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 NOVEMBER 1991

ERRATA

Please note the error on top of page 11 in September issue of *Fusion Facts*. The name Robert T. Bass should be **Robert T. Bush.** We apologize, Dr. Bush.

PAPER FROM INDIA

Dr. M. Srinivasan sent us a paper on the use of molten salts to load metals with hydrogen. The article is on page 17. We solicit your comments on how this approach can be adapted to cold fusion.

BALL LIGHTNING PICTURES

Dr. Kiril Chukanov has sent us some dramatic colored photographs of ball lightning that he has created. Please write if you would like a copy.

A. EC ACHIEVES NUCLEAR FUSION

Give us five billion more is the request of European Community (EC) scientists after having produced 1.7 megawatts of power for nearly two seconds. Not exactly making headlines is the fact that the 15 megawatts of input power is required over a significantly longer time to produce the achieved output.

Compared with some of the latest cold fusion events, the achievement of 11% "excess heat" does not compare favorably. We note that McKubre reports over 200%; Liaw et al report over 1500%; Shoulders about 3000%; and an expected 1000% or more from the latest Pons-Fleischmann work. In addition, these output energies are achieved on a more nearly continuous basis and at an estimated total cost of $20 million over the past two-and one-half years (compared to $20 billion for hot fusion).

Give us $10 million suggests the U.S. group that are obtaining petitions to have the Energy committee of the U.S. House of Representatives hold a public hearing on cold fusion. The ten million dollar request is, in my opinion, not as important as the expected results of a public hearing where the media and the public would hear the truth about cold fusion. Because the entry costs into cold fusion are only about $100,000, many U.S. corporations could fund an initial effort. Such corporations are waiting to read in the *Wall Street Journal* that cold fusion is a viable future technology.

Fusion Facts compliments the "hot fusion" scientists on their achievement. Our position is that hot fusion is too expensive to be funded by any group less than a government. However, a hot fusion reactor is unlikely to be packaged into a total home energy unit in this century. By contrast, a cold fusion energy system is likely to be providing a variety of oil-saving energy tasks before 1995. **Our position is that the denial of cold fusion by any "hot fusionists" (orchestrated or otherwise) can only result in loss of credibility for <u>all</u> scientists.**

As scientists, hot fusion and cold fusion, we should be mutually supportive in the advancement of our knowledge of fusion reactions. **Any other approach only lessens the esteem for science that is provided by the public.** When scientists play the game of politics, all parties and our nation loses. When our country is faced with the importation of up to 90 percent of our oil by the year 2000, patriotic and sincere scientists will work together to help resolve the U.S. energy crisis. *Fusion Facts*, therefore, commends the **American Nuclear Society** and especially their journal editor, **Dr. George H. Miley**. This professional organization has been publishing peer-reviewed technical notes on cold fusion beginning with the September 1989 issue of *Fusion Technology. [Hal Fox.]*

B. COLD FUSION POSITION PAPER

By Hal Fox, (Previous revision *Fusion Facts*, May 1990)

BACKGROUND

As announced by Fusion Information Center, Inc. (FIC) in its June 9, 1989 press release: "The discovery of solid-state fusion has been confirmed, there are more than one nuclear reactions occurring, and the process has commercial applications."

The following position paper has been prepared to provide a "given" foundation as a basis for the development of technological impact studies and as a review of the extent of the continued cold fusion progress. Several issues of *Fusion Facts* contain an article that summarizes the impact that the development of fusion energy systems are expected to have on a selected industry. The impact that cold fusion and other enhanced energy devices will make on commercial energy systems is now becoming nearer to being a predictable reality.

THE ROLE OF PALLADIUM.

Solid-state fusion reactions appear to occur near the surface and within the metal lattice of a palladium electrode immersed in an electrolyte made up of deuterium oxide (heavy water) and the addition of a lithium compound (usually LiOD) [1]. However, some dramatic progress is being made with palladium-plated silver [2] and palladium-silver alloys [3]. In addition, the use of potassium carbonate and light water [4] is gaining attention of several laboratories. In addition, titanium has been successfully used in demonstrations of cold fusion especially in molten salts [5]. {See reference [6] for additional background information on palladium. Ed.}

The current competition for using a palladium cathode is a nickel cathode used in a light water electrolyte containing potassium carbonate. This electrochemical cell is claimed to be producing as much as 30 times the input energy [4]. Currently this cell is reported to be developing over 300 watts. The Pons-Fleischmann type of cell has been reported to achieve over 3 kW per cu cm of palladium using a palladium-plated silver cathode [2].

NUCLEAR REACTIONS.

When palladium is properly prepared and used as a cathode (connected to the negative terminal of a battery) immersed in heavy water (deuterium oxide) together with a platinum or a nickel anode (connected to the positive terminal of the same battery) deuterium ions can be packed into the palladium metal lattice. Under some conditions (such as with the presence of lithium in the electrolyte) the palladium deuteride (similar to palladium hydride that is formed in palladium when hydrogen is used) supports one or more nuclear reactions. These reactions are better understood than when first announced [1] but not as yet fully understood. There is some difference of opinion among scientists as to whether the Mills technology [4] is a previously unknown chemical reaction (as claimed by Mills) or a nuclear reaction.

Under the proper experimental conditions, within a specific type of palladium metal lattice (crystal structure) and usually in the presence of lithium, the deuterium atoms periodically fuse and the resulting energy shows up as heat in the palladium electrode. The following known or suspected nuclear reactions are being reported:

Deuterium + deuterium --> ^{3}He + neutron + energy.

Deuterium + deuterium --> tritium + proton + energy.

Deuterium + deuterium --> ^{4}He + energy [7]

Lithium 6 + deuterium --> 2 ^{4}He + energy.

The first two have been previously observed in **hot fusion** experiments in almost equal numbers. In some reports, the observed neutron-producing reaction ceases when the current is raised to exceed 150 mA per sq cm of cathode surface. The helium-4 reaction has been previously observed only at very low rates of occurrence in **hot fusion**. However, this reaction - producing ^{4}He or balloon gas - appears to be the predominant reaction in the Pons-Fleischmann fusion cells [7]. The fourth reaction would be expected to occur only at the surface of the Pd cathode. In both cases, the ^{4}He produced is the isotope of helium normally found in nature. These last two reactions are preferred because they produce large amounts of energy and no harmful radiation byproducts.

The Mills electrochemical cell either produces hydrogen with a collapsed electron (the theory proposed by Mills) or a nuclear reaction that has yet to be identified but possibly an energetic proton - potassium nuclear reaction.

The following indicates how the d-d nuclear reaction energy can be calculated:

Deuterium + deuterium --> ^{4}He + Energy
2.014 + 2.014 --> 4.0026 + 0.0254 (atomic mass units).

When the two deuterium atoms combine into helium there is an atomic mass fraction that is converted into energy. By using the famous Einstein equation:

$$E = m \times c^2$$

which states Energy = the atomic mass fraction multiplied by the speed of light times the speed of light. This mass fraction (of 0.0254) is converted to energy and that energy is apparently transferred to heat in the palladium electrode.

Other nuclear reactions may be taking place in the palladium (such as neutron capture by Pd and the change of one Pd isotope into another Pd isotope.) However, the helium 4 reaction is preferred because there are no other atomic by-products such as the expelling of a neutron (atomic particle with the mass of a hydrogen atom but having no charge) or the production of tritium (which is radioactive). Large amounts of neutrons are harmful to living tissue and are not a desirable by-product. Tritium gas is harmful when ingested. Tritium is also radioactive but the nuclear by-product is a beta particle which can easily be shielded.

There is now evidence that these nuclear reactions can be controlled by varying the current flow through the fusion cell. For this position paper, it is now known that the solid-state nuclear fusion reactions can be controlled and that a reasonable level of energy can be safely produced by the use of either the Pons-Fleischmann cold fusion cell or the Mills electrochemical cell.

NUCLEAR GENERATION OF HEAT.

The current embodiments of experimental solid-state fusion power are produce low-level heat (low temperatures as compared with fossil-fuel-fired industrial boilers that produce super-heated steam). For fusion power to become practical, engineers will be required to design devices that will produce more heat and be able to remove or use the heat at higher temperatures. Alternatively, the fusion heat will be directly converted to electrical energy.

Some of the current experiments are producing a reported 3,000 watts of heat energy per cubic centimeter of palladium [2]. A desired goal is to achieve 1,000 watts of energy per cubic centimeter of palladium in a cell that produces steady output of excess energy. The Electrical Power Research Institute (EPRI) is funding McKubre at SRI International and this group appears to be planning for commercial applications. Mills [4] expects to achieve 1,000 watts output in the near future with an experimental electrochemical cell using light water and potassium carbonate.

The engineering techniques (heat exchangers) used to remove 1,000 watts of heat from a cubic centimeter of palladium are based on the same technology that is used to extract large amounts of heat from power transistors used in electronic circuits. In other words, the well-developed heat-transfer technology that has been used in other industries is being adapted to solid-state fusion.

PRACTICAL ENERGY LEVELS.

For the purposes of this position paper, it is assumed that a practical design for a palladium/deuterium nuclear reactor or for a light-water potassium carbonate fueled reactor will be developed that will remove 250 to 1,000 watts of heat energy per cubic centimeter of the reactor cathode (palladium or nickel). Improvements up to 5,000 watts per cubic centimeter are expected later.

Ten cubic centimeters of the reactor's electrode (palladium, PdAg alloy, nickel, or some other alloy) will produce 2.5 to 10 kilowatts of power on a continuous basis in a properly designed cold fusion nuclear reactor. Assuming some inefficiencies, this output power could be converted into 2 to 10 horsepower of continuous heat energy.

An engineering estimate for weight is five to twenty-fifty pounds of complete reactor system per usable horsepower. If a fusion reactor were to be used to power an American automobile such a cold fusion energy system would weigh 100 to 500 pounds. However, a much smaller reactor could be used to continuously charge batteries in a battery-powered automobile. From an engineering view, this application of a cold fusion energy system would provide a non-polluting auto with a greatly simplified set of motive components (as compared to the complex internal combustion engine used today). Alternatively, a cold fusion reactor could create steam to run a steam-driven auto.

PROBLEMS AND TIMING OF SYSTEM DEVELOPMENT.

Previously, most scientific reports of cold fusion experiments cited erratic results (similar experiments did not produce the same results). Some reports cited bursts of energy (heat is not produced uniformly). The previously lack of controllability (not being able to turn an experiment OFF and later turn it ON) is now being resolved. However, for some applications (such as for a battery charger) controllability in not a problem. In general, this control problem must be solved before fusion

power systems are fully commercial. The current technological problems are reminiscent of the early days of solid-state semiconductor work (during the development integrated circuits.)

Other unknowns, such as whether or not the crystal lattice of the palladium gradually becomes non-operative; the temperatures at which the deuterium will not remain in the lattice; and the role of lithium in the production of excess heat, all require more experimental and theoretical efforts. These are considered to be problems that will affect the timing of the eventual developments of useable solid-state fusion systems and not whether such systems are eventually developed. There is also a similar problem in the Mill's electrolytic cells. Assuming that it is discovered that the Mill's cell is from nuclear reactions, what will be the cell life as the nuclear byproducts buildup up in the cell?

The progress made during the past year in solid-state fusion (especially in controllability and reproducibility) indicates that commercial solid-state fusion energy systems can soon be designed. These solid-state energy systems will be able to produce larger energy densities (power generated per cubic meter of plant) that is now achieved in natural gas or coal-fired power plants. The benefits of solid-state energy systems are the following:

1. Non-polluting if properly designed (no ash, smog, radioactivity, nor CO_2).

2. Low fuel costs (deuterium, hydrogen, or potassium are the fuels and provide enormous amounts of energy per pound of fuel as compared with fossil fuels.)

3. Energy systems can be built in a large range of sizes from electric automobile battery chargers to megawatt power plants.

EARLY ENGINEERING DESIGN GOALS.

For the purposes of making technological impact predictions, it is assumed that engineers can produce useable energy using solid-state fusion reactors. The estimate of size and weight (an early engineering design goal) is 25 pounds in weight and one cubic foot in size for each kilowatt or horsepower of power.

Later design goals would be to reduce this weight and volume by a factor of ten to achieve a reactor of 2.5 pounds per horsepower and packaged in a smaller volume of space.

It is forecast that initial commercialization will be for smaller solid-state fusion systems where the production and use of low-levels of heat (of the order of 300 to 500 degrees Fahrenheit) is sufficient. Therefore, home heating and cooling applications and applications for the direct conversion of heat to electrical power are expected to precede the larger industrial applications of solid-state fusion systems. It is expected that the Electrical Power Research Institute (EPRI) will soon be involved in scale-up experiments for power generation for utility companies.

