FUSION facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

ISSN 1051-8738 • University of Utah Research Park •

ISSN 1051-8738

--Since 1989--

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

VOLUME 8 NUMBER 5 **NOVEMBER 1996**

CONTENTS FOR NOVEMBER 1996

> The important thing in science is not so much to obtain new facts, as to discover new ways of thinking about them.
>
> *- Sir William Bragg*

A. ANTI-GRAVITY IMPLIES INFINITE FREE ENERGY

Robert Bass
November 9, 1996

If the empirical Podkletnov Effect (*Journal of New Energy,* vol 2, no 2, ref 4, p 136) is confirmed to be physically valid as described, then it will be simple to produce unlimited ***free energy*** from some hitherto untapped renewable source. Indeed, the device described *loc.cit. [cf.* also *BusinessWeek*, Sept. 30, 1996, p 42] produces a constant reduction in the measured weight of an arbitrary test mass when run in steady-state at constant power. But this means that the total **energy input** grows **linearly** with time, whereas the total **energy output** stored in a vertically-arrayed flywheel (driven by the torque producible from asymmetric weight-reduction and consequent unbalanced unidirectional torque generated as each successive portion of the flywheel's rim becomes tangent to the Podkletnov beam) grows **quadratically** with time. The announced result follows at once.

INTRODUCTION

The reason for predicting that a rotary engine of the type discussed below will produce more energy than that required to drive it, is the result of the kind of *Gedankenexperiment* (thought experiment) to which Einstein attributed his deepest discoveries and for which he is famous. Start with an acceleration ray [1-3], which produces a small but noticeable effect, no matter how small. On the principle that an ion engine has been advocated as useful for deep-space voyages even though its thrust is microscopic and its initial acceleration is measurable only in micro-gees, a very, very small generator of an acceleration ray will, in a sufficiently long time, produce a noticeable angular acceleration of a perfectly-balanced, frictionless flywheel, even if one must wait for "years" for the effect to become noticeable.

Moreover, if the ray persists for a sufficiently long time, the flywheel (assuming it is ideal, and will not fly apart) is capable of

storing **ANY** amount of angular momentum and **rotational kinetic energy**, no matter how large, which grows as the **square of the time**, whereas **the averaged power** consumed by the ray generator grows only **linearly with time**; accordingly, **no matter how small is the acceleration effect**, there will be a finite time after which **the energy stored in the flywheel is greater than the energy used to power the beam generator.**

ANALYSIS

To see this more explicitly, suppose that the **averaged** power consumption of the beam generator [1, 2, 3] is given by k watts per unit time, where k is a constant. Let the flywheel consist of two masses of size M connected by lever arms of length L to the axis of rotation. Then the moment of inertia of the flywheel is given by $I = ML^2$. Let the acceleration to a mass M by the beam be denoted by a. Then the unbalanced **unidirectional** torque on the flywheel is given by $T = aML$, and so the angular acceleration of the flywheel is $T/I = a/L$; therefore, after t seconds the angular velocity will be at/L. Consequently, the kinetic energy of the flywheel after t seconds will be

$$E_f = (1/2).I.(a.t/L)^2 = (1/2).M.a^2.t^2 = K.t^2$$

where $K = (1/2).M.a^2$ is a **constant**.

But at that time t, the total energy consumed by the beam generator will have been just $E_b = k.t.$ One concludes that the **ratio of energy consumed** in driving the flywheel versus **energy stored** in the flywheel, is $E_b/E_f = (k/K)/t$, which as t increases becomes **arbitrarily small!** Then the energy input is negligible in comparison to the usefully available energy output!

An alternative formulation is that $E_f > E_b$ as soon as $t > (k/K)$.

DISCUSSION

Where did the "excess energy" ($E_f - E_b$) come from? Presumably the SED theory of Puthoff to the effect that an accelerating charge can pick up energy from the background ZPF is correct, and so one is tapping into 10^{90} Joules [or more] per cm^3 that modern microphysics says, according to either QED or SED, is available for use but hitherto unexploited. For documentation, note the well-annotated study of several contemporaneously advocated inertial-mass-modification (i.e. anti-gravity!) experiments by R.L. Forward [4], which also contains a list of 28 "active researchers in **vacuum fluctuations**."

Consequently, the essentially zero-pollution rotary engine discussed above can, in principle, actually continuously produce more useful energy than is required to operate it! This startling result smacks of "perpetual motion," long rejected by the Establishment as *a priori* "impossible."

But if any of the new theories surveyed by Forward [4] turn out to be "correct" (in the sense that they make only verifiable predictions and make no **observably falsified** predictions), then they will be tentatively accepted by all true scientists as (provisionally) acceptable [true scientists regard ALL propositions as tentative!] But then the question arises, how to explain, e.g. by the Puthoff *et al.* ZPF theory, the persistence and quantization of **spin in QM** and QED? Puthoff has admitted to Bass in private e-Mail messages that were later published in the *Cold Fusion Newsletter* that this is, and remains, the big unsolved mystery.

