieved with two water-arc guns, arranged muzzle-to-muzzle, each accelerating a tiny droplet of heavy water to 15 km/s. It does seem feasible, considering that a miniature water-arc gun was able to accelerate 3.8 gm of water to 1,000 m per s with

a 75 kA current pulse. The expelled slug of liquid water punched a half-inch hole into a 1/4 inch thick aluminum pate (P. Graneau et al., 4th Symposium on Electromagnetic Launch Technology, U of Texas, April 1988.)

EDITOR'S COMMENTS

We wish to thank Dr. Graneau for his collection of anomalies. There is no longer any question among cold fusion scientists that we are **dealing with a new science.** When we have sufficient experimental evidence from various cold and warm fusion experiments (cluster impact, plasma focus, gas loading, and electrochemical) a theory will emerge that will properly explain most of the observed phenomena. It is *Fusion Facts* technical judgement that commercialization of cold fusion will precede the theory. However, some working models (such as Bush's TRM) may greatly aid in the more rapid development of the technology.

G. LETTERS TO THE EDITOR

OPEN LETTER TO FELLOW SCIENTISTS

From Dr. Melvin H. Miles

An Open Letter to Fellow Scientists

Nature is a prestigious international journal that has played a leading role in many important scientific developments since it was first published in 1869. However, their treatment of the recent cold fusion controversy has been somewhat less than fair. Science is always concerned with the search for truth and the exposure of errors. Although the scientific method will eventually lead to the resolution of the cold fusion controversy, it is now clear that this anomalous effect cannot be readily dismissed as experimental error. The publication of apparent errors and incorrect conclusions, however, such as in the two papers by N. Lewis et al., certainly hinders the quest for truth about this phenomena. A more careful and unbiased review and evaluation is needed for submitted papers on both sides of the cold fusion controversy. I hope that *Nature* will honor its long tradition in seeking scientific truths and correcting errors by publishing my enclosed letter.

[The "enclosed letter" is a letter to John Maddox, Editor of *Nature* pointing out the flaws in the calorimetric experiments reported by N. Lewis et al. (*Nature*, **340**, 525, 1989) and that were brought to Dr. Miles attention by Dr. Noninski (*Fusion Facts*, June 1990, p 20-24). We commend Dr. Miles on his professional handling of this matter with *Nature*.]

AN UNSCIENTIFIC AMERICAN

An exchange of correspondence with *Scientific American.*

In re: John Rennie, "The Ig Nobel Prizes", *Scientific American,* Dec 1991, p 26, 0 references.

The following correspondence involves the following ignoble remarks by John Rennie: "Perhaps the most noteworthy parties overlooked by the Ig Nobel Prize committee were B. Stanley Pons of the University of Utah and Martin Fleischman [sic] of the University of Southampton, the discoverers of cold fusion. There's always next year."

In addition to not having the courtesy to spell Dr. Fleischmann's name correctly, John Rennie shows an enormous lack of familiarity with current scientific literature. His ridicule of two eminent scientists engendered the following exchange:

From Jed Rothwell (Cold Fusion Research Advocates) to Dr. Jonathan Piel (Editor, *Scientific American*): "John Rennie believes that Cold Fusion has been discredited... He is incorrect. Cold fusion has been verified by hundreds of workers in over 100 world class laboratories... We think that Cold Fusion is, at least, a major scientific revolution. Furthermore, we feel that it may well become a practical source of limitless, pollution free energy. You may not be persuaded by the evidence, but as a journal of science, you should report that hundreds of credible, sincere scientists are working intensively to understand cold fusion. You should not ignore nor belittle these people. Your job is to report the news objectively, not to filter nor control it. Cold fusion is newsworthy if for no other reason than because large numbers of respected, high caliber scientists believe it is real..."

From Jonathan Piel to Jed Rothwell: "I am struck by the final clause of the first sentence in the second

paragraph of your petition: '...even though its precise physical mechanism is not fully understood at present.' Such a characteristic is typical of another kind of event in science, one which Irving Langmuir accurately described in a classic paper in the 1950's. You should look up the reference. My colleagues and I are grateful for the professional advice. I would say that we have followed it to a 'T' with respect to cold fusion."