COSTS OF OPERATION.

For the purposes of calculating energy costs in 1991 prices the following assumptions will be made:

* Palladium will cost $200 per troy ounce and will be used as an electrode.

* Deuterium will cost $1000 per gallon.

* The conversion efficiency of deuterium to usable energy will be ten percent.

* The maintenance costs will be ten percent per year of initial fabrication/installation costs.

* Services for purifying and reforming palladium will be readily available and are included in the "maintenance costs".

* Initially, it will require two cubic centimeters of palladium to produce a continuous one kilowatt-hour of energy.

CONVERSIONS FOR CALCULATIONS.

1 cubic centimeter of palladiUm weighs 106 grams.
1 troy ounce is 31.1 grams.
1 cubic centimeter of palladium weighs about 3 troy ounces.
1 cubic centimeter of palladium will cost $600.

ENGINEERING ESTIMATES.

Early reactors will cost $3,000 per kilowatt and reduce to $ 500. Maintenance costs will be $ 300 per kilowatt per year and reduce to $ 100 per kilowatt per year. The cost of capital will be ten percent per year.

The cost of fuel will be $0.01 per kilowatt hour. The energy values are roughly two million gallons of fuel oil per gallon of heavy water (deuterium oxide). At ten percent efficiency and at $1,000 per gallon the equivalent cost of fuel would be about one cent for the energy equivalent of one gallon of fuel oil.

COSTS FOR HOME SOLID-STATE REACTOR.

Utah Power and Light reports the average Utah home uses 550 kilowatt-hours of electrical energy per month. Assuming a present cost of $0.10 per kilowatt-hour, the average monthly electrical bill is now $55.

Assuming that a home solid-state fusion reactor produced continuous power and used storage batteries for peak load, the initial cost of a one kilowatt reactor installation would be $5,000. At ten percent interest rate the cost of capital would be $ 500 per year. The maintenance cost would also be $ 500 per year. This $1,000 cost exceeds the typical electrical home bill of $550 per year. As the costs of the solid-state fusion reactor lowered, the home fusion reactor would become a viable alternative as compared to the current cost of electrical power.

Calculations based on a one kilowatt fusion reactor that would cost $1,000 to buy and install and $200 per year for maintenance shows that the annual cost (including cost of capital) would be about $300 per year. This amount would be considerably less than the cost of today's electrical power.

The above calculations do not consider the cost of "fuel" because fuel costs are negligible in comparison to equipment costs, cost of capital, and maintenance costs.

In general, it is expected that the combination of rapid engineering developments of solid-state fusion systems together with the relatively low entry cost to the manufacturer for entering the business will lead to the effective construction and use of medium and small solid-state fusion reactors within two to four years.

NEW DISCOVERIES WILL SUPPORT COLD FUSION.

Few researchers have reported the successful use of any other metal than palladium to replicate the effect discovered by Pons and Fleischmann with the exception of Mills [4]. A reasonable technological forecast is that metals other than palladium will be found to support solid-state fusion. It is likely that optimum results will be found by using a combination of metals (an alloy) that will support solid-state fusion and be less expensive.

The position of this paper is that the combination of the results of intense interest, sufficient research funds, and many scientists working in the field will lead to rapid development of solid-state fusion systems. Therefore, the following developments are expected:

* The discovery of other metals or of alloys that will support solid-state fusion.
* Increases in output temperatures in operating fusion reactors.
* Improvements in direct heat-to-electricity conversions.
* The gradual lowering of the costs of fusion reactors.
* The complete control of the nuclear reactor.
* A continuation of the low cost of entry into the solid-state fusion industries.
* A rapid growth in specialty companies to serve the industry. For example, in production and marketing of heavy water, reactor electrodes, safety devices, instrumentation, etc.
* The rapid development of engineering prototypes of new systems based on solid-state fusion developments.

REFERENCES

[1] M. Fleischmann, S. Pons, and M. Hawkins, "Electrochemically induced nuclear fusion of deuterium." *J. Electroanal. Chem*., 261, pp 301-308, and erratum, 263, p187 (1989).

[2] Robert T. Bush and Robert D. Eagleton (Physics Dept, Calif. State Polytechnic Univ., Pomona, CA), "A Calorimetric Study of the Excess Heat Effect in Thin Films of Palladium", Presented at Second Annual Conference on Cold Fusion, June 30-July 4, 1991, Como, Italy.

[3] James B. Hunter & H. Fox, "Solid Fusion and Palladium Silver Alloys," *Fusion Facts*, **Aug 1991**, Vol 3, No 2, p 17, 1 picture of alloy tests.

[4] Randell L. Mills, Steven P. Kneizys, "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, 10 refs.

[5] 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.]

[6] Hal Fox, "Cold Fusion Position Paper," *Fusion Facts*, **May 1990**, Vol 1, No 11, p 18-22.

[7] 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.

C. NEWS FROM THE U.S.

CALIFORNIA - ELECTRON BEAD THEORY

Courtesy of Dr. Samuel Faile

Richard W. Ziolkowski & Michael K. Tippett (U. of Calif, Lawrence Livermore Nat'l Lab), "Collective effect in an electron plasma system catalyzed by a localized electromagnetic wave", *Physical Review A*, Vol 432, No 6, pp 3066-3072, 15 March 1991, 7 refs.

AUTHORS' ABSTRACT

The possibility of the existence of an essentially single-species plasma state represented by a stable packet of charged particles moving collectively through space-time is examined. The collective plasma state is catalyzed by a localized electromagnetic wave. Condensation to this state is shown to occur on a very short time scale. The model treats the particle packet as a warm electron plasma (fluid) and self-consistently incorporates the resulting electromagnetic field. Predicted characteristics of the localized particle packet and its associated electromagnetic fields compare favorably with recent experimental data.

AUTHORS' INTRODUCTION

It has been shown recently that localized-wave (LW) solutions can be constructed for a variety of linear hyperbolic partial differential equations. For instance, these novel space-time solutions have been constructed for the scalar wave equation, Maxwell's equations, and the Klein-Gordon equation. They are characterized by the maintenance of their initial, localized characteristics over unusually long propagation distances.

Recent ultra-short-time discharge plasma experiments by Shoulders and his co-workers have produced data that indicate the existence of a plasma state representing a freely moving, localized packet of electrons. This collective plasma state has been called an electromagnetic vortex (EV) by that group. They have been described as tightly bound groups of negative charges with extremely high densities. In particular, the EV's have been reported as follows:

1. To be roughly spherically symmetric with radii on the order of 1 micrometer;
2. To travel at speeds on the order of 0.1 speed of light;
3. To have electron densities approaching that of a solid, on the order of 10^{20} to 10^{24} per cu cm with negligible ion content;
4. To have highly localized electromagnetic fields association with them;
5. To tend to propagate in straight lines for non-negligible distances on the order of 1.0 to 10 mm;
6. To deflect and accelerate in experiments as though they have only electron characteristics;
7. To be a highly localized energy state since they release copious amounts of x-rays with their sudden destruction;
8. To transport in some cases (called the black EV state) without emission of electrons or photons; and
9. To form other quasistable structures by coupling adjacent EV's together.

EDITOR'S COMMENTS

Fusion Facts reported on the Shoulder's patent in its July 1991 issue, page 30. We are pleased to present this analytical paper from scientists at the Lawrence Livermore National Laboratory to lend further credence to this exciting new field. This paper by Ziolkowski and Tippett was received by Phys Rev July 13, 1990. Since that time the Kenneth Shoulder's EV patent on excess energy has issued in the United States. In simple words, the author's are adapting some higher math solutions to model the formation of electron beads. In their conclusions, the authors state: "We must reemphasize that we have not modeled in any detail the breakdown events that lead to the localized charge states. Nonetheless, we anticipate that during the charge initiation process, there will be many ions present in the source region that would help compensate for the Coulomb repulsion forces of the electrons, hence, the formation of the electron cluster." The experimental evidence is that positive ions are very small in number compared to the electrons. Thus the idea of the Casimir force to compact the electrons into a small bead is an attractive model.

The authors note, "If one were to introduce a dielectric guiding channel [as taught in Shoulder's patent] for the electron clusters, which has also been done experimentally, their lifetimes would be enhanced because that structure would provide additional compensation for the Coulomb forces trying to dissolve the cluster." The authors also state: "Nonetheless, the possibilities are intriguing and the ramifications of this work are startling if future efforts confirm the original observations and interpretations." Finally, the author's promise, "With the possible theoretical existence of an EV state in hand, we will be investigating numerically in the future the full evolution of an EV state: from the initial conditions for their creation in a discharge event to their propagation through and interaction with the local environment. We hope to predict typical discharge parameters and configurations that lead to an EV state so that this phenomena can be investigated experimentally in a very detailed manner."

CALIFORNIA - BIOLOGICAL EFFECTS

Courtesy of Dr. Samuel Faile

Glen Rein (Quantum Biology Res Lab, Palo Alto), "Utilization of a Cell Culture Bioassay for Measuring Quantum Potentials Generated From a Modified Caduceus Coil," 26th Intersociety of Energy Conversion Engineering Conference - 91 Proceedings, Boston, Aug 4-9, 1991, Vol 4, pp 400-403, 20 refs.

AUTHOR'S ABSTRACT

A modified caduceus coil was used to test the hypothesis that bucking electromagnetic fields and cancelling their vectors generates a time varying quantum field. A 60 Hz sine wave modulated with nested square waves in the kHz region was used to drive the caduceus coil. The coil was shown to stimulate the growth of lymphocytes in culture both directly and indirectly through storing its frequency information in water. Several physical anomalies were also observed using a sensitive magnetometer to measure the residual (non-cancelled) magnetic field.

EDITOR'S COMMENTS

Caduceus coils are made by winding coils of electrical wire in such a manner that the resulting electromagnetic fields are cancelled. The result is the suspected production of energy fields that are not as yet well known. Such coils have been used in some energy production devices in which excess energy was produced. The author states, "These unconventional coils have been used in greater-than-unity devices where physical anomalies have been reported. In order to explain these anomalies, it has been proposed that these devices generate time-varying quantum potentials and their enfolded virtual, non-Hertzian energy. The resultant of all EM [electromagnetic] forces acting on these systems (counterwound coils) is believed to sum to zero in accordance with Newton's third law **thereby orthorotating the zero-point energy into our 3-space.**"

One of the anomalies that has been reported, both in the literature and in anecdotal reports, suggests that such non-Hertzian fields can have biological effects on plants and humans. To test this hypothesis, the author measured the growth of Lymphocytes in similar Petri dishes supplied with standard growth medium supplemented with 10% fetal calf serum. Four types of experimental treatments were used: Controls, standard mitogen (drug that promotes cell division), exposure to the caduceus coil, and coil exposure plus mitogen. The author reports the use of two different types of signals ("complex trains of monopolar DC square waves with an overall repetition rate of 930 Hz.") The use of the mitogen showed growth gains of 1662%. The coil promoted growth gains of 1783%. The mitogen plus the coil showed 1822% growth gain. Signal 2 showed 87% growth gain over the controls. Using the coil to treat the water used to make the growth medium showed a 61% growth gain over the controls.

Some other anomalies were found. The background radiation measured with a Geiger counter dropped to near zero when the coil was turned on. An opposite effect was observed with cobalt-60. A 67% increase in radiation from the cobalt-60 was observed when the coil was turned on. The author states, "Since these experiments are preliminary in nature, it is difficult to draw any conclusions about the possibility of non-Hertzian energy modulating radioactivity. Nonetheless, the results indicate another physical anomaly."

This interesting research report has been summarized for the following reason: When we are witnessing new and unexpected chemical, physical, or biological behavior, it may be appropriate to test for the anecdotal anomalies. When one reads Faraday's journals, it is apparent that this experimenter followed up many unusual and strange observations. The end result was a great contribution to the development of electrical devices. One can also note that many of Faraday's findings are still subject to further experimental verification and possible further dramatic development. Pons' and Fleischmann's discovery has led to many new discoveries and findings. It is possible that the processes in an electrochemical cell that is producing excess heat may be producing other energy forms that would effect biological processes as has been shown by Dr. Glen Rein for the caduceus coil.

CONNECTICUT - NUCLEAR EMULSION

KODAK Products for Light Microscope Autoradiography (an advertising brochure).

Eastman Kodak Company manufactures two nuclear-type recording materials for use in autoradiography at the light microscope level. They are supplied in gel form for use as liquid emulsions. Included in this publication is information on the characteristics, general handling, and processing for these emulsions. This information will help you achieve the reproducibility which is necessary if you are to have confidence in your autoradiography results.