If indeed the Li-Torr idea [1] that the spinning of ions in a superconductor is the key to artificial acceleration rays is correct, then the question arises: where does the energy come from that keeps the ions spinning, despite the loss of energy to gravitational waves? It is not incumbent upon the present author to answer that question in fundamental physics in order to be entitled to point out that if the accidentally-discovered, strictly empirical Podkletnov Effect is authentic, then the excess energy must be coming from somewhere.

Regarding the competing "schools" of QM + QED versus SM + SED, i.e. versus Stochastic Mechanics (SM), as in Edward Nelson's work, plus Stochastic Electrodynamics (SED), as in the work by Puthoff *et al.* cited in [4], it is unknown whether QM + QED or SM + SED is the better theory. Therefore, the reader is at liberty to ascribe the unknown source of energy to the **paradoxically nonsensical Zero Point Energy (ZPE)** of the "virtual polarized vacuum" of QED **or** to the **real ZPE** of the "actual energetic vacuum" of SED, **or** to some **other** hitherto **unknown** source, such as an energetic aether.

CONCLUSION

Tapping a novel source of **near-infinite** (or **renewable**) **ambient energy**, hitherto untapped, does not constitute "impossible perpetual motion," nor a violation of Conservation of Energy; it just involves **extracting ambient energy** from the ZPE or ZPF, **whichever** or **whatever** it may be. (Orthodox physicists claim that there is enough energy in a vacuum whose volume could be contained between the reader's cupped hands to boil all of the oceans of the world!) With this vast ocean of untapped energy surrounding us at all times, the possibility remains that the non-polluting rotary engine discussed above is merely somehow tapping into something like the incredible reservoir of the little-understood vacuum-fluctuating ZPE/ZPF!

Accordingly, it is perfectly possible in principle to use such an acceleration-beam powered rotary engine, **once started**, to drive an auxiliary rotary electrical generator which drives the acceleration-ray generator which drives the primary rotary engine, and thereby to provide a **self-contained** rotary engine which (until it wears out from mechanical friction) produces limitless amounts of both mechanical and alternating-current electrical power without requirement of any external source of energy whatsoever!

REFERENCES

1. Frank Znidarsic, "The Zero Point Interaction," *J. New Energy*, vol 1, no 2, Summer 1996, pp 133-136, esp. Refs. 4a,b,c,d,e to papers by Li, Torr, Podkletnov, Modanese.
2. Otis Port, "Take That, Isaac Newton," *Business Week*, Sept. 30, 1996, p 42.
3. Chris Tinsley, "Table-Top Anti-Gravity?" *Infinite Energy*, vol 2, no 9, July-Aug. 1996, p 49.
4. Robert L. Forward, "Mass Modification Experiment Definition Study," *Infinite Energy*, vol 2, no 9, July-Aug. 1996, p 53-64.

ANTI-GRAVITY MACHINE

Henry P. Dart, III

The recent announcement by Russian scientist, Eugene Podkletnov, that he has invented an anti-gravity machine, which was to be described in an article authored by Podkletnov and Finnish physicist, Petri Vuorinen, is now tainted with controversy. The British journal *New Scientist* has reported in its 21 September 1996 issue that the article, which had been scheduled for publication in the *Journal of Physics D: Applied Physics*, has been withdrawn following a statement by the alleged co-author, Petri Vuorinen, denying that he ever worked on anti-gravity with Podkletnov.

Although Podkletnov has said that tests ruled out the possibility that the claimed weight loss was the result of magnetic fields or air flow, his statement is suspect. His own diagram of the machine indicates it involves a levitating ring of superconducting material spinning at a rate of 5000 rpm. Apparently any anti-gravity effect produced by the machine is the well known magnetic effect associated with superconductivity.

At the Southwest and Rocky Mountain Division meeting of the AAAS in Norman, Oklahoma (May 1995), the author of this article discussed briefly his theory of repulsive gravity which occurs in the centers of the enormously massive central stars that exist in the nuclei of all galaxies, such as the one in galaxy M-87, which has a mass of 2.4 billion solar masses. Under this theory, which has nothing to do with magnetism or superconductivity, when the scalar field value in the interior of such a massive star attains a value roughly equal to that which occurs at the Schwarzschild radius, under the formula F = ma, the force also becomes negative or repulsive. This phenomenon has the following effects:

1. The central region of the star develops enormous centrifugal forces that counteract the equally enormous centripetal forces developed in the exterior portion of the star, thereby preventing the gravitational collapse of very massive stars, a heretofore unsolved problem; and

2. It supplies an alternative explanation for the enormous jets of matter that are expelled from the polar regions of the central stars, which jets are currently explained as being propelled by magnetic forces that operate at some distance from the central star, while the central star is described as a "Black Hole" from which nothing, not even light itself, can escape.

The author's paper on this subject is scheduled for publication in *Toth-Maatian Review*.