From Jed Rothwell to Jonathan Piel: "Thank you for your brief, enlightening note. I shall copy it to all the other petition signatories. One thing puzzles me. Langmuir lists six characteristics of 'pathological science,' but our statement that the 'mechanism is not fully understood' is not among them:

1. Causative agents barely observable,
2. Effect remains close to the limit of detectability
3. Claims of great accuracy,
4. Fantastic theories contrary to experience suggested,
5. Criticisms met by ad hoc excuses, and
6. The ratio of supporters to critics rises to 50% then falls.

"Which of these six do you have in mind, number four? We claim there is no accepted theory; surely that is not the same as claiming a fantastic theory. If you consider the lack of theory a hallmark of pathological science, are you expanding Langmuir's list? You [would then] condemn everything from high temperature superconductivity to human cognition, since these phenomena are not fully understood yet. I strongly disagree with your last statement. Your coverage of Cold Fusion has been inaccurate and incomplete. You have made a catastrophic misjudgment, and your continuing refusal to reexamine the experimental evidence is nothing but closed-minded unscientific obstinacy."

ROMANIA - NEW CORRESPONDENT

Dr. Peter Glück, Institute of Isotopic & Molecular Technology of Romania has kindly consented to be a correspondent for *Fusion Facts*. Dr. Glück can read and translate from Russian, French, Italian, German, Spanish, Hungarian, Bulgarian, Polish, Czecho-Slovakian, and Serbo-Croatian. Here are excerpts from his November 6, 1991 (rec'd Nov 20, 91) letter:

Dr. Mills' achievements are more than impressive, he seems to be a genius, something like Peter Hagelstein. The problem is - in this case: **it is difficult to imagine that nature is so intelligent too.** But the background and qualifications of Mills, his paper and his book, the replication of his results by Noninski and James McBreen [Brookhaven Nat'l Laboratory] are all proofs that he has discovered an enhanced energy device which is the nearest neighbor (or relative) of cold fusion. [Dr. R.T. Bush agrees, see page 1].

Another very interesting cell is a Hungarian discovery or idea. The cathode is the base plate of the electrolysis cell, deuterium is diffusing slowly from inside to outside. You can use different barrier layers and you can destroy locally this later, e.g. by a laser. I believe that neutrons, tritium, and heat are coming in bursts because they are coming from very restricted areas, hot spots (bursts are temporal because they are local). Such a cell can be very useful for finding these peculiar areas. [We have asked Peter for a drawing.] I have spent many years working in the field of heterogeneous catalysis, for me the concept of "very few active sites" is quite natural and I understand that it is difficult to control. . . . [See Cravens notes on IR viewing, pg 15.]

I also suggest that you consider the Cold Fusion bibliography of Dieter Britz, (Kemisk Institut, Aarhus Universitet, Langelandsgade 140, DK-8000, Aarhus C Danmark, Fax +45-86 196 199, E-Mail). He is too clever to remain a skeptic for a long time and his abstracts are interesting. He is making a contribution to cold fusion. I quote from his letter: "...the authors did not, in my opinion, get as much of their data as they should, I am referring to the Birgülz, et al paper, showing remarkable correlation between alpha emission and cell temperature. You see, I am fair, here I am helping the Believers." [Dr. Glück corrects an error we made on page 19 of FF for Sept., 1991 where we accepted a mistranslation and used the term alpha rays when we should have used alpha particle.]

Another quotation from Dieter Britz: "Have you seen the Mallove book? I have offered a review of this book to New Scientist but have not heard from them yet. I like the book, better in fact than the one by Close. I have contact with them both. Mallove is very fair on the skeptics, he is a

gentleman. Needless to say, the book has been unfairly rubbished. My review is favorable on the book but I do say that I am a skeptic just the same. Close is a bit obsessed with the gamma spectrum affair (and I have told him that), perhaps rightly so; lately, though, he seems to me to be softening just a little on the possibility of some exotic nuclear process may be taking place." I am trying to show that he [Britz] is a good guy, perhaps we (FF) have to write some essays "Defending the Skeptics" in order to help them to suffer a metamorphosis and become believers.