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FLORIDA - ENERGY FROM TANK CIRCUIT

Courtesy of Dr. Samuel Faile

Donald A. Kelly (Space Energy Association, Clearwater, Florida), " The Enhanced Tank Circuit as a Free Energy Module", 26th Intersociety of Energy Conversion Engineering Conference - 91 Proceedings, Boston, Aug 4-9, 1991, Vol 4, pp 424-428, 3 refs.

AUTHOR'S ABSTRACT

The conventional [electronic] tank circuit is an established electrical component arrangement which has been generally confined to limited application up to this time. A tank circuit is defined as a circuit capable of storing electrical energy over a band of frequencies continuously distributed about a single frequency, at which the circuit is said to be resonant or tuned. The selectivity of the tank circuit is proportional to the ratio between the energy stored (capacitance) and that dissipated (EMF flow) which is known as the "Q" [or quality] of the circuit. Tank circuits may be all solid-state components or the hybrid type of both solid state components along with dynamic, rotating inductors. The recent reemergence and study of the two important Russian papers has stirred renewed interest in the increased potential of an "enhanced" type of tank circuit project(s). The Russian experiments suggest that the full band of a tank circuit can be utilized to take advantage of a full EMF output available over an extended period of time, and then periodically and uniformly re-exciting the circuit as an effective electrical energy conservation method. The various experiments done by the Russian researchers has shown that such enhanced tank circuits can provide an over-unity output by way of an energy conservation method, i.e., an initial excitation of the circuit at double the resonant frequency of the circuit will result in a continuous EMF output for an extended time period. The energy conservation method toward true "free energy" was first introduced by Ed Gray/EV Gray's system in 1975.

AUTHOR'S CONCLUSIONS

When all the aspects and data of the two past Russian papers and experiments are fully understood by a wide body of researchers, we believe that we will be on the way towards a practical solid-state solution to part of our current alternate energy problem. . . .

EDITOR'S COMMENTS

The 3 references cited by Kelly are:

[1] L.I. Mendelstam & N.D. Papaleksi, "On the Parametric Excitation of Electric Oscillations", *UCRL Translation No. 10231*, Received March 14, 1967, University for California, Lawrence Livermore Radiation Laboratory, Livermore, CA, 94550.

[2] L. Mendelstam, N. Papaleksi, et al, "Report on Recent Research on Non-Linear Oscillations", *NASA Technical Translations, NASA TT F-12, 678*, November 1969. Identified as Access No. N70-11506, Code 1, Category 23, 60 pages, Available from: N.T.I.S. Dept of Commerce, Springfield, VA 22161.

[3] Paul Brown, "The Moray Device and the Hubbard Coil were Nuclear Batteries", *Magnets Magazine*, March 1987.

In his introduction Kelly states, "When a thorough review of the current 'free energy' field is made it will be seen that very few projects have a sound basis in both theoretical and practical hardware areas. The enhanced tank circuit concept . . . has now become valid in both areas . . ."

As a teenage electronic experimenter, my friend and I noticed that a large capacitor that we hooked up to the output of a ham radio transmitter (therefore to the outside antenna) would pick up a charge. When discharged with a wire directly across the capacitor, the capacitor would again become charged again after a few minutes, even though the radio transmitter was off. Is it possible that a tank circuit, in the presence of lots of small electromagnetic radiation, could be considered as an "accelerated frame" that could tap the Lorentz invariant zero-point energy? See the report on Hathaway's article under News From Abroad - Canada. See also the amazing (and scarcely believable) report from Kenrick summarized in this section. Kenrick's PODMOD is apparently based on a tank circuit and, depending on load, has been reported to "generate output as much as 4,000 times the input power."

INDIANA - CLUSTER-BEAM THEORY

Y.E. Kim, M. Rabinowitz, G.S. Chulick, R.A. Rice (Purdue Univ), "Theories of cluster-impact fusion with atomic and molecular cluster beams," *Mod Phys Lett B*, **1991**, Vol 5, No 6, pp 427-438.

AUTHORS' ABSTRACT

Apparently disparate experimental results have been obtained for D-D fusion products from the impact of atomic and molecular cluster beams on deuterated targets. Unexpectedly high fusion rates observed with beams of D_2O clusters in the energy range 10-1000 eV/d have been a formidable challenge to theoretical physics with previous attempts to explain these surprisingly high yields being unsuccessful. A further challenge exists because the resultant models also do not explain why fusion is not observed in similar experiments with beams of D clusters. We present a theory in which heavy atomic partners in the molecules play a vital role in producing the observed rates, and which can also explain the apparently conflicting experimental results.

From Chemical Abstracts, September 23, 1991.

INDIANA - COULOMB SCREENING

Yeong E. Kim, Robert A. Rice, Gary S. Chulick (Dept of Physics, U of Purdue), "The effect of Coulomb screening and velocity distribution on fusion cross-sections and rates in physical processes," *Mod Phys Lett A*, **1991**, Vol 6, No 10, pp 929-938.

AUTHORS' ABSTRACT

The Coulomb screening effect, in conjunction with a particle velocity distribution, is shown to greatly enhance the cross-sections and reaction rates for d-d and p-p fusion for kinetic energies E less than or equal to about 50 eV in the center of mass (CM) frame. This may help to explain the observed fusion reaction rates from recent low-energy experiments, and indicates the p-d fusion may actually serve as an important source of internal energy for planetary bodies.
From Chemical Abstracts, October 21, 1991.

MARYLAND & USSR - THEORY IS CLASSICAL PHYSICS

Michael Danos (Nat'l Inst of Standards & Tech, Gaithersburg) & V.B. Belyaev (Joint Inst for Nucl Res, Dubna), "Estimate of the Neutron Transfer Fusion Rate," *Fusion Technology*, **Nov 1991**, Vol 20, No 3, pp 354-357, 2 figs, 6 refs.

AUTHORS' ABSTRACT

The e^4-order quantum electrodynamic term for neutron transfer fusion is 10^{40} to 10^{50} times larger than the direct term, suggesting that room-temperature fusion does not contradict nonexotic physics.

AUTHORS' SUMMARY

At this point, it is worthwhile to briefly discuss some aspects of the influence of the surroundings and the way they might modify the computed fusion rate. A prominent consideration is provided by analogy with other physical processes associated with the Coulomb interaction, e.g., bremsstrahlung or pair production, which, as is well known, are decisively influenced by screening of the nuclear charge by the surrounding electrons. This effect plays no role in the present context for two reasons. First, the reaction amplitude, being analogous to Compton scattering, is quadratic in the charge of particle C. Thus, rather than yielding a cancellation between the contributions from the nuclei and from the electrons, as is the case in low-momentum transfer bremsstrahlung (i.e., the screening effect), here the amplitudes add. Furthermore, in the present case, the typical momentum transfers are some hundreds fm^{-1}. The process is therefore inelastic in that particle C is knocked out of its initial bound state, thus eliminating the possibility of interference, either destructive or constructive. Hence, the contributions form the different neighboring catalyzing particles, both nuclei and electrons, simply add as probabilities. Thus, as far as the basic reaction mechanism is concerned, the surroundings only increase the reaction rate. The investigation of the actual inhibition factor, evident in the ratio of observed to computed fusion rate, is far beyond the scope of this technical note. **However, our result, which is 40 to 50 orders of magnitude larger than the conventional results, seems to indicate that the existence of room-temperature fusion under favorable conditions is compatible with the present-day understanding of physics and requires no special mechanism for its explanation.**

MICHIGAN - HYDROGENIC REACTIONS

Frederick J. Mayer & John R. Reitz (Mayer Applied Research, Ann Arbor), "On Very Low Energy Hydrogenic Nuclear Reactions," *Fusion Technology*, **Nov 1991**, Vol 20, No 3, pp 367-372, 2 figs, 16 refs.

AUTHORS' ABSTRACT

Some results are described that derive from the assumption that very low energy (approx 1 eV) electron-proton, electron-deuteron, and electron-triton resonance particle systems are created in various materials and experiments. Information regarding the resonance width and lifetime is extracted from the data of cluster-impact fusion experiments, and these experiments are discussed in connection with other anomalous experiments, including cold fusion experiments, which are examples of a new class of hydron-mediated nuclear reactions - resonant direct nuclear reactions.

NEW JERSEY - HYDROGEN LOSS

Courtesy of Dr. Samuel Faile

J.M. Rosamilia, J.A. Abysa & B. Miller (AT&T Bell Laboratories, N.J., USA) "Electrochemical Hydrogen Insertion into Palladium and Palladium-Nickel Thin Films", *Electrochemica Acta*, **Vol 36**, No 7, pp 1203-1208, 1991, 12 fig, 11 Ref.

AUTHORS' ABSTRACT

A generator-detector mode with the rotating ring-disk electrode has been used to determine the difference between Pd and Pt electrode behavior and the origin of the larger overpotentials at Pd-hydrogen evolving cathodes.

The use of thin film Pd disk electrodes has allowed full hydrogen or deuterium charging of the metal phase in short times. The electrode system has made feasible simultaneous measurements of the hydrogen uptake in PdH_x films where the maximum composition reached was $PdH_{0.81}$. Alloying Ni into Pd decreases the maximum hydrogen absorption by solid solution Pd-Ni films to near zero at 17% Ni. The outgassing of hydrogen on open circuit from variously charged electrodes can be followed in real time and shows the losses associated with transfer of specimens to post-analysis (approx. 6% in 5 min).

NEW MEXICO - LOS ALAMOS NEUTRONS

H.O. Menlove, M.A. Paciotti, T.N. Claytor, H.R. Maltrud, O.M. Rivera, D.G. Tuggle, S.E. Jones (Los Alamos Nat'l Lab), " Reproducible neutron emission measurements from titanium metal in pressurized deuterium gas," *AIP Conf Proc*, **1991**, Vol 228 (Anomalous Nucl Eff Deuterium/Solid Syst), pp 287-301.

AUTHORS' ABSTRACT

We have measured neutron emission from samples of Ti metal and sponge in pressurized D_2 gas. In Jan 1990, we improved our sample preparation procedure and our detector sensitivity level so that the neutron-emission measurements are now reproducible, but not yet predictable. We have measured excess emission from the majority of our most recent samples using our high-sensitivity neutron detectors. The improved sensitivity in our new detector system was obtained by using low-radioactive-background stainless steel tubes, a small detector volume with high efficiency, and additional cosmic-ray shielding. Our most sensitive detector consists of 2 independent segments making up inner and outer rings of ^3He tubes. The combined total efficiency is 44%. In addition to inner and outer ring segments, we have separate detector systems operating in parallel control experiments to monitor environmental change. We have measured neutron bursts from a variety of samples containing Ti Metal and D_2 gas. The low-multiplicity bursts, emitting from 2 to 10 neutrons occur much more frequently than the higher multiplicity bursts. By measuring high-mass samples (300 g Ti) over several weeks, with many liquid N temperature cycles, we have detected neutron-emission above the background from most of the samples with a significance level of 3 to 9 sigma.

From Chemical Abstracts, October 21, 1991.

NEW YORK - DATA REVISITED

V.C. Noninski & C.I. Noninski, "Comments on 'Measurement and analysis of neutron and gamma-ray emission rates, other fusion products, and power in electrochemical cells having palladium cathodes'", *Fusion Technology*, **May 1991**, Vol 19, No 3, pp 579-580, 10 refs, 1 fig.

EDITOR'S COMMENT

In our May 1991 issue, we neglected to review this important letter to the editor from the Noninskis. Dr. V.C. tried without success to get this letter published in *Nature*. His careful evaluation of the published negative papers from MIT shows that they actually measured excess heat and did not recognize the fact. In addition, the Noninskis show that the report by N. Lewis, et al (Cal Tech) is also subject to reevaluation as their data shows that they also achieved excess heat.

NEW YORK - HEATING UP?

Courtesy Dr. Samuel Faile

Gene Bylinsky, "Cold Fusion heats up again", *Fortune Magazine*, **Vol 124**, No. 1, July 1, 1991, p. 18.

The beginning of this short article is quoted:

"Remember B. Stanley Pons, a former professor at the University of Utah and his British collaborator, Martin Fleischmann? In 1989 they claimed to have produced cold fusion in a jar, potentially opening an era of abundant and inexpensive energy. Their discovery was later discredited because nobody else could reliably and repeatedly reproduce their results. The pair are continuing their experiments in Europe.

"But, cold fusion isn't dead yet. A team of scientists at **SRI International,** a Menlo Park, California, R&D firm, is expected to report that it has been able to switch on and off power production in three types of fusion jars by carefully controlling and monitoring the electrochemical reactions inside."

NEW YORK - COLD TIP

Courtesy of John Connors

"Cold Tip", *Entrepreneurial Manager's Newsletter*, Vol 13, No 2, November 1991, p 7.