B. EDITORIALS

NOBEL PRIZE NOMINATIONS FOR ENERGY

Hal Fox, Editor

Now that we understand the importance and nature of **cold fusion**, it is time to nominate B. Stanley Pons, Martin Fleischmann (Fellow of the Royal Society), and Kenneth R. Shoulders for a Nobel Prize. Pons and Fleischmann deserve the prize for their fundamental discovery of cold fusion [1]. Kenneth R. Shoulders deserves a part of the prize for his excellent work in discovering and revealing how nuclear reactions take place in both the palladium-heavy-water system and in the sono-fusion system [2]. A further degree of experimental information about nuclear reactions has been added by the Neal-Gleeson Process [3].

A summary of these fundamental discoveries illustrates how important they have been and **will be in the rapid advancement of the treatment of radioactive wastes** (especially radioactive slurries); the production of thermal energy without neutrons; and probably the development of **factory-made scarce elements** [4].

The importance of these discoveries merits a tutorial on the power of ion-carrying charge clusters.

CREATING A CHARGE CLUSTER

Charge clusters can be created in a variety of environments ranging from near vacuum to some liquids. Kenneth Shoulders has taught, in both his book [5] and his patents [6], how to make and recognize charge clusters. These charge clusters are created by most sparks, lightning, and more professionally, by the techniques demonstrated by Shoulders in several of his patents [6].

Recently, it has been determined that charge clusters can be created in liquids, provided that the correct electrodes, molarity, voltage and current are properly chosen. For some early research in which it is believed that charge clusters were being created in ethylene glycol with silicon, see the work of Waring and Benjamini [7]. It is unlikely that the authors realized the nature of the "sparks" emitted from the silicon when the voltage was increased beyond the normal range for luminescence. It is also believed that the effective method for promoting nuclear reactions in the Neal-Gleeson Process is the formation and use of charge clusters, although this observation was not known to the authors at the time the paper was written [3].

It is believed that in their atmospheric spark-gap experiments, Reiter and Faile [8] are creating and observing the remarkable effects of charge clusters [8].

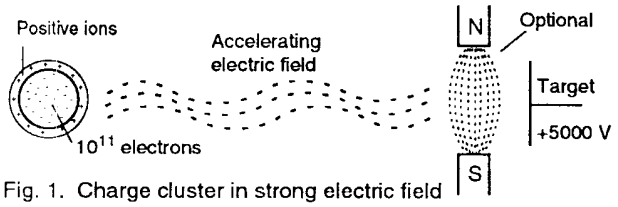


Fig. 1. Charge cluster in strong electric field

Fig. 1 illustrates a typical one micron charge cluster consisting of about 10^{11} (100 billion) electrons. Due to some, as yet unknown, high degree of dynamics, the cluster creates internal forces that are stronger than the mutual repulsion forces of the electrons. The end result is that the cluster is stable, at least while it is moving. As shown in the illustration, the negative cluster can attract and retain a relatively small number of positive ions (one ion for about every 100,000 electrons). In fact, the high degree of concentrated charge on a cluster will ionize gases and liquids under proper conditions. For example, if a charge cluster is created in a hydrogen atmosphere, some of the ionized hydrogen ions (we call protons) will be attracted to the charge cluster.

In Fig. 1, we depict the charge cluster in a strong electrostatic field with a downstream anode connected to a positive 5,000-volt power supply. In this strong electric gradient, the charge cluster (and the attached ions) will accelerate to a velocity of about one-tenth the speed of light. If we were to build a proton accelerator, we would have to use an accelerating voltage of about nine million volts to impart the same velocity to a cluster of protons. **Therefore, this simple device is essentially a high-energy accelerator of positive ions but based on a low-energy initial source!**

We know that the proton is about 1836 times as heavy as the electron. If we calculate the impact momentum (mv^2) that has been provided to each proton attached to the charge cluster, we find that the impact energy, **according to standard nuclear physics,** is sufficient to cause nuclear reactions.

USING THE CHARGE CLUSTER

As discovered and patented by Shoulders [6], charge clusters can be used to make or create more energy output than input to the device. As discovered and now as a patent pending, Neal and Gleeson have found a method (Neal-Gleeson Process) by which **radioactive elements can be stabilized**. The method by which charge clusters can reduce radioactivity is conceptually easy to understand. If one looks at a chart of Nuclides and Isotopes, the high-mass elements are replete with radioactive isotopes. On the other hand, the lower-mass elements and their isotopes are more stable. The role of the charge cluster and its load of positive ions is to impact the radioactive heavy element; cause the elements to become unstable; promote **spontaneous fission**; and produce two (normally) smaller fragments which are usually stable. The process is basically simple when you know how to do it.