I shall be grateful if you could ask our cold-fusionist friends to put my name on their list for preprints. In the last year I wrote 311 letters and received 240 answers, this is my main possibility to obtain information. [Send to: Dr. Peter Glück, Institute of Isotopic and Molecular Technology, R-3400 Cluj-Napoca, P.O. Box 700, ROMANIA.]

May I call your attention to the fact that not the whole press is dominated by the science "maffia". A notable exception is the French popular-science journal *SCIENCE ET VIE*. Some examples: "Cold fusion isn't' dead. Stop. Confusion continues. Stop." (No. 880, Jan 1991, p 86, on Provo symposium.) "Cold fusion is finally accepted" (No 886, June 1991, p 102 on Fred Mayer's theory and Hawaii cell).

I believe we have to work out a network with such journals and/or people, they can help us in our [cause], Do you agree? [Definitely & Absolutely agree. Ed.]

I am enclosing a list of patents on cold fusion, I have found them in Chem. Abstracts and in the Britz bibliography. I haven't seen these in FF. I have tried tens of patents, studied hundreds of them, and seen many thousand, so I know that, "Patents help you to learn the mythology and not the history of a process. Very few patents are of any use (technological not legal) without know-how data." For example, I cannot believe that a cold fusion patent [except for Pons and Fleischmann] dated e.g. May 1989 is based on serious technological research. [See the patent list in the following paragraphs.]

LIST OF COLD FUSION PATENTS

Courtesy of Dr. Peter Glück

[Entries: List No.; Patent Application No; Title; Applicant; Date of publication; Priority date. Dates are in mm/dd/yy format.]