This newsletter tells their readers about cold fusion, "Do you recall the brouhaha a few years ago over the premature announcement that two university of Utah scientists had discovered cold fusion? It startled the world! No wonder, if it had been verified it would have been the greatest discovery of all times. . . . We have a reliable source who thinks this is not a lot of hot air."

[We will send a copy of *Fusion Facts* to this newsletter and see what they would expect their entrepreneurial subscribers to do. Ed.]

TEXAS A&M - Pd LOADING

Del R. Lawson, Michael J. Tierney, I.F. Cheng, Leon S. Van Dyke, M.W. Espenscheid, Charles R. Martin (Dept of Chem), "Use of a coulometric assay technique to study the variables affecting deuterium loading levels within palladium electrodes," *Electrochim. Acta*, **1991**, Vol 36, No 9, pp 1515-1522.

AUTHORS' ABSTRACT

Measurement are reported of hydrogen (H) and deuterium (D) loading stoichiometries in Pd electrodes. These analyses were accomplished by using an electrochemical method developed for in situ determination of palladium deuteride stoichiometries. The electrochemical method quantifies the amount of deuterium incorporated into the metal lattice by collecting the charge released during the potential controlled discharge of deuterium loaded Pd electrodes. In addition, ex situ gravimetric analyses were used to confirm electrochemical measured D/Pd atom ratios. Gravimetric analyses were also used in cases where the diameter of the Pd electrode precluded the relatively slow diffusion-limited electrochemical discharge method. A variety of electrolytic factors were studied to determine what conditions, if any, promote the greatest absorption of deuterium into the pd lattice. Loading values were observed of 0.73 +/- 0.02 deuterium atoms per Pd lattice atom under all the electrolytic conditions studied in LiOD and D_2SO_4 solutions. As found in previous studies, H/Pd values were approximately 10% higher than D/Pd values. These measurements of D/Pd stoichiometries indicate that interfacial parameters, current density, pD, charging time and surface purity have a negligible effect on the maximum deuterium concentration within Pd electrodes.
From Chemical Abstracts, October 21, 1991.

EDITOR'S COMMENTS

It is surprising that this effort reports D/Pd ratios only up to 0.73. It is a well-known fact that fusion events in an electrochemical cell appear to require D/Pd ratios of about 1.0. It is also surprising that none of the interfacial parameters studied appear to have an effect on the maximum deuterium concentration.

TEXAS, U. OF - SCREENING

T. Tajima, H. Iyetomi and S. Ichimaru (Dept. Phys., Univ. Texas, USA), "Influence of Attractive Interaction Between Deuterons in Pd on Nuclear Fusion", *J. Fusion Energy*, **Vol 9,** No 4, 1990, pp 437-440, 3 fig, 17 Ref.

AUTHORS' ABSTRACTS

It is shown that in a heavily deuterated palladium metal a pair of deuterons exhibits attractive interaction at short distances (may equal 0.1-0.7 A) due to strong Coulomb correlations in the ion-sphere model and due to the screening action of localized 4*d* electrons. This mechanism can lead to enhanced thermonuclear reactions at room temperatures some 50 orders of magnitude faster than that in a D_2 molecule. Characteristic signatures of predicted nuclear reactions are described.

UTAH - FIELD CALCULATIONS

K.J. Bunch & R.W. Grow (Univ of Ut & NCFI), "Self-consistent Field Calculations on Diatomic Hydrogen in a Potential Well," *Fusion Technology*, **July 1991**, Vol 19 No 4, pp 2131-2134, 1 figs, 8 refs.

AUTHORS' ABSTRACT

The equilibrium behavior of diatomic hydrogen in a potential well is explored. The amount of "squeezing" experienced by hydrogen in the well is compared to that expected for hydrogen within palladium. results show insufficient squeezing to account for the cold fusion phenomenon.

WASHINGTON D.C. - ANOMALIES

Courtesy of Dr. Samuel Faile

Debra R. Rolison & William E. O'Grady (Surface Chem Branch, Naval Res Lab), "Observation of Elemental Anomalies at the Surface of Palladium after Electrochemical Loading of Deuterium or Hydrogen," *Anal. Chem.*, Sept 1, 1991, Vol 63, No 17, pp 1697-1702, 25 refs.

AUTHORS' ABSTRACT

In this work, the results from surface-sensitive analyses are reported for Pd after electrolysis of light water and heavy water. Pd foils used to electrolyze D_2O or H_2O (with Li_2SO_4 electrolyte and using the electrode configuration of Pons and Fleischmann) show a near-surface enrichment of Rh and Ag as detected by X-ray photoelectron spectroscopy (XPS). Rh and Ag are present as impurities in the starting Pd material but at levels (50 and 100 ppm), respectively) well below the XPS detection limit. The surface concentration of Rh increases as a function of total accumulated electrolytic charge and reaches a maximum of about 4 atom % relative to Pd. It is

demonstrated that Rh and Ag are not electrodeposited at the Pd surface but rather must derive from the palladium itself. This phenomenon is most likely due to surface segregation of the Rh and Ag impurities under the forcing (current and time) conditions of the long-term (1-4 week) electrolyses as palladium deuteride or palladium hydride forms. An estimated segregation energy (delta G) of 17 kJ/mol for Rh and 11 kJ/mol for Ag is obtained, derived from a chemical potential-driving force resulting from changes in the palladium matrix as the deuteride (hydride) phase forms.

EDITOR'S COMMENTS

We have had the privilege of meeting Dr. Rolison and are impressed with the quality of her and her associate's work. Because so few positive results have been reported using Pd foil, as contrasted with Pd rods as cathodes in an electrochemical cell, we would like to see Rolison do similar work with a Pd cathode that had participated in the production of tritium and/or excess energy. We do commend the Naval Research Laboratory for supporting this and other important cold fusion efforts.

WASHINGTON, D.C. - NRL FINDS NEUTRONS

G.P. Chambers, G.K. Hubler, K.S. Grabowski (NRL), "Search for energetic charged particle reaction products during deuterium charging of metal lattices," *AIP Conf Proc*, **1991**, Vol 228 (Anomalous Nucl Eff Deuterium/Solid Syst), pp 383-396.

AUTHORS' ABSTRACT

Thin Ti films were bombarded with low energy (350-1000 eV) d at high current densities (0.4 mA per sq cm) in an effort to produce fusion reactions at ambient temperatures. A Si particle detector was used to observe possible reaction products. Evidence for nuclear reactions occurring at a rate of at least 10^{-21} events per d pair per sec is presented.
From Chemical Abstracts, October 21, 1991.

WASHINGTON - UNBELIEVABLE POWER

Courtesy of Dr. Samuel Faile

Richard L. McKie & Michael A.P. Kenrick (Gamma Star International), "PODMOD - Power Generation for a Brave New World Order", 26th Intersociety of Energy Conversion Engineering Conference - 91 Proceedings, Boston, Aug 4-9, 1991, Vol 4, pp 479-483, 11 refs.

AUTHOR'S ABSTRACT

The current development status of an innovative solution to the problem of generating electrical power is presented: the PODMOD Power On Demand MODule. The circuitry invokes Tesla's theories of electron flow, resonance, and magnetism, combined with modern theories on high frequency electronics and radio antennas to generate electrical power directly, without the inefficient conversion of energy from other sources. The PODMOD requires modest input power from a battery **to generate output as much as 4,000 times the input power.** Output varies with the imposed load up to the maximum capacity of the circuit. Prototypes have been built and tested, including independent tests by accredited specialists. A patent application has been lodged with the US and other Patent Offices worldwide. Plans are now underway for full-scale commercial production of PODMOD units, to be housed in standard 40-ft shipping containers, each having a continuous base-load generating capacity of 10 MW. The units can totally replace existing power generation facilities, and will avoid the need for construction new power stations based on conventional fossil-fuel energy conversion. Modularity and portability allow the generating power to be located near the demand centers, fulfilling Tesla's dream of avoiding the need for high-voltage transmission lines. Smaller versions of the PODMOD driving small, high-torque, high-horsepower electric motors, have the potential to power cars, boats, trains, and planes.

EDITOR'S COMMENTS

This paper has the form of a peer-reviewed technical paper but has little content except claims. No experimental data, picture, graphs, or drawings are provided. No reference to standard peer-reviewed literature is cited. One reference is made to a dated, signed affidavit by Nicholas G. Butler. The claims and specifications for a planned future commercial development are, therefore, not believable. Contrast this paper with an excellent paper by George D. Hathaway (see CANADA under News From Abroad) which has all the merits of an excellent paper and cites 28 references from acceptable peer-reviewed journals. Or contrast the claims made without any data, with the numerous papers on cold fusion that have all the data, drawings, references, and conclusions that professional scientists and engineers expect to read. In addition, Gamma Star International appears not to own a phone. We will mail our comments to Gamma Star International, and, if we have been overly critical, we will apologize in a future issue.

D. NEWS FROM ABROAD

ARGENTINA - NEUTRON MEASUREMENTS

J.R. Granada, R.E. Mayer, P.C. Florido, G. Guido, V.H. Gilette, S.E. Gomez, N.E. Patino, A. Larreteguy (Univ. Nac. Cuyo), "Neutron measurements on palladium-heavy water electrolytic cells under pulsed current conditions," *AIP Conf Proc*, **1991**, Vol 228 (Anomalous Nucl Eff Deuterium/Solid Syst), pp 158-176.

AUTHORS' ABSTRACT

The results of neutron measurements performed on electrolytic cells containing deuterated Pd cathodes, using a high efficient thermal n detection system in combination with a procedure involving a nonstationary current through the cell's circuit. Experiments carried out over a long period revealed a low level neutron production correlated with the current pulses, giving rise to characteristic patterns which were strongly dependent on the previous charging history of the cathodes employed. Another set of measurements was performed with essentially the same experimental set-up, but on board of a submarine 50 meters under the sea surface. A very low background level was attained under these conditions, thus yielding a much improved signal-to-noise ratio as compared to ground laboratory situation. The counting rates observed in the underwater measurements on cells containing deuterated Pd cathodes are well separated from those obtained in test (H_2O runs.
From Chemical Abstracts, October 21, 1991

BULGARIA - COLD FUSION HYPOTHESIS

Courtesy of Dr. Samuel Faile

N. Blalbanov (Plovdivski Univ), "Hypothesis explaining the electrochemically induced nuclear fusion", *Nauchni Tr. - Plovdivski Univ.*, Vol 26 (4-Fiz.), pp 247-251, 1989, in Bulgarian.
Reported in Chemical Abstracts, October 7, 1991.

CANADA - ZERO-POINT ENERGY ENGINEERING

Courtesy of Dr. Samuel Faile

George D. Hathaway (Hathaway Consulting Services, Toronto), "Zero-Point Energy: A New Prime Mover?, Engineering Requirements for Energy Production & Propulsions from Vacuum Fluctuations", 26th Intersociety of Energy Conversion Engineering Conference - 91 Proceedings, Boston, Aug 4-9, 1991, Vol 4, pp 376-381, 28 refs.

AUTHOR'S ABSTRACT

Recently, investigations of novel non-conventional sources of energy and propulsion technologies have led to the belief that vacuum fluctuations or zero-point energy (ZPE) can be tapped as an additional prime mover alongside fusion, fission, hydrocarbons, hydropower, geothermal and solar-based technologies. Only a handful of researchers have seriously investigated the possible use of vacuum fluctuation energy for power production and gravitational interaction and have suggested methods of experimentation, among them, Vallee, Puthoff, Tchernetcky, and Alzofon. In theories ranging from advanced semi-classical treatments to quantum electrodynamics (QED) and dynamic nuclear orientation, they suggest several more or less practical approaches to interacting with vacuum fluctuation energy which may be undertaken with today's technology.

Notwithstanding the paucity for consistent, repeatable results directly attributable to vacuum interactions, it is possible to outline the engineering tools and techniques required to begin to investigate ZPE. Extremely high frequency oscillations at high field strengths (Vallee), highly non-linear plasmas or arcs (Tchernetsky) super-high charge concentrations or field gradients (Puthoff), and dynamic magnetic resonance cooling of nuclei (Alzofon) are prime candidates for investigation at present.

The paper attempts to draw together the most practical aspects of this work, which is currently at a sufficiently advanced stage to allow initial experiments to be designed. Only the essentials of theories propounded will be presented, chiefly those aspects from which real-world physical apparatus and order-of-magnitude measurement can be deduced. The work of other researchers which may have a bearing on the subject will also be briefly touched upon.

The task of characterizing this type for research in engineering terms is difficult from a number of viewpoints. The primary difficulty lies in the sheer novelty of the suggestion that such energy conversion may be possible at all. As well, the generally esoteric nature of the theoretical basis of most of the work related specifically to ZPE has prevented more physicists from such undertakings. The resulting lack of parametric equations which can be translated into testable hypotheses invoking actual laboratory apparatus (as opposed to gedanken experiments, for instance) might indicate that this presentation may be premature.