Now that we understand the process, at least one patent is pending on the use of an embodiment of the process by which low-energy (input) clusters can promote selected nuclear reactions which will produce high amounts of thermal energy. For example, let us assume that lead (Pb-208 to be precise) is the target element. We bombard the lead with a charge cluster, it becomes unstable and splits into two equal halves and provides us with two atoms of palladium (Pd-104). **The process is a little more complicated because we have to deal with the mass of the impacting ion.** However, to keep it simple, assume the that Pb-208 atom with a mass of 207.976627 is impacted, caused to fission and produces two Pd-104 atoms. The total mass produced is then two times 103.90403 or 207.80806. **Note that the mass produced (207.80805) is less than the mass of the Pb-108 (207.976627). The difference in mass is not much, but according to Einstein's formula $E = mc^2$, we can calculate the energy equivalent of the missing mass fraction. Of course, even a small amount of missing mass multiplied by the speed of light squared will be a significant amount of energy. Therefore, this reaction, <u>if we can cause it to be produced</u>, will provide thermal energy to our system.**

MAKING SCARCE ELEMENTS

In the preceding section, we discussed the possibility of using Pb as a target material, impacting the lead with charge clusters and transmuting the lead into palladium to get excess thermal energy. **If we could accomplish that feat, then we would have the thermal energy <u>plus a more valuable element produced than we started with!</u>** Nature may not be so kind. The idea that a particular nuclear reaction is **possible** does not mean that the same reaction is **probable.** Nature will inform us, as we ask the correct questions, what we can and cannot accomplish. **However, it is believed that there are many scarce elements in the periodic table which we will be able to make from more plentiful elements**. It is the judgement of this author that an element in nature is scarce because the probability of making such an element is low -- meaning that the production of such element must require energy. However, it appears that creating energy with nuclear reactions will be relatively simple. It is also expected that we will be able to find the combination of ions and target elements that can be used **together with input energy** to create the scarce element of our choice.

SUMMARY

Now you realize the enormous importance of what Pons, Fleischmann, Shoulders, and others have accomplished. They should get the Nobel prize! They deserve the recognition. A new line of research and development in physics has now been provided. At least one, and probably several new patent applications have resulted from this new line of research and development. In summary, we now know how we can do the following:

1. **Clean up radioactive wastes.**

2. Create clean, abundant, thermal energy -- with no neutrons.

3. Create factory-produced scarce elements.

Note to investors: FIC has filed a patent application that will cover a broad range of nuclear transmutation topics. FIC is seeking interested help from brokers to help make a market for the soon-to-be-filed public registration of FIC's stock. If you can help, fax Hal Fox at 801-583-2963.

REFERENCES

1. Martin Fleischmann, Stanley Pons, and M. Hawkins, "Electrochemically Induced Nuclear Fusion of Deuterium," *J. Electroanal. Chem.*, (1989), vol 261, pp 301-308, and erratum, vol 263, p 187.
2. Kenneth and Steve Shoulders, "Observations on the Role of Charge Clusters in Nuclear Cluster Reactions", *J. New Energy*, Fall 1996, vol 1, no 3.
3. Bass, Neal, Gleeson, & Fox, "Electro-Nuclear Transmutations: Low-Energy Nuclear Reactions in an Electrolytic Cell," *J. New Energy*, Fall 1996, vol 1, no 3.
4. Hal Fox, Robert W. Bass, & Shang-Xian Jin, "Plasma-Injected Transmutation," *J. New Energy*, Fall 1996, vol 1, no 3.
5. Kenneth R. Shoulders, EV - A Tale of Discovery, 265 pages, illus., c1987, privately published and available from the author.
6. Kenneth R. Shoulders, "Energy Conversion Using High Charge Density," U.S. Patent 5,018,180, issued May 21, 1991, see also "Circuits Responsible to and Controlling Charged Particles," U.S. Patent 5,054,047, issued Oct. 1, 1991.
7. Worden Waring & E.A. Benjamini, "Luminescence during the Anodic Oxidation of Silicon," *J. Electrochem. Soc.*, vol 111, no 11, Nov 1994, pp 1256-1259.
8. Reiter and Faile, "Spark Gap Experiments," *New Energy News*, Sept 1996, p 11ff.

BETA-DECAY, THE NEUTRON ADJUSTER
Hal Fox

It is known that heavy elements seem to have extra neutrons. For example, take the case of Uranium-238, the most plentiful (99.2745% in nature) isotope of uranium. This uranium atom has 92 protons and 146 neutrons, for a total of 238 protons and neutrons. Assume that we can split this uranium-238 nucleus into two equal halves by adding an alpha particle (helium nucleus with two protons and two neutrons). We would have an element with 47 protons. The element with 47 protons is silver. Assume that we have also split the number of neutrons in half and we have a silver isotope with 47 protons and 74 neutrons for a total of 121 protons and neutrons. Looking in a table of Nuclides and Isotopes [1], we find that there is an unstable isotope of silver, Ag-121, with a half-life of 0.78 seconds and that it will transform (decay) by the emission of a negative beta (β- in the table).

BETA DECAY
In such a chart of the elements and isotopes, there is a valley of nuclear stability and the stable elements found in nature lie along this valley of possible elements and isotopes. Some authors will talk about a nuclear **drip line**, which is a boundary along both sides of this valley of stability beyond which elements are not known to exist with any measurable degree of stability. Silver-121 is adjacent to the drip line on the boundary of elemental existence.