1. JP 90,271,288; "Nuclear fusion employing heavy fermion effect in solid"; T. Neguzi; 11/6/90; 4/13/89.

2. JP 90,276,989; "Apparatus for nuclear fusion at room temperature"; Hitachi; 11/13/90; 4/5/89.

3. JP 90,276,990, "Nuclear fusion at room temperature"; Hitachi; 11/13/90; 4/10/89.

4. JP 90,276,991; "Apparatus for nuclear fusion at room temperature"; Hitachi; 11/13/90; 4/5/89.

5. JP 90,276,992; "Deuterium absorption in nuclear fusion"; Hitachi; 11/13/90; 4/14/89.

6. JP 90,278,189; Power generator and heater based on cold nuclear fusion"; T. Masakasu; 11/14/90; 4/19/89.

7. JP 90, 280,088; "System for cold nuclear fusion, heat transport and thermoelectric cells"; Sanyo; 11/16/90; 4/20/89

8. JP 90,282,289; "Power generator based on cold nuclear fusion"; Sumitomo; 11/27/90; 4/28/89.

9. JP 90, 293,692; "Cold nuclear fusion"; A.I.S.T.; 12/4/90; 5/9/89.

10. JP 90,298,891; "Nuclear fusion reactor'; Seiko-Epson; 12/11/90; 5/15/89.

11. JP 90,302,693; "Apparatus for cold nuclear fusion using solid bodies"; Sanyo; 12/14/90; 5/12/89.

12. JP 90,304,393; "Cold nuclear fusion based on heavy water electrolysis"; Seiko-Epson; 12/18/90; 5/18/89.

13. JP 90,306,194; "Apparatus for cold nuclear fusion and heat transport system"; Sanyo; 12/19/90; 5/19/89.

14. JP 90,307,093; "Cold nuclear fusion on heavy-water electrolysis"; Seiko-Epson; 12/20/90; 5/22/89.

15. JP 90,311,792; "Method of cold fusion"; Seiko-Epson; 12/27/90; 5/29/89.

16. JP 90,311,793; "Electrolysis apparatus used in cold nuclear fusion"; Seiko-Epson; 12/27/90; 5/29/89.

17. JP 91,002,690; "Deuterium-absorbing materials in cold nuclear fusion"; N. Hirokasu; 1/9/91; 5/31/89.

18. JP 91,006,490; "Controlling cold nuclear fusion based on electrochemistry"; Nippon Light Metal; 1/11/91; 6/5/89.

19. JP 91,033,687; "Laminated electrode structure for cold fusion"; Taiyo Yuden; 2/13/91; 6/30/89.

20. JP 91,035,192; "Uranium cathode for electrolytic exothermic tritium formation"; Nuclear Fuel Ind.; 2/15/91; 7/3/89.

21. JP 91,035,193; "Lanthanum nickel cathode for electrolytic exothermic tritium formation"; Nuclear Fuel Ind; 2/15/91; 7/3/89.

22. WO 90/10935; "Method and apparatus for power generation"; S.Pons et al; 9/21/90; 7 dates 3/13/89-5/16/89.

23. WO 90/12403; "Method and apparatus for providing nuclear energy"; S.I.Lo; 10/18/90; 6/3/89.

24. WO 90/13126; "Energy/matter conversion methods and structures"; R.L. Mills; 4/13/90; 4/21/89.

25. WO 90/13127; "Electrolytic apparatus for disassociation of compounds containing hydrogen isotopes"; Ceramatec; 11/1/90; 4/18/89.

26. WO 90/13128; "Enhancing nuclear fusion rate in a solid"; EPRI; 4/20/90; 4/23/89.

27. WO 90/13129; "Coherent fusion apparatus"; P. Hagelstein; 12/6/90; 4/6/89.

28. WO 90/13897; "Deuterium-lithium energy conversion cell"; Drexler Tech; 11/15/90; 5/12/89.

29. WO 90/14668; "Cold fusion propulsion apparatus and energy generating apparatus"; D.J.Cravens; 11/29/90; 5/1/89.

30. WO 90/14670; "Isotope deposition stimulation and energy conversion for nuclear fusion in a solid"; EPRI; 4/20/90; 5/2/89.

31. WO 90/15415; "Cold fusion support"; Johnson-Matthey; 12/13/90; 6/2/89.

32. WO 90/16070; "Catalyzed nuclear fusion of heavy isotopes of H_2"; Condensed Matter; 12/27/90; 6/14/89.

33. WO 91/01037; "Chemo-nuclear fusion methods"; G.E. Shaffer; 1/24/91; 7/13/89.

34. WO 91/01493; "Method and device for the determination of the obtained energy during electrolytic processes"; V.Noninski; 2/7/91; 7/20/89.

35. WO 91/02359; "Distributed accumulation for energy conversion"; Drexler Tech; 2/21/91; 8/4/89.

36. WO 91/02360; "Electrochemical nuclear process and apparatus for producing tritium, heat and radiation"; G.J.Schoessow; 2/21/91; 6/30/89.

37. DE 3,910,806; "Method and apparatus for nuclear fusion reaction at low temperature"; H. Hora; 10/11/90; 4/4/89.

38. DE 3,913,002; "Fusion energy production by using Fe group metals as electrodes"; K.F. Dies; 10/25/90; 4/20/89.

39. DE 3,915,153; "Method and apparatus for sorbing hydrogen in solids especially in electrodes for cold fusion and support containers"; Siemens; 11/15/90; 5/9/89.

40. DE 3,916,397; "Method and apparatus for fusion of light nuclei"; Siemens; 11/22/90; 5/19/89.

41. DE 3,920,312; "Method and apparatus for fusion of light particles in solid getter"; Siemens; 1/3/91; 6/21/89.

42. EP 392,324; "Electrochemical nuclear fusion method"; SEL(Japan); 10/12/90; 4/13/89.

43. EP 392,325; "Electrochemical nuclear fusion method"; SEL(Japan); 10/12/90; 4/13/89.

44. EP 393,461; "Plasma nuclear fusion method"; SEL(Japan); 10/24/90; 4/20/89.

45. EP 393,465; "Method for producing plasma nuclear fusion"; SEL(Japan); 10/24/90; 4/20/89.

46. EP 394,980; "Cold nuclear fusion apparatus"; Matsushita; 10/31/90; 4/27/89.

47. EP 396,066; "Apparatus for cold fusion"; Matsushita; 10/31/90; 4/26/89.

48. EP 402,988; "A process with relevant plants and devices, for the production of energy through the indicated apparatus"; Ecoline; 12/19/90; 6/14/89.