However, it is hoped that the paper will demonstrate that the discovery of techniques to extract and convert useful energy from the vacuum virtual fluctuations is not an ivory tower pipe dream, but more a matter of nuts and

bolts and thus it should serve as a rationale for those engineers and researchers to keep a close watch on vacuum energy physics.

AUTHOR'S CONCLUSIONS

It is apparent that, within these formulations [presented in the paper], there is a critical range of parameters from which it may be expected that we shall see EM-induced gravitation and vacuum energetic effects in the laboratory. As some of these parameters have already been achieved **it is expected that such phenomena will soon be observed**. Perhaps cold fusion and claims of other unusual energy systems and apparent anti-gravitational effects have vacuum fluctuation processes as their bases. Vacuum energy engineering is currently in an embryonic stage. It is hoped that others skilled in theoretical physics and engineering practice will be able to review and expand on the work presented above and assist in producing a set of engineering principles from which commercial applications may result.

EDITOR'S COMMENTS

Hathaway's presentation of ZPE is one of the best summaries that we have seen. To paraphrase his discussion of vacuum energy: Imagine an electromagnetic cavity resonator as large as the universe. This cavity can have within its bounds an extremely large number of modes of electromagnetic radiation covering a large number of wavelengths. It has been shown that the spectral density is Lorentz invariant. The ZPE density may be very large but not be measurable from inertial frames. However, this energy may be detectable and even tappable from accelerated frames. The author cites Puthoff and others to show that the calculated energy is extremely large. The author discusses the Casimir Effect which Puthoff has also described in his papers [*Fusion Facts*, Sept 1991 pg 1]. The author states: "Such a device [to tap ZPE] may be a cold dense charged plasma in which charge condensation takes place by radial Casimir forces, perhaps similar to ball lightning." Having been tutored by Puthoff, I believe that the electron beads produced by Shoulders and Puthoff are such charge condensations held together by radial Casimir forces. In addition, I believe that this is an acceptable explanation for Chukanov's ball lightning. Both electron beads and ball lightning have been shown to provide more energy out than input to create the beads or balls. Hathaway also suggests the possibility of making a vacuum fluctuation LASER. The paper also discusses possible measurable gravitational effects that some of the mathematics indicate may be a side effect of tapping ZPE. We will suggest to Hathaway that some of the Shoulders-Puthoff electron bead experiments have, indeed, found some of the measurements suggested as imminent in Hathaway's conclusions.

CANADA - DEUTERON INJECTION

J.S.C. McKee, G.R. Smith, J.J.G. Durocher, K. Furutani, C.B. Kwok, H. L. Johnston, M.S. Mathur, J. K. Mayer, A. Mirzai (Univ Manitoba), "Neutron emission from low energy deuteron injection of deuteron-implanted metal foils in (palladium, titanium, and indium)," *AIP Conf Proc*, **1991**, Vol 228 (Anomalous Nucl Eff Deuterium/Solid Syst), pp 275-286.

AUTHORS' ABSTRACT

In examination of the possibility of observing D-D fusion reactions at or near room temperature, our group at Manitoba has searched for an enhancement in the neutron production rate resulting from stoping [beamed] d interacting with implanted d in a metal matrix. This non-equilibrium process was selected as an alternative to electrolysis as a means of injecting the material. The d were implanted into the metal matrix by a small high current accelerator which accelerated a mixed beam of D or energy 60 keV and molecular D_{2+} which upon dissociation at the surface of the metal yields two 30 keV D. The precise composition of the beam was unknown. The presence of neutrons was registered continuously during the experimental runs. Scintillation light was detected as the neutrons transferred a portion of their energy to protons in a large plastic scintillator detector. Anomalous occurrences were observed during the operating of the experiment, in the form for sudden increases in the observed neutron detection rates. We undertook to repeat the experiment under more controlled conditions, with the intent of resolving to our satisfaction whether anomalous neutron production was actually occurring. In addition, an attempt to measure x-ray production within the target metal was made. The build up of d in the metal matrix was such that where the density of d in an available TiD target would be expected to be on the order of 4×10^{28} per cu meter, our implantation scheme resulted in deuterium densities less than 2×10^{31} per cu meter in the matrix. The loss of d from the matrix will be small compared with theory.
From Chemical Abstracts, October 21, 1991.

CHINA - PRECURSORS TO "COLD FUSION"

S.Y. Dong, K.I. Wang, Y.Y. Fend, L. Chang, C.M. Luo, R.Y. Hu, P.L. Zhou, D.W. Mo, Y.F. Zhu, C.L. Song, Y.T. Chen, M.Y. Yao, C. Ren, Q.K. Chen, and X.Z. Li (Tsinghua Univ, Beijing), "Precursors to 'Cold Fusion' Phenomenon and the Detection of Energetic Charged Particles in Deuterium/Solid Systems," *Fusion Technology*, **Nov 1991**, Vol 20 No 3, pp 330-333, 3 figs, 6 refs.

AUTHORS' ABSTRACT

A precursor to the "cold fusion" phenomenon in deuterium/solid systems is sought in order to solve the problem of reproducibility. The results of the first experiments are discussed. Electromagnetic radiation and energetic charged particles have been detected. It is shown that the surface condition has an important effect on this phenomenon.

AUTHORS' SUMMARY

To summarize the results of our experiments, we have three points:

1. There is a kind of electromagnetic radiation that might be a precursor of the anomalous nuclear effect. Hence, we are designing the next step of the experiment to diagnose the electromagnetic radiation in real time. This electromagnetic radiation is different from the electromagnetic radiation caused by energetic charged fusion products, which cannot be taken as a precursor.

2. We have repeatedly detected charged-particle signals in a deuterium/palladium system as long as we use palladium foils cut from the same sheet of palladium. Since the charged particles have a range of only a few microns in the palladium it suggests that the anomalous nuclear effects are related to some surface phenomena.

3. Surface contamination may suppress the anomalous nuclear effect. It may explain why many experiments have failed.

These three points are consistent with the electron screening model, which has been suggested by the existing nuclear reaction data at low energy.

CHINA & LANL - NEUTRONS FROM Ti CHIPS

Rongbao Zhu, Xiaozhong Wang, Feng Lu, Dazhao Ding, Jianyu He, Hengjun Liu, Jincai Jiang, Guoan Chen, Yuan Yuan, Liucheng Yang, and Zhonglin Chen (China Inst. of Atomic Energy, Beijing), "Measurement of Neutron Burst Production in Thermal Cycle of D_2 Absorbed Titanium Chips," *Fusion Technology*, **Nov 1991**, Vol 20 No 3, pp 349-353, 5 figs, 4 refs.

AUTHORS' ABSTRACT

A high-level neutron coincidence counter equipped with 18 ^{3}He tubes and a JSR-11 shift register unit with a detection limit of 0.20 n/s for a 2-h run is used to study the neutron signals in D_2 gas experiments. Different material pretreatments are selected to review the changes in frequency and size of the neutron burst production. Experimental sequence is deliberately designed to distinguish the neutron burst from fake signals, e.g., electronic noise pickup, cosmic rays, and other sources of environmental background. Ten batches of dry fusion samples are tested, among them, seven batches with neutron burst signals that occur roughly from -100 C to near room temperature. In the first four runs of a typical sample batch, seven neutron bursts are observed with neutron numbers from 15 to 482, which are 3 and 75 times, respectively, higher than the uncertainty of the background. The samples seem to be inactive after four or five temperature cycles, and the inactive samples could be reactivated by degassing and recharging of deuterium. The same anomalous phenomena were observed in the Mentou Valley Underground Laboratory situated 580 m below ground.

ENGLAND - A REVIEW

J.D. Davies, J.S. Cohen (Birmingham Univ), "More on the cold fusion family", *Electromagn. Cascade Chem. Exot. At.*, **1990**, No 52 pp 269-75, 32 refs.

A review with 32 references.
From Chemical Abstracts, Oct. 21, 1991.

ENGLAND - STORM TRIGGERING

Nick Hawkins (Specialist Res Ltd, London), "Possible Natural Cold Fusion in the Atmosphere," *Fusion Technology,* **July 1991**, Vol 19, No 4, pp 2112-2113, 16 refs.

AUTHOR'S ABSTRACT

Nongeological 'natural cold fusion' effects in meteoro-electrical disequilibria are possible, and various laboratory simulations of these effects are being studied.

FRANCE - CASIMIR FORCE

Courtesy of Dr. Samuel Faile

Marc Thierry Jackel & Serge Reynaud (Paris, France), "Casimir force between partially transmitting mirrors", *J. Phys. I France 1*, Vol 1, No 10, October 1991, pp 1395-1409, 20 refs.

AUTHORS' ABSTRACT

The Casimir force can be understood as resulting from the radiation pressure exerted by the vacuum fluctuations reflected by boundaries. We extend this local formulation to the case of partially transmitting boundaries by introducing reflectivity and transmissivity coefficients

obeying conditions of unitarity, causality, and high frequency transparency. We show that the divergences associated with the infiniteness of the vacuum energy do not appear in this approach. We give explicit expressions for the Casimir force which hold for any frequency dependent scattering and any temperature. The corresponding expressions for the Casimir energy are interpreted in terms of phase shifts. The known results are recovered at the limit of a perfect reflection.

EDITOR'S COMMENTS

The authors start with the formula for the electromagnetic field in a four-dimensional spacetime and get the formula $F = h\ c\ (pi)^2 / (240\ q^4)$ where h is Planck's constant, c the speed of light, and q the distance between the mirrors. Obviously from these equations as q approaches zero, the force gets extremely large. Without some limiting wavelength for the electromagnetic fields, the F approaches infinity. The authors add to the literature by providing calculations to handle cases in which the boundaries are not perfectly reflecting. It will be of considerable interest to make suitable changes to these equations that will represent the forces involved where the Casimir force condenses a number of electrons to form an electron bead. An interesting question concerns the amount of energy that can be added to an electron bead and then be recovered as the electron bead disintegrates. Anyone care to tackle that problem?

GERMANY - SIMPLE PLASMA MODEL

Dieter Seeliger & Andreas Meister (Dresden Univ), "A Simple Plasma Model for the Description of d-d Fusion in Condensed Matter," *Fusion Technology,* **July 1991**, Vol 19, No 4, pp 2114-2118, 2 figs, 25 refs.

AUTHORS' ABSTRACT

A simple plasmalike model that describes the time behavior of the deuteron-deuteron (d-d) fusion reaction rate as a function of charging time is presented. When used to describe the experimental shape of d-d neutron production rates averaged over broad time intervals, the model gives reasonable agreement. The fusion rates obtained from this comparison are of the order of the magnitude of effects that could be expected by the combination of electron screening and fluctuation enhancement. The model allows predictions of the conditions under which d-d fusion neutrons in condensed matter might be observed and explains why, in many cases, no effects are observed.

GERMANY - D-D FUSION FROM Pd SLAB

Michael Bittner, G. Ludwig, Andreas Meister, J. Muller, Detlef Ohms, Elief Paffrath, Dietmar Rahner, Rainer Schwierz, Dieter Seeliger, P. Stiehl, Klaus Wiesener, and Peter Wustner (Dresden Univ), "Evidence for the Production of d-d Fusion Neutrons During Electrolytic Infusion of Deuterons into a Palladium Cylinder," *Fusion Technology,* **July 1991**, Vol 19, No 4, pp 2119-2124, 8 figs, 8 refs.

AUTHORS' ABSTRACT

A lengthy experiment for the observation of deuteron-deuteron (d-d) fusion neutrons emanating from a massive palladium cylinder is described. The experimental results are discussed in the framework of a plasmalike model for fusion in condensed matter, resulting in fusion rates of $lambda^{PL}_{D-D} = (1.19 +/- 0.15) \times 10^{-44}$ per sec.

AUTHORS' CONCLUSION

The experiment used a compact palladium cylinder for >600 hours and a sensitive fast neutron spectrometer. It showed very weak but definite signals of neutrons that most likely results from d-d reactions. However, this effect became observable experimentally only after >200 hours of loading because of the large loading time constant of such a massive electrode. After this, strongly fluctuating positive effects occurred during several hundred hours with slowly decreasing intensity.

The average long-term behavior of the effects observed was comparable with the predictions of a crude plasmalike model. The fluctuating character of the effects seems to indicate, however, that the particle flow inside the metal was not a continuous, smooth one as assumed in this model, but rather it behaved as statically distributed microavalanches transporting the deuterons into the depth of the metal.

The cumulative number of reaction events that occurred during the measuring cycle was of the order of $(6.26 +/- 1.1) \times 10^4$.