According to D.E. Alburger, in an brief explanation of "Beta Decay" [2], such a nucleus may have too many neutrons (alternatively, on the other side of the valley of elemental stability, an isotope may have too few neutrons). Such an isotope, produced either naturally or artificially, has too many (or too few) neutrons. Therefore, the isotope will have an excess of energy as compared with its neighbors. In a sense, we can think of Ag-121 and other such isotopes as sitting on the hill overlooking the valley. Nature prefers that this excess energy be transformed and that the element become more nearly stable. **The mechanism is beta decay.**

In the case of Ag-121, the decay process is shown in the table of nuclides as β- and the cryptic figure of 0.78s is provided. The 0.78 seconds is the time that it will take for one half of the Ag-121 nuclei to transform themselves by β- (beta decay) into some other more stable nuclei. The way the chart is constructed, the results of a β- decay are found by moving up one row and to the left one column. In this case we find an isotope of cadmium (Cd-121). Note that the number 121 is preserved. That is, the number of protons and neutrons are still the same (conservation of the sum of protons and neutrons, or the baryon number).

The beta decay process transmutes the silver into cadmium (in this case) with no change in atomic weight (maybe a very small change due to the energy released with the electron). The change is the emission of a **beta ray**. After the beta ray was named, it was found first to be an electron, and later found to be a combination of an electron and a neutrino, each of which is emitted by the decaying nucleus with a sharing of energy between the electron and neutrino. In general, the energy emitted can be considered to be passed on to whatever material stops the electron and/or the neutrino. (Note that neutrinos are extremely hard to stop but also that they are not considered to be a form of damaging radiation). The beta, an electron with energy of motion, can be stopped with a relatively thin barrier. The entire process can be considered as one in which a neutron in the nucleus decides to become a proton and has to conjure up and throw away an electron (and a neutrino) to accomplish the mission.

For the case under consideration, U-238 + alpha becomes Ag-121 and then Cd-121. The story is not over. We have gotten rid of one neutron and acquired a proton. However, the Cd-121 is listed as being unstable and having two modes of beta decay with

half lives of 8 and 13.5 seconds. The result of this casting off of another electron and the converting of another neutron to a proton brings us to a nucleus of Indium-121. In-121 is still unstable and becomes Tin, Sn-121, which is still unstable and suffers beta decay to becomes Antimony, Sb-121. **Now we have rolled down into the valley of elemental stability**. Sb-121 is stable. Assuming that we have begun with Uranium and its excess neutrons, we have converted neutrons to protons by moving from Ag-121 to Cd-121 to In-121 to Sn-121 to Sb-121. Each of these steps has transformed a neutron to a proton (four times). We now have a stable nuclei with 51 protons and 70 neutrons. Our process has converted four neutrons to four protons and thrown away four electrons and four neutrinos.

And that is how nature gets rid of the excess neutrons as we transmute heavier elements into lighter elements. Just thought you would like to know. According to claims in the Fox-Jin-Bass Plasma-Injected Transmutation patent application and article, table-top particle (positive-ion) accelerators may soon be available at relatively small expense and therefore within the budget of colleges and high schools. This equipment will allow for further study of elements, isotopes, and transmutation. Therefore, one of the books (or wall charts) that are expected to increase in sales are the Charts of Nuclides and Isotopes [1].

References:

1. E.W. Walker, J.R. Parrington, & F. Feiner, Nuclides and Isotopes, 14th edition, c 1989, General Electric Co., Nuclear Energy Operations, 175 Curtner Avenue, M/C 397, San Jose, CA 95125. (Wall charts also available.)
2. R.G. Lerner & G.L. Trigg, Encyclopedia of Physics, 2nd edition, pp 93-95, c 1991, VCH Publishers, N.Y.

C. NEWS FROM THE U.S.

CALIFORNIA - NAVY ACKNOWLEGES ANOMALIES

M.H. Miles, Benjamin F. Bush, Kendall B. Johnson (R&T Div., Naval Air Warfare Center Weapons Div., China Lake, CA), "Anomalous Effects in Deuterated Systems," NAWCWPNS TP 8302, September 1996, 99 pages, 36 refs, 35 figs.

EXECUTIVE SUMMARY

Our results provide compelling evidence that the anomalous effects in deuterated systems are real. Nevertheless, we have not been able to solve the reproducibility problem. This research area will remain highly controversial until reproducibility can be demonstrated. The lack of reproducibility stems mainly from unknown and uncontrolled variables in the palladium stock. There is a remarkable correlation of excess power with the source of the palladium. The best reproducibility was obtained using palladium-boron (Pd-B) materials supplied by the Naval Research Laboratory (NRL), Washington, DC. Seven out of eight experiments that used Pd-B cathodes produced excess power. In experiments that used the palladium from Johnson-Matthey, 18 of 28 experiments produced excess heat. In contrast there were several palladium sources that never produced excess power in any experiment. Our calorimetric results, conclusions, and problems are practically identical to those reported by SRI International Energy Research Center, Menlo Park, California. They are also consistent with many other laboratories that have reported excess heat. Calorimeters that are capable of detecting excess power levels of 1 watt per cubic centimeter (W/cm^3) of palladium are essential for research in this field. The small volume of palladium in co-deposition experiments likely made it difficult to detect excess power effects.