49. EP 414,399; "Process for storing hydrogen, and apparatus for cold nuclear fusion and method for generating heat energy using the process"; Canon; 2/17/91; 8/4/89.

50. US 4,986,887; "Process and apparatus for generating high density H_2 in a matrix"; S.Das Gupta; 1/22/91; 3/31/89.

51. CAN 2,023,216; "Method of preparing electrode for use in heat generating apparatus"; U/Utah; 2/16/91; 8/15/89.

52. FR.DEM. 2,642,943; "Reactor for electrolytic nuclear fusion in solid electrolyte"; F. Forrat; 12/7/90; 6/6/89.

Peter Glück notes, "I don't believe this list is complete, due to the scarcity of my sources, but perhaps we need such a list to follow the development of the sub-field **technology.** Usually a **technology** has thousands of patents. I predict cold fusion and other EEDs will be in the same situation in the near future." [Thanks Dr. Glück for this great contribution!]

H. CONFERENCES, PAPERS & MISC.

LETTER FROM JAPAN
From Professor Hideo Ikegami

ANNOUNCING: THE 3rd INTERNATIONAL CONFERENCE OF COLD FUSION (ACCF3)

Date: October 21 (Wed) - October 25 (Sun), 1992

Place: Nagoya Congress Center, Nagoya, Japan

The conference will cover the broadest topics relevant to the cold fusion phenomena in the broadest research fields including nuclear physics, electrochemistry, and solid-state physics.

The tentative dead lines are:
Preliminary Registration: 15 March 1992
One-Page Abstract: 15 June 1992
Final Registration: 1 September 1992

The First Announcements with a preliminary registration form will be circulated in November. The succeeding announcements will be mailed solely to those who return the preliminary registration form by 15 March 1992.

The final registration form and a hotel reservation card will be enclosed with the 2nd and 3rd Announcements which will be sent in April and July 1992, respectively.

Nagoya is the fourth largest city in Japan and is located between Tokyo and Kyoto on the Pacific coast of the main island and has many tourist sites. By bullet train, it takes two hours from Tokyo and 50 minute from Kyhoto, though many international flights are directly available to Nagoya International Airport.

For further information contact the Conference Chairman:

Professor Hideo Ikegami
National Institute for Fusion Science
Nagoya, Japan 464-01
Phone: 052-781-5134 (office)
Fax: 052-781-9564
E-Mail: ikegami@nifs.ac.jp

Fusion Facts will continue to publish the latest information about this conference to keep you informed. Prof. Ikegami states, "The next cold fusion conference in Japan will be a crucial and exciting one."

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New from the Fusion Information Center is *Fusion Briefings*, a 3.5 page newsletter, that is a monthly digest of cold fusion developments. Written with the lay person in mind, it is an overview of what is happening in the areas of research, business, patents, and the companies involved with cold fusion. Designed for the manager who needs to be aware of cold fusion development, but does not require all of the technical details, *Fusion Briefings* lets him track the developments that will have the most impact on his business.

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We are especially interested in any new discoveries that improve the replication of cold fusion electrochemical cells or of other devices that provide excess energy. We are also interested in simply-stated summaries of your theories or models, especially as they pertain to improvements of devices that produce excess energy.

Brief **Letters to the Editor** are also welcome. Topics of interest include latest business developments related to cold fusion, patent information, and your constructive criticism of any cold fusion concepts. We especially welcome news of any **enhanced energy devices** that have been reduced to practice.

Remember to keep your written material simple but precise. A large fraction of our subscribers do not have English as their primary language.

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