The plasma fusion rate (lambda) as determined from the experiment has to be compared directly with calculations of the so-called reactivity in a plasma. However, besides the usual averaging over the Maxwellian velocity distribution, the electron screening and dynamic enhancement of the tunneling probability should also be taken into account to get a comparable order of magnitude for lambda from theory and experiment. Further work on this is in progress, both in the direction of testing other samples experimentally as well as in the development of elaborate physical descriptions.

GERMANY - D-D FUSION IN Pd SLAB

Michael Bittner, Andreas Meister, Detlef Ohms, Elief Paffrath, Dietmar Rahner, Rainer, Schwierz, Dieter Seeliger, Klaus Wiesener, & Peter Wustner (Technixche Univ, Dresden)," *Fusion Technology*, **Nov 1991**, Vol 20, No 3, pp 334-348, 16 figs, 14 refs.

AUTHORS' ABSTRACT

Two successive long-duration experiments for the observation of deuteron-deuteron (d-d) fusion neutrons emanating from a massive palladium slab are described. The experimental effects observed are discussed through the use of a simple plasmalike model for the time dependence of fusion reactions in condensed matter, which is modified for a plane geometry. This results in a plasma fusion rate of 1.0 +/- 0.15 x 10^{-44} per sec. While plasmalike behavior leading to observable d-d fusion reaction intensities occurs temporarily, under non-equilibrium conditions of electrolytic charging only, for permanently occurring d-d molecular fusion in the fully loaded palladium slab from the experiments, only an upper limit can be set, which is given by lambda$_{D-D} < 10^{-26}$ per sec.

INDIA - TRITIUM FROM TITANIUM
Courtesy of Dr. Samuel Faile

T.C. Kaushik, A. Shyam, M. Srinivasan, R.K. Rout, L.V. Kulkarni, M.S. Krishnan, S.K. Malhorta, V.B. Nagvenkar (Bhabha Atomic Res Cent, Bombay), "Preliminary report on direct measurement of tritium in liquid nitrogen-treated deuterated titanium (TiD_X) chips," *Indian J. Technol*, **1990**, Vol 28, No 12, pp 667-673.

AUTHORS' ABSTRACT

In a simple experiment to look for cold fusion, batches of hundreds of TiD_X chips were directly cooled in liquid N and warmed up to room temperature many times. The chemically cleaned chips were earlier deuterated using D_2 gas of known T content. During the first thermal cycle, a significant spike which may be attributed to a neutron burst, was registered in a bank of 10 BF_3 counters. The chips were later analyzed for T by counting the T betas directly, possibly for the first time in such experiments, using a gas flow beta counter as well as indirectly by counting the beta-excited Ti K x-rays using a NaI detector. A surprisingly high (approx MBq) level of activity was detected in four chips besides significant amounts of T (>KBq) in > 50% of the chips of a batch of more than thousand TiD_X chips. However, some auxiliary experiments suggest that the low level (approx KBq) T in a majority of the chips may possibly have resulted due to cross-contamination from the 4 high activity chips when cycled together. No T activity was observed within the detection threshold (approx 0.5 KBq) of the available detectors, in any of the remaining batches from the same stock even when some of them were similarly treated. The results appear to be in conformity with similar experiments conducted at Frascati, Los Alamos, Trombay, and several other labs, where neutron bursts were reported from TiD_X when subjected to repeated thermal cycling. The process responsible for the anomalous generation of MBq level of T activity in 4 out of the approximately thousand TiD_X chips remains to be investigated.
From Chemical Abstracts, September 23, 1991

INDIA - MOLTEN SALT CHARGING
Courtesy of Dr. M. Srinivasan

John T. John, P.K. De & H.S. Gadiyar (BARC, Trombay, Bombay), "High Temperature Cathodic Charging of Hydrogen in Zirconium Alloys and Iron and Nickel Base Alloys," **BARC-1544, Government of India, Atomic Energy Commission,** 1991, 42 pages, 21 figs, 16 refs, Available from BARC ATomic Research Centre, Trombay, Bombay, India.

AUTHORS' ABSTRACT

These investigations lead to the development of a new techniques for charging hydrogen into metals and alloys. In this technique a mixture of sulfates and bisulfates of sodium and potassium is kept saturated with water at 250-300 degrees centigrade in an open pyrex glass beaker and electrolyzed using platinum anode and the material to be charged as the cathode. Most of the studies were carried out on Zr alloys. It is shown that because of the high hydrogen flux available at the surface and the high diffusivity of hydrogen in metals at these temperatures the materials pick up hydrogen faster and more uniformly than the conventional electrolytic chargin g at room temperature and high temperature autoclaving in LiOH solutions. Chemical analysis, metallographic examination and XRD studies confirm this. This technique has been used to charge hydrogen into many iron and nickel base austenitic alloys, which are very resistant to hydrogen pick up and to H-embrittlement. Since this involved a novel method of electrolyzing water the hydrogen/deuterium isotopic ratio has also been studied. At this temperature the D/H ratio in the evolved hydrogen gas was found to be closer to the value in the liquid water, which means a smaller separation factor. This confirms the earlier observation that separation factor decreases with increase of temperature.

AUTHORS' CONCLUSIONS

1. The high temperature cathodic charging (HTC) is a versatile technique for charging a variety of metals and alloys with hydrogen.

2. Because of the high temperature and high flux present in this case it can introduce more hydrogen than by any other hydrogen charging technique in the same time.

3. The H-D separation factor during the electrolysis at 260 C was smaller than that in low temperature electrolysis, showing thereby that the diminished rate of HD-H_2O exchange does not have any beneficial effect on separation factor.

EDITOR'S COMMENTS

We thank Dr. M. Srinivasan for sending us this paper to share with our readers. The key information for cold fusion (in my opinion) is that cold fusion alloys for electrolytic cells may be charged with deuterium in a similar fashion. The use of sulfates and bisulfates where the Hs are replaced by Ds, may be a useful technique for pre-loading candidate cathodes for use in cold fusion electrolytic cells. As taught by Liaw, et al (University of Hawaii), the anode in molten salt experiments may be the receptor of deuterium (where LiD provided the D^- ion). This teaching suggests that some novel loading experiments may be designed and used in cold fusion research. *Fusion Facts* seeks comments and suggestions from its readers.

INDIA - THEORY USING CLASSICAL PHYSICS

Lali Chatterjee (Jadavpur Univ, Calcutta), "On a Weak Flavor for Cold Fusion," *Fusion Technology*, **Nov 1991**, Vol 20 No 3, pp 358-360, 1 figs, 7 refs.

AUTHOR'S ABSTRACT

The possibility of recent reports of cold fusion in deuterated metals being manifestations of primal nucleoweak reactions catalyzed by the host environment is investigated. Resulting experimental signatures are predicted.

EDITOR'S COMMENTS

By invoking a possible weak interaction between d-e-d, the author demonstrates that it is not necessary to invoke any exotic physics or unnatural mechanism to explain cold fusion. The experimental signatures predicted are: (1) the absence of final-state protons as the protonic constituents are used up in the weak sector, and (2) identical experiments with pure water should produce deuterons. Question: Can this theory explain the excess heat obtained by Dr. Randell Mills using light water and potassium carbonate?

INDIA - TWO FACES OF COULOMB

Lali Chatterjee (Jadavpur Univ, Calcutta), "The Two Faces of the Coulomb Barrier," *Fusion Technology*, **Nov 1991**, Vol 20 No 3, pp 349-353, 2 figs, 4 refs.

AUTHOR'S ABSTRACT

The necessity of a dual response of the coulomb barrier to incoming and outgoing particles is pointed out. The conflicting dictates of physics and of asymptotic conditions is investigated and possible compatibility attempted. Applications are discussed.

ISRAEL - HAFNIUM-HYDROGEN REACTION

Courtesy of Dr. Samuel Faile

Y. Levirtin, J. Bloch & M.H. Mintz (Nuc Res Center & Ben Gurion Univ of the Negev, Beer-Sheva), "Kinetic study of the hafnium-hydrogen reaction," *J of the Less-Common Metals*, (name changed to *J of Alloys and Compounds*), Oct 1, 1991, Vol 175, No 2, pp 219-234, 9 figs, 14 refs, in English.

AUTHORS' ABSTRACT

The kinetics of hafnium hydride formation were studied utilizing conventional rate measurements (Sieverts system) combined with metallographic examinations of partially hydrided samples. the rate measurements were performed at 700 Torr H_2 over a temperature range 200-550 C. Two types of hafnium samples (polycrystalline and crystal bar) were compared. The progression of the massive stage of the reaction is characterized by a contracting-envelope morphology with a constant hydride front velocity. The anisotropy in the reaction front velocity regarding different crystalline orientations of the metal is small, resulting in similar results for the different types of hafnium. The temperature dependence of the front velocity obeys an Arrhenius-type relation over the temperature range 250-450 C, with an apparent activation barrier of about 0.4 eV is evaluated, which agrees with the average reported value for the diffusion of hydrogen in hafnium hydride. At temperatures above about 500 C, deviations from the Arrhenius relation are displayed, possibly owing to a change of mechanism.

ITALY - LATTICE INSTABILITY THEORY

Alexander Tenenbaum & Eugenio Tabet (Dip Fiz Univ La Sapienza, Rome), "Lattice instability and cold fusion in deuterated metals," *NATO ASI Ser, Ser B,* **1990**, Vol 236, pp 323-327.

AUTHORS' ABSTRACT

A model is presented which could help in explaining cold fusion processes on the basis of a lattice collapse in a deuterated metal. A thermodynamic instability can, under favorable conditions, trigger a coherent and concentric displacement flow in the metal, which can accumulate in a small region the excess elastic energy originally distributed in an expanded domain. Conditions allowing nuclear fusion processes can be created.
From *Chemical Abstracts,* October 21, 1991.

JAPAN - NEUTRON EMISSION

Ryuuzo Takagi, Hiroo Numata, Izumi Ohno (Tokyo Inst of Tech), Kazutaka Kawamura (Tokai Univ), Shiro Haruyama (Tokyo Nat'l College of Tech), "Neutron Emission During a Long-term Electrolysis of Heavy Water," *Fusion Technology,* **July 1991**, Vol 19, No 4, pp 2135-2139, 6 figs, 6 refs.

AUTHORS' ABSTRACT

Electrolysis of heavy water has been carried out for >4 months with special attention to neutron emission. The results of the measurements of the electrode potential of the palladium cathode, the temperature of the palladium cathode and of the electrolytic solution, and the neutron count rate are described.

AUTHORS' CONCLUSION

We observed a high neutron count rate continuously for several hours a few days after changes in the current density or circulating water temperature. However, we did not see corresponding changes in the overpotential, which means that the cold fusion does not take place at the surface of the cathode, but rather inside the cathode.

EDITOR'S COMMENTS

The authors ran their experiments at both 40 and 50 C. They also noted an oscillation in the overpotential at current densities of 0.8 to 3.2 mA per cu cm. The periods of oscillation ranged from 25 minutes to about 3.5 hours. The neutron count rates are summarized as being 3 sigma above background for the four major events that were observed. This is an important verification of cold fusion. We commend the authors on their good work.

JAPAN - HEAVY ELEMENT ALCHEMY

Takaaki Matsumoto & Kazuya Kurokawa (Kokkaido Univ, Sapporo), "Observation of Heavy Elements Produced During Explosive Cold Fusion,," *Fusion Technology*, **Nov 1991**, Vol 20 No 3, pp 323-329, 17 figs, 4 refs.

AUTHORS' ABSTRACT

Many-body fusion reactions may take place during cold fusion. Heavy elements are observed that might have been produced by such reactions during electrolysis of heavy water. Elements such as sodium, magnesium, aluminum, and zinc are observed inside grain-shaped defects in a palladium rod used in a cold fusion experiment.

EDITOR'S COMMENTS

The authors point out, "If the concentration of hydrogen exceeds a critical value, direct cold fusion chain reactions can be ignited locally in bursts. When hydrogen atoms are forced to move in metal, they might be stored in layers between media with different structures or properties, and the concentration of hydrogen atoms in those places could be increased far beyond the critical value. Thus, the hydrogen might be burned in bursts or very rapidly, i.e., explosively." The authors designed an experiment in which the palladium rod cathode is loaded with deuterium. The Pd rod is then raised partly out of the electrolyte to cause a rapid flow of deuterium.

In the discussion, the authors relate, "Explosive cold fusion was easily performed by moving hydrogen in palladium metal, and experimental evidence suggesting the occurrence of explosive cold fusion was observed. Although the explosion was caused mainly by a chemical reaction of the mixed hydrogen and oxygen gas, it is reasonable to consider that fusion energy has also contributed to the explosion by decomposing water." The many enlarged microscope pictures of the Pd rod depict an interesting set of explosive-like craters in the Pd. In addition, the EDX spectrum photos show evidence of several elements from Sodium through Zinc. It is suggested that these heavier elements and some lighter elements were created by cold fusion reactions. In the final paragraph, the authors suggest, "Although clarifications are still needed in the light element region, it has been verified that heavy elements such as titanium, iron, and copper can be produced directly by electrolyzing seawater. These materials are by-products of energy production; thus, industrial nuclear alchemy can be expected in the future."