Results from our laboratory indicate that helium-4 (^4He is used interchangeably with helium-4) is the missing nuclear product. Thirty experiments have shown a correlation between either excess power and helium production or no excess power and no excess helium. Studies using both glass and metal flasks place the ^4He production rate at 10^{11} to 10^{12} atoms per second per watt (atoms/s·W) of excess power. This is the correct magnitude for typical deuteron fusion reactions that yield helium as a product. It is highly unlikely that our heat and helium correlations could be due to random errors. The only valid experiments that showed significant excess power but no excess helium involved a palladium-cerium (Pd-Ce) cathode.

Our best experiments produced up to 30% excess heat, 0.52 watts of excess power, and 1400 kilojoules (kJ) of excess enthalpy. This amount of excess enthalpy is difficult to explain by any chemical reaction. We have demonstrated that any recombination of the deuterium (D_2) and oxygen (O_2) electrolysis gases in our experiments can be readily detected and easily corrected. There was never any measurable recombination when the palladium cathodes were fully submerged in the deuterium oxide plus deuterated lithium hydroxide (D_2O + LiOD) electrolyte.

Anomalous radiation was detected in some experiments by the use of X-ray films, several different types of Geiger-Mueller (GM) counters, and sodium iodide (NaI) detectors. Normal radiation counts were always observed when no electrolysis experiments were running. The appearance of anomalous radiation always correlated with the expected rate of loading of the palladium with deuterium. Nevertheless, the anomalous radiation effect was not reproducible.

CALIFORNIA - VACUUM ENERGY

Robert L. Forward (Forward Unlimited, Malibu, CA), "Mass Modification Experiment Definition Study," *Infinite Energy*, vol 2, no 9 (1996), page 53.

AUTHOR'S ABSTRACT

The vacuum [aether] is proving to be one of the hottest topics in contemporary physics. It is a source of numerous effects: force fields that emerge from nowhere, particles popping in and out of existence, and energetic jitterings with no apparent power source. Many researchers see the vacuum as a central ingredient of 21st Century physics. Some even believe the vacuum may be harnessed to provide a limitless supply of energy. This report summarizes an attempt to find an experiment that would test the Haisch, Rueda, and Puthoff conjecture that the mass and inertia of a body are induced effects brought about by changes in the quantum-fluctuation energy of the vacuum. However, it was not possible to identify a definitive experiment. But, it was possible to identify an experiment that might be able to prove or disprove that the inertial mass of a body can be altered by making changes in the vacuum surrounding the body. Other experiments, which do not involve mass modification, but which teach something about the vacuum, were also defined and included in a ranked list of experiments. This report also contains an annotated bibliography and list of scientists active in the field.

MINNESOTA - PROTON CONDUCTING OXIDE HEATS UP

R.A. Oriani (Univ. of Minnesota, Corrosion Res. Cntr., MN), "An Investigation of Anomalous Thermal Power Generation from a Proton-Conducting Oxide," *Fusion Technol.*. vol 30, no 2, Nov. 1996, pp 281-287, 7 refs, 5 figs, 3 tables.

AUTHOR'S ABSTRACT

A high-temperature Seebeck-effect calorimeter, in which the thermoelectric electromotive force across a large-area-enveloping thermopile is a measure of the heat flux from a power source, has been constructed to examine the claimed generation of excess thermal energy from a proton-conducting oxide immersed in deuterium gas. The claim has been confirmed in a few experiments out of many unsuccessful ones.

UTAH - SIMULTANEITY INTERPRETATIONS

W. Vincent Coon, "Simultaneity Interpretations," *Galilean Electrodynamics*, vol 7, no 6, Nov/Dec 1996, pp 109-111.

AUTHOR'S ABSTRACT

It is shown that in inertial frame scenarios, the Einstein interpretation of the Lorentz Transformation (LT) competes with other transformations which do not support light speed invariance. These rival transformations can be obtained by re-evaluating LT simultaneity which is susceptible to overhauling.

INTRODUCTION

Isotropy postulates of space and the speed of light are the basis for defining simultaneity in Special Relativity Theory (SRT). [When,] in a simple text-book scenario, two identical clock-transmitters send signals toward each other precisely as each clock registers an agreed time, and if the signals meet at a point exactly mid-distant between the clocks, the clocks are said to be synchronized. Supposedly, the signals have the same speed relative to the clocks. This is an assumption that should not be taken for granted. In order to confirm that the signal speeds are the same, they must be verified empirically. But unambiguous measurements of one-way speed are impossible because of *speed synchronization circularity*. You see, in order to measure a signal's one-way speed we depend on synchronized, separated clocks, but in order to synchronize separated clocks we must know a signal's one-way speed to begin with. Defending light speed invariance by SRT's clock settings is therefore tautological. In short, the isotropy assertions of SRT remain postulates because they cannot be proven. Because these assertions cannot be proven, the synchronism required by light speed invariance is vulnerable to reassessment. Revisions of "synchronization" are accomplished by resetting clocks according to other standards of alleged simultaneity which are no less provable. The following exercise [paper] shows how to go about this algebraically.

D. NEWS FROM ABROAD

CHINA - NEW PROCESS & PARTICLE ?

Jie Fu Yang, "Possible New Process and New Particle," *Cold Fusion*, issue 19, Oct. 1996, pp 17-21, 23 refs.

AUTHOR'S ABSTRACT

This paper points out some problems in traditional ideas and explores the process and product before cold fusion. Some contradictions between the "abnormal" nuclear phenomena and d-d fusion have been analyzed previously. Some problems revealed by cold fusion are frontiers -- problems of science. It is meaningless to try to understand and appraise these new nuclear phenomena with traditional ideas, and the experimental condition of the cold fusion includes external conditions and internal conditions. The internal conditions relative to the character of the electrode absorbs deuterons and with its absorbency, experimental failure is inevitable if the internal condition cannot be repeated; but we cannot mistakenly think it is a negative result.

This paper will point out some problems with traditional ideas, and, based on the facts, will also point out that: 1) there is weak interaction in the nuclear force; 2) there is an excited state of deuterons in reaction $^{2}_{1}H$ (d, d*) d*; and 3) the experimental evidence of dineutron existence to discuss the excited deuteron $^{2}_{1}H^{*}$ in the deuteron absorbing process and productive dineutron

$^{2}{}_{0}N^{*}$ in weak interaction process, and estimate their mass and the energy.

INDIA - FOGGING PHENOMENON

R.K. Rout, A. Shyam, M. Srinivasan, A.B. Garg (BARC, Neutron Phys. Div., Bombay, India), V.K. Shrikhande (BARC, Tech. Phys. & Prototype Engr. Div., Bombay, India), "Reproducible, Anomalous Emissions from Palladium Deuteride/Hydride," *Fusion Technol.*, vol 30, no 2, Nov. 1996, pp 273-280, 3 refs, 5 figs, 5 tables.

AUTHORS' ABSTRACT

Each and every palladium sample loaded/reloaded either with hydrogen or deuterium was observed to fog radiographic films kept in its close proximity in air. Strangely, even with ten layers of black paper (thickness ≃ 63 mg/cm^2) as a filter between film and sample, fogging was observed. On the other hand, no fogging could be observed even when thin beryllium foil (≃ 1.4 mg/cm^2), three layers of transparent polyester foils (≃ 10 mg/cm^2), or thin aluminized polycarbonate (0.3 mg/cm^2) were employed as filters. Several experiments have been performed to identify the phenomenon responsible for fogging. **These experiments appear to rule out any of the known mechanisms, suggesting a new, strange, and unknown phenomena.**

JAPAN - TRITIUM & NEUTRON GENERATION

Hideo Kozima et al., "An Analysis of Tritium and Neutron Generation in a Pd + LiOD/D_2O System," *Cold Fusion*, issue 19, Oct. 1996, pp 4-8, 11 refs, 1 fig.

AUTHORS' ABSTRACT

The trapped neutron catalyzed model for cold fusion (TNCF model) was used to analyze experimental data showing tritium and neutron generation in an electrolytic system composed of a Pd cylindrical cathode, a Pt anode and an LiOD + D^2O electrolytic solution. The density of the trapped thermal neutrons n_n was determined from the amount of tritium observed in the solution as 10^5/cm^{-3}. The density n_n was used to calculate the number of high energy neutrons to be observed in the experiment giving the t/n ratio 6 x 10^5, a result consistent with the observation 8.7 x 10^4.

JAPAN - THERMAL NEUTRON CAPTURE

Hideo Kozima, "Thermal Neutron Capture by TGS Crystal at a Phase Transition Region," *Cold Fusion*, issue 19, Oct. 1996, pp 9-11, 12 refs.

AUTHOR'S ABSTRACT

Experimental data of an effect of thermal neutron irradiation on the phase transition behavior of triglycine sulphate (TGS) was investigated using the trapped neutron catalyzed fusion (TNCF) model for cold fusion. Trapping mechanism in TGS is supposed as a multi-domain structure formed in the phase transition region to explain the experimental data successfully.

JAPAN - EXCESS HEAT AND ^{4}HE GENERATION

Hideo Kozima et al., "Excess Heat and ^{4}He Generation in Pd-Black Cathode by D_2O + LiOH Electrolysis," *Cold Fusion*, issue 19, Oct. 1996, pp 12- 16, 7 refs.

AUTHOR'S ABSTRACT

Quantitative analysis of the electrolysis experiments on the D_2O + LiOH using a palladium double-structure cathode with Pd-black and platinum anode. The huge excess heat and a large amount of helium observed in the experiment were analyzed using the TNCF model. The density of the trapped neutrons in the sample determined by the experimental data is consistent with the value determined by other data on the isotope shift.

NETHERLANDS - DECREASING RADIOACTIVITY

Otto J.A. Reifenschweiler (Philips Res. Lab., Eindhoven, The Netherlands), "Some Experiments on the Decrease of Tritium Radioactivity," *Fusion Technol.*, vol 30, no 2, Nov. 1996, pp 261-272, 27 refs, 9 figs.