JAPAN - IS COLD FUSION POSSIBLE?

Courtesy of Dr. Samuel Faile

Michio Enyo (Hokkaido Univ, Sapporo), "Is the cold fusion reaction possible?" *Kagaku to Kogyo*, **1991**, Vol 44, No 1, pp 47-51, 18 ref, in Japanese.

AUTHOR'S ABSTRACT

A review on feasible cold fusion reactions, detection and measurement of neutrons, tritium and excess heat, theoretical treatment of electrochemical models and their fundamental understanding.
From Chemical Abstracts, September 23, 1991.

JAPAN - MONTE CARLO SIMULATION

Courtesy of Dr. Samuel Faile

Setsuo Ichimaru, Shuji Ogata, Aiichiro Nakano, Hiroshi Iyetomi (Dept. of Phys., Univ. of Tokyo, Japan), Toshiki Tajima (Dept. Phys. and Inst. Fusion Studies. Univ. of Texas, USA), "Statistical-Mechanical Effects on Cold Nuclear Fusion in Metal Hydrides", *Strongly Coupled Plasma Physics*, 1990, pp 653-656, 4 fig, 4 ref.

AUTHORS' ABSTRACTS

We perform Monte Carlo simulation study for short-range correlations between itinerant hydrogen, interacting mutually via electron-screened repulsive forces, in periodic and aperiodic (due to defects) lattice fields of metal hydrides. We find that the screening potentials and the resultant fusion rates depend extremely sensitively on microscopic details in the lattice fields, corroborating qualitatively the varied results in recent cold fusion experiments.

CONCLUSION

When the periodic lattice fields are perturbed by defects, the enhancement factor increases drastically in TiH_2 while it rather decreases in PdH. Since the adopted potential for Ti-H has an extra term of long-range repulsion, which is absent in the adopted Pd-H potential, the fields around defects in TiH_2 have much finer structures with microscopic undulation than those in PdH. The resulting short-range modulation of density is the cause of enhancement. The value in Table I implies lamda$_{dd}$ may equal 7×10^{-23} per sec for ThH_2 with defects at T = 300 K. Possibility of such an "observable" fusion rate thus depends extremely sensitively on microscopic details in lattice fields, corroborating quantitatively the varied results in recent experiments.

JAPAN - NO NEUTRONS

Courtesy Dr. Samuel Faile

Hidekazu Kumagai, Sieechiro Nakabayashi, Sadamu Yamagata, Shohei Isomura, Takashi Ichihara, Koichi Yoshida, Takeshi Suzuki, Kazuyoshi Takahashi, Akira Kira, & Isao Tanihata (Inst of Physical and Chemical Research, Saitama), "Attempts in Detection of Neutrons on So-Called Cold Nuclear Fusion," *J. Physical Society of Japan*, Vol 60, No 8, Aug 1991, pp 2594-2601, 5 refs.

AUTHORS' ABSTRACT

Neutron emissions from electrolysis of D_2O with palladium and palladium-titanium electrodes as well as from pressurized D_2 gas with titanium alloys have been measured. The neutron detector system was so designed to have very low background condition. Neutron-gamma separation technique using liquid scintillator was applied to obtain essentially no gamma ray background condition for neutron counting. Special care was taken to stabilize the detection system using event-by-event data recording. No significant signal of neutron emission was observed. Upper limits of emission probability of neutron have been determined to be 6×10^{-3} per sec, 1×10^{-2} per sec, and 2.3×10^{-2} per sec for Pd electrode, Pd-Ti electrode, and pressurized gas system. These values are orders of magnitude lower than that presented by Jones paper (0.4 per sec).

EDITOR'S COMMENTS

The experimental measuring equipment is impressively described. However the details for the electrolytic cell are not included in the paper. It is expected that now one could redo this experiment with the latest cell design information and measure some increase in neutrons. The main problem may be that the cell configuration is highly aneutronic. These authors did report on measurements of D/Pd ratio that indicated about 1.2 as measured by Rutherford scattering. The measuring equipment and laboratory conditions appeared to be excellent. We would suggest that copying Miles (China Lake) cell configuration, and measuring for tritium and heat might provide some excellent data if they care to try more experiments.

JAPAN - H IN ULTRAFINE Pd PARTICLES

Courtesy of Dr. Samuel Faile

Naokazu Tateishi, Kiyochika Yahikozawa, Katsunori Nishimura, Masato Suzuki and Yoshio Takasu (Dept Fine Mat. Eng., Faculty of Textile Sci. and Tech, Shinshu Univ., Nagano, Japan) Yukinori Iwanaga, Mitsuko Watanabe, Eiji Enami, Yoshiharu Matsuda (Dept. Ind. Chem., Faculty of Engineering, Yamaguchi

Univ., Yamaguchi, Japan), "Electrochemical properties of ultra-fine palladium particles for adsorption and absorption of hydrogen in an aqueous $HClO_4$ solution", *Electrochimica Acta*, **Vol 36**, No 7, 1991, pp 1235-1240, 9 fig, 15 Ref.

AUTHORS' ABSTRACT

Ultra-fine palladium particles were prepared by vacuum evaporation onto a flat plane of a glassy carbon rod. Their diameters were estimated to be 2-10 nm by means of a high resolution scanning electron microscope (SEM). Properties of Pd/GC electrodes in hydrogen adsorption and absorption were characterized by cyclic voltammetry. Adsorption strength of hydrogen species on the Pd particles of Pd/GC did not depend on the particle size, whereas amounts of the adsorbed hydrogen species and the absorbed ones into the Pd particles were dependent. The X-ray photoelectron spectroscopy (XPS) clearly revealed that the energy level of Pd 3*d* electron band increased with a decrease in the Pd particle size.

JAPAN - HYDROGEN STORAGE

Courtesy of Dr. Samuel Faile

H. Fujii, S. Orimo, K. Yamamoto, K. Yoshimoto, & T. Ogasaware (Hiroshima Univ & Mazda Motor Corp), "New composite materials for hydrogen storage using magnesium as a binder," *J of Less-Common Metals* (Now retitled as *J of Alloys and Compounds)*, **Oct 1, 1991**, Vol 175, No 2, pp 243-257, 12 figs, 13 refs, in English.

AUTHORS' CONCLUSIONS

In this work, we have developed new composite materials for hydrogen storage which contain $ZrFe_{1.4}Cr_{0.6}$ or $TiMn_{1.5}$ as a storage material and magnesium as a binder. The influences of composition, compacting pressure and sintering treatment on hydrogen storage capacity, kinetics and cyclic durability for the composite pellets were investigated by measuring the pressure-composition isotherms and by performing absorption-desorption cycles. Microscopic analyses of the composites were also carried out using X-ray diffraction, SEM, EPMA, and ESCA. The results obtained are summarized as follows:

1. The composite pellets obtained by sintering the mixture of the $ZrFe_{1.4}Cr_{0.6}$ particles and magnesium powder at 773 K for 20 hours show some excellent hydrogen storage properties: they absorb and desorb hydrogen readily and rapidly under an H_2 pressure less than 1 MPa without any activation treatment and decrease in hydrogen storage capacity.

2. The pellets exhibit no disintegration even after 1000 hydriding-dehydriding cycles.

3. A similar improvement is observed in the $TiMn_{1.5}$ - Mg composite system.

4. From observations of the microstructure and distribution of the constituting elements in the composite by SEM, EPMA, and ESCA, the sintering at 773 K promotes the so-called "magnesium-reduction" and makes the surface of the original hydride particle in the composite clean, leading to fast kinetics.

5. The magnesium-reduction, therefore, helps to form a new thin composite phase on the surface boundary between the hydride particles and the magnesium metal, in which magnesium acts as a binder.

6. As a result, the composite pellets display no disintegration even after 1000 sorption cycles.

EDITOR'S COMMENTS

With no phase change and with the binder making a thin film composite phase, would it be a possible candidate for a cold fusion cell cathode? We suggest that this application be considered.

KOREA - FIVE HEAT BURSTS

Courtesy of Dr. Samuel Faile

Kyung-Suk Yun, Jeh-Beck Ju, Byung-Won Cho, Won-Il Cho and Seong-Yong Park (Electrochem. Lab., Korean Inst. of Sci. & Tech., S. Korea), "Calorimetric observation of heat production during electrolysis of 0.1 M LiOD + D_2 solution", *J. Electroanal. Chem.*, **Vol 306**, No 1-2, 24 May, 1991; PP 279-285, 5 fig, 25 Ref.

AUTHORS' ABSTRACT

Excess heat production during the electrolysis of a solution of 0.1 M LiOD in D_2O with a palladium cathode and a platinum anode has been reported by Fleischmann et al. After their report, many research groups around the world have tried to observe excess heat production and other evidence for the phenomenon so far called "cold fusion." Reviews on this phenomenon have been written. While most research groups have not observed any excess heat production or any evidence of a fusion reaction during D_2O electrolysis, several research groups have claimed sporadic observation of excess heat or evidence of reaction products believed to result from a fusion reaction. This indicates that the reaction mechanism for the production of excess heat seems to depend strongly on the experimental conditions. There are many different experimental factors; environmental conditions; such as temperature, cell geometry, pressure, etc. methods of electrode preparation, electrode materials, electrochemical system parameters, and the duration of electrolysis. In

this study, we have examined the phenomenon of excess heat generation during the D_2O electrolysis in relation to electrode materials and the method of electrode preparation.

AUTHORS' CONCLUSION

The production of heat during the electrolysis of D_2O has been examined. A heat-conduction type calorimetric system for the detection of heat bursts was designed and fabricated. Five events of excess heat burst were observed in 22 separate experiments. The maximum amounts of excess heat measured from the heat burst curves were 0.16 W to 0.26 W (25-128 W per cu cm of Pd). Heat production occurred sporadically and seems to be independent of the electrolysis time. Pretreatment by annealing the palladium electrode tends to increase the reproducibility of heat product slightly.

KOREA - REVIEW OF KOREAN WORK

Jong Hong Byun (Kaist, S. Korea), "Cold Nuclear Fusion", *Hwahak Kwa Kongop Ui Chinbo,* 1990, 13 Ref, in Korean.

AUTHOR'S ABSTRACT

Review and reflections on the controversies surrounding cold fusion, including a list of Korean organizations and personnel funded to carry out related studies are given.

KOREA - HYDROGEN-INDUCED AMORPHIZATION
Courtesy of Dr. Samuel Faile

U-In Chung, Yong-Gyoo Kim and Jai-Young Lee (Dept. Mat. Sci and Eng., Korea Advanced Inst. of Sci. and Tech., S. Korea), "General Features of Hydrogen-induced amorphization in RM_2 (R=rare earth, M=transition element) Laves phases", *Philosophical Magazine B*, **Vol 63**, No 5, 1991, pp 1119-1130, 7 fig, 24 Ref.

AUTHORS' ABSTRACT

From a literature survey, the hydrogen-induced amorphization behavior in RM_2 (R=rare earth, M=Ni, Fe, Co) Laves phases is classified into two groups according to whether a crystalline hydride phase appears during the transition to an amorphous state or not. The major factor that determines the presence or non-presence of the crystalline metal hydrides is related to the stability of the compound, which can be estimated by the heat of formation (delta H_F) or the decomposition temperature of the compound itself. The crystalline metal hydrides are found only in the compounds with high stability. It is proposed that the mechanism for the two types of amorphization is related to the degree of lattice expansion with absorption, which is a function of the elastic modulus of the compounds. To explain the dependence of the elastic modulus of the compound on the two types of amorphization behavior, the concept of a nucleation barrier for amorphization is adopted. Compounds with a large lattice expansion (compounds with a low Young's modulus) do not produce the crystalline metal hydrides, which is attributed to amorphization without a nucleation barrier because the packing density of the crystalline state is lower than that of the corresponding amorphous state. Only the compounds with a small lattice expansion exhibit the crystalline state owing to a somewhat high nucleation barrier.

KOREA - HYDROGEN-INDUCED AMORPHIZATION Courtesy of Dr. Samuel Faile

Yong-Gyoo Kim (Dept Mat. Sci. and Eng., Korea Adv. Inst. of Sci. and Tech, S. Korea), Sung-Man Lee (Dept. Mat. Eng., Kangwon Nat. Univ., S. Korea), Jai-Young Lee (Dept. Mat. Sci. and Eng., Korea Adv. Inst. Sci. and Tech.), "Hydrogen-induced amorphization of the Laves compound $CeNi_2$ and the structural and thermal characteristics of the amorphous phase", *J. of Less-Common Metals*, **Vol 169**, No 2, May 1991, PP 245-256, 8 fig, 26 Ref.

AUTHOR'S ABSTRACT

The hydrogen-induced amorphization behavior of the C15 Laves compound $CeNi_2$ were investigated by X-ray, differential scanning calorimetry, transmission electron microscopy and thermal desorption techniques. From the X-ray measurements, it was observed that the $CeNi_2$ compound is amorphized by hydrogenation, and the transformation to an amorphous state takes place without the formation of a crystalline hydride phase. At high reaction temperatures (400 C.), the sample decomposes into the $CeNi_5$ and CeH_2 phases, which are believed to be equilibrium phases in a hydrogen atmosphere. Amorphization is possible even when the reaction temperature is as low as -76 C. From this low temperature amorphization behavior, it is suggested that the elastic strain due to hydrogen absorption may play a key role in the amorphization. Electron diffraction of the hydrogenated sample shows two diffuse halos, which are proposed to be caused by phase separation of the amorphous phase. One of these is considered to be a cerium-rich phase (close to CeH_2) and the other is a nickel-rich phase (close to $CeNi_5$). Therefore, it is suggested that the amorphization of $CeNi_2$ by hydrogenation may occur by lattice distortion in the course of the phase decomposition. The thermal decomposition and hydrogen desorption behaviors of the

amorphous $CeNi_2$ hydride was examined by differential scanning calorimetry and a thermal desorption technique using gas chromatography. The first crystallization product is the $CeNi_5$ phase followed by the formation of CeH_2 at higher temperatures. Through the formation of intermediate compounds of varying [Ce]/[Ni] ratios, the $CeNi_5$ and $CeNi_2$ phases combine into the original $CeNi_2$ compound.

MEXICO - TRITIUM MEASUREMENTS

Jose Maria Malo-Tamayo, Jesus Morales-Rivas, Blanca Zamora-Celis, Francisco Pablo Ramirez-Garcia, Octavio Novaro-Penaloza (Subdir. Gen. Invest. Apl., IMP, Mexico), "Cold fusion experiments at IMP", *Rev. Inst. Mex. Pet.,* **1990, Vol 22,** No 1, pp 42-47, (In Spanish).

AUTHORS' ABSTRACT

Experimental results on cold fusion conducted at the Mexican Petroleum Institute (IMP) are presented. Preliminary results on the detection and quantitative measurement of T obtained in an 8-day electrochemical cold fusion experiment are included.

PAKISTAN - DEUTERON MODEL

Courtesy of Dr. Samuel Faile

Hafsa Khan & Pervez Hoodbhoy (Quaid-i-Azam Univ, Islamabad), "Convenient parameterization for deep inelastic structure functions of the deuteron," *Physical Review C,* Vol 44, No 3, pp 1219-1222, 3 figs, 8 refs, in English.

AUTHORS' ABSTRACT

The spin, as well as spin-averaged, twist-two structure functions of the deuteron are calculated in a version of the convolution model that incorporates relativistic and binding energy corrections. A simple parameterization of these structure functions is given in terms of a few deuteron wave-function parameters and the free nucleon structure functions. This allows for an easy comparison of structure functions calculated using different deuteron models.

POLAND - Pd MIGRATION IN HALL FIELD

Courtesy of Dr. Samuel Faile

Ryszard Pietrzak (Inst. Phys., Pedagogical University of Opole, Poland), "Investigation of diffusion and migration of hydrogen, deuterium and tritium in palladium in a Hall field",*J. of Less-Common Metals*, **Vol 169,** No 2, May 1991, pp 227-234, 4 fig, 10 Ref.

AUTHOR'S ABSTRACT

The migration of hydrogen, deuterium and tritium in palladium in a Hall field at 343 K was investigated, using resistance and isotope methods. It was found that all isotopes of hydrogen migrate towards the negative Hall electrode. The effective charges of the migration in a Hall field are 194 +/- 3e for hydrogen, and 464 +/- 5e for deuterium and tritium. The results obtained confirm predictions of a tentative model based on the electron-ballistic theories of migration in a Hall field.

AUTHOR'S CONCLUSIONS

It follows from the present investigations that during migration in palladium in a Hall field

(1) hydrogen, deuterium and tritium migrate in accordance with the direction of the Hall field and their effective charges have opposite signs to the Hall constants of the systems investigated, and

(2) the effective migration charges of deuterium and tritium in palladium in a Hall field remain the same within experimental error, whereas the effective migration charge of hydrogen has a smaller value.

ROMANIA - TOPOENERGETIC PRINCIPLES

George Dragan (AMCO-SA, Bucharest), "Topoenergetic Evidence of Cold Fusion Phenomena," *Fusion Technology*, **Nov 1991**, Vol 20 No 3, pp 361-364, 4 figs, 16 refs.

AUTHOR'S ABSTRACT

The data about heat flow reported from the Fleischmann and Pons experiments are discussed on the basis of topoenergetic principles concerning the behavior of composite systems. Data from the Fleischmann and Pons experiments obey the universal topoenergetic representation denoting a valid transformation process evidenced by calorimetric measurements. The probable nature of this process and the further experiments necessary for its identification are discussed by considering the composite structure of the crystalline palladium specimens responsible for its occurrence.

RUSSIA - NO NEUTRONS

Courtesy of Dr. Samuel Faile

I.I. Astakhov, A.D. Davydov, V.E. Kazarinov, I.G. Kiseleva, L.B. Kriksunov, D. Yu. Kudryavtsev, G.L.

Teplitskaya, V.M. Tsionskii (A.N. Frumkin Inst. of Electrochem., Acad. of Sci. U.S.S.R.), N. V. Katargin, I.A. Lebedev, B.F. Myasoedov, O.P. Shcheglov (V.I. Vernadskii Inst. of Geochem. and Anal. Chem, Acad. of Sci. U.S.S.R.), "An attempt to detect neutron and gamma radiations in heavy water electrolysis with a palladium cathode", *Electrochimica Acta*, **Vol 36**, No 7, pp 1127-1128, 4 Ref.

AUTHORS' ABSTRACT

The electrolysis of LiOD and D_2SO_4 solutions in D_2 carried out with a palladium cathode under different conditions did not reveal any excess over the neutron and gamma radiation background that would testify in favor of the suggestions about a possible occurrence of cold nuclear fusion.

USSR - REACTIONS BY MUONS

Ya. B. Zeldovich & A.D. Sakharov (Fiz Inst im Lebedeva), "Reactions induced by muons in hydrogen," *Usp Fiz Nauk*, **1991**, Vol 161, No 5, pp 43-46, In Russian.

AUTHOR'S ABSTRACT

The nuclear reactions between H isotopes (p + D, D + D, D + T, T + T, p + T) catalyzed by muons, which modify the form of the potential barrier, were considered. Their probabilities were discussed. The probability of forming the muonic mol. in the collisions D(mu) + p --> Dp mu and D(mu) + D --> D(2mu) was also considered. The role of particular transitions in these processes was discussed.

From *Chem Abstracts*, October 21, 1991.

E. LETTERS TO THE EDITOR

CHUKANOV ON COLD FUSION

Fusion Facts recently (Oct 1991, page 13) reported on Dr. Chukanov's development of ball lightning and the excess energy that he was able to obtain. Dr. Chukanov has sent us the following note: Thank you for my article in *Fusion Facts*. I am enclosing a part of my theory on 'cold fusion'."

Extracts from Dr. Chukanov's cold fusion theory follow:

Analysis of possible chemical reactions leads to the conclusion that excess heat cannot be of chemical origin. Any single chemical interaction of hydrogen would generate 15 - 20 eV; "cold fusion" produces several keV per atom.

Nuclear reactions cannot account for the excess heat, because nuclear reaction end products would be trillions of times greater than is the case. It is clear that the excess heat is a result of an unknown process. Pons's and Fleischmann's claims that they can obtain "clean" energy from "cold fusion" are not convincing. Even if there is some nuclear synthesis of deuterium, this synthesis is only a side process accounting for an insignificant part of the total energy balance.

"Cold fusion" can be explained with the help of the quantum limitations of matter theory. The unusual property of some metals (Pd, Ti, etc.) to absorb hydrogen from the environment is the basis of the "cold fusion" clean energy production. Palladium ions have fixed places within the palladium crystal - they vibrate around a fixed position in the lattice. On the other hand deuterium nuclei are relatively free. Palladiums's metallic lattice forces hydrogen to behave like a metal too, and it gives up its only electron to the combined electron cloud.

[Chukanov's paper discusses the relative pressure and spacing of deuterium atoms with the Pd lattice and observes that the spacing cannot account for the "cold fusion" excess energy.]

. . . Very confusing is the balance of energy (if is assumed that the law for conservation of energy is in force) and the drastic discrepancy between the amount of heat produced and the quantity of nuclear synthesis by-products. These are the basic flaws of all theories admitting nuclear synthesis as an explanation.

Along the guidelines of quantum limitations theory "cold fusion processes" are easily explained. In the initial phase of saturation, when density of deuterium plasma in palladium's lattice is still low ($R_{De-De} > 3.2 \times 10^{-3}$ cm, and $n < 2.5 \times 10^{8}$ per cu cm), the assembly of deuterium nuclei is far from the critical quantum point of transition to the second form of matter (material continuum) at point 1. Higher density [of deuterium in the Pd], however, makes this critical point come closer and closer. There are two options: the assembly of deuterium nuclei may remain in the form of discreet matter, or transit to the form of material continuum. A universal principle of Nature is the tendency of matter to preserve its initial state. The stronger the external influence, the fiercer is the resistance. Very important here, however, is the time limit within this external influence is exercised. If it is instantaneous, the material system upon which it is exercised has no time to react, and jumps into another state. This is the mechanism according to which plasma passes into the state of material continuum - ball lightning, described in some of my works. A high

frequency impulse whips the electrons out of the atoms, and the congregation of nuclei passes into a state of material continuum -ball lightning. Low frequency and the low voltage electric current cannot transform plasma into a ball-lightning. In this case matter reconciliates electrons and nuclei into a new combination (the duration of this reconciliation is about 10^{-6} sec). Deuterium saturates palladium very slowly - the process continues for hundreds of hours. Deuterium nuclei in this case easily resist conversion into a material continuum at point 1 in a manner very uncommon to the traditionally thinking physicist. To resist transition into material continuum deuterium nuclei start to oscillate and increase their energy in order to stay away from quantum limitation $R_{K,P}$ and thus violate the law for conservation of energy. This increase of energy results into the mysterious excess heat in "cold fusion". It, however, has nothing to do with nuclear synthesis.

[Chukanov shows by calculation that when the palladium is fully saturated with deuterium nuclei the average energy and temperature of these nuclei is about 0.4×10^7 deg K.]

. . . Millions of degrees! This [temperature] can lead to normal "hot" fusion of deuterium nuclei. "Cold fusion" is in reality hot fusion. . . .

[The point 1 referred to by Chukanov is a point on the boundary of the curve $R_{K,P} = 2 \times 10^{-16} / E$ plotted on the R (cm.) y-axis and E (erg) x-axis grid. Point 1 lies between the two curves R_d = sq rt E / 0.91×10^{-8} and the curve R^C = sq rt E / 2.96×10^{11}. These three curves plotted on the R,E grid define an area that Chukanov lists as being the "Determined region of existence of the substance". As the deuterium density increases in the palladium lattice, the deuterium plasma changes from a rarification to condensation (at point 1 on the boundary of the $R_{K,P}$ curve). At this stage (point 1), Chukanov's graph shows that further increase in deuterium plasma density must be accompanied with an increase in energy. Prior to reaching point 1, the deuterium plasma could become more condensed without an increase in energy (vertical path on the graph). Chukanov goes on to explain that these more energetic deuterium atoms collide more often with the palladium ions and therefore transfer energy (heat) to the palladium lattice. The source of the energy being "tapped" and observed comes from Nature in the same manner that Chukanov's ball lightning plasma can trap and release excess energy to the environment under graphically similar conditions.]

If our readers wish to communicate with Dr. Kiril Chukanov, please send your request to *Fusion Facts*, P.O. Box 58639, Salt Lake City, UT 84158. If you desire a copy of his paper, we will obtain permission and send you a copy. Ed.

F. CONFERENCES, PAPERS & MISC.

ANNOUNCING: THE 3rd INTERNATIONAL CONFERENCE ON COLD FUSION (ACCF3)
Date: October 21 (Wed) - October 25 (Sun), 1992
Place: Nagoya Congress Center, Nagoya, Japan

The conference will cover all topics relevant to cold fusion 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.

For further information contact the Conference Chairman:
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