AUTHOR'S ABSTRACT

Experiments claiming a sharp decrease in the radioactivity of tritium incorporated in small monocrystalline particles of titanium have been reported and are described here in more detail. Additional evaluation provided a high degree of evidence for the decrease in the radioactivity of tritium. A first attempt is made to explain this remarkable effect in terms of a "nuclear pair hypothesis."

POLAND - FUSION IN METAL DEUTERIDES

Roman Edmund Sioda (Poland), "Can Nuclear Fusion be Initiated in Metal Deuterides?" *Cold Fusion*, issue 19, Oct. 1996, pp 28-35, 24 refs.

AUTHOR'S ABSTRACT

The model of cold fusion, which assumes the existence of local "hot spots" in deuterated metals -- hypothetically producing excess heat and some "nuclear ashes" -- requires a further detailed

discussion, concerning its validity, scope and characteristics. Some of these questions are being discussed, especially what concerns the possible origin of the local “hot spots” (accidental nuclear events) and the properties of “plasma” in a developed hot spot -- in the light of the kinetic theory of gases.

E. 6TH INTERNATIONAL CONFERENCE ON COLD FUSION (continued from Oct. *FF*)

All the following abstracts are taken from the *Program & Abstracts* of the ICCF-6 conference, held Oct. 13-18, 1996, Hokkaido, Japan.

AUSTRALIA - LONG RANGE NUCLEAR REACTIONS

Heinrich Hora, J.C. Kelly (*School of Phys.,* Univ. New South Wales, Australia), George H. Miley (Fusion Studies Lab., Univ. Ill., Urbana, IL), "Field-Screened Long-Range Nuclear Reactions," p 92.

AUTHORS' ABSTRACT

Recent experiments on nuclear reactions in metals, such as titanium/palladium multi-layer electrodes with very high concentrations of hydrogen or its isotopes, have confirmed the "swimming electron layer" (SEL) model. It was found that the SEL, created between different metals or at clean metal surfaces, screens the Maxwellian ions of the hydrogen isotopes, resulting in a reduction of their Coulomb repulsion by up to a factor 14. Similar conclusions have been reached by Ichimaru for high density plasmas. This screening enables nuclear reactions to occur at the greater distances of a few picometers, comparable with 400 eV temperature cases. The reactions permitted are not only for the fusion of hydrogen isotopes, but also the exothermic branches of the reactions of hydrogen isotopes with certain palladium isotopes, as shown by mass spectrometry. We examine highly exothermic reactions of hydrogen at platinum interfaces (e.g. with nickel) and conclude that the reaction is favored at the interfaces (ideal: thorium-nickel) and is much less probable in the interior of the metal. The reactions between the nuclei occur at very low momentum and may not easily result in MeV particles or quanta because of momentum conservation. We conclude that the enormous reaction energy goes into a large number of excited (rotational or surface) states decaying as emission of soft gammas for the thermalization of the nuclear energy.

CHINA - LOADING RATIO STUDY

Feng S. Bu (Beijing General Res. Inst. for Non-Ferrous Metals, China), Xing Z. Li (Dept. Phys., Tsinghua Univ., China), "Loading Ratio Study in a Gas-Loading System," p 99.

AUTHORS' ABSTRACT

Enhancing the loading ratio (D/Pd) in a gas-loading system is essential for the "excess heat" measurement in order to reproduce the "heat after death" phenomenon in a gas-loading system instead of the electrolysis system. A series of literature indicated that the annealing of the palladium sample is important in enhancing the loading ratio. However, the annealing procedures suggested were quite different from one scheme to another. The American experiments in 1971 showed that the simplest flamed palladium wire would reach H:Pd = 0.94 as a matter of routine without mentioning the source of the palladium. The Italian experiments in 1990's showed that annealing in a vacuum quartz vessel would reach a maximum D/Pd = 1.42 or H/Pd = 1.08 for the palladium from the England or Russia. The Indian experiments in 1990's suggested a protocol for the optimum rapid loading which used self-heated palladium wire (from USA) in air by ohmic current. A metallography comparison has been applied to study those different procedures in a gas-loading experimental devices. The preliminary experiments showed that annealing in a vacuum vessel generated large grains in a palladium wire from a Chinese resource. The maximum size of the grain is of the order of 300 microns in a palladium wire with a diameter of 0.34 mm. The effect on the loading would be presented in conjunction with other metallurgical observations.

CHINA - POSSIBLE PHASE TRANSITION

Guei S. Huang, Xing Z. Li (Dept. of Phys., Tsinghua Univ., China), "A Possible Phase Transition in a Gas-Loading D/Pd System," p 101.

AUTHORS' ABSTRACT

The resistance method has been widely applied in measuring the loading ratio (D/Pd or H/Pd) *in situ* in a closed or open system. While the volumetric method was applied in parallel with the resistance method, we found that at a certain temperature the resistance of the palladium wire might have a sudden jump without the corresponding gas-absorption monitored by a pressure meter. This phenomenon might imply that a resistance method alone might not be enough to determine the loading ratio, and there might be a phase transition at this temperature. The interesting questions are whether there is any heat releasing during this phase transition, and whether there are any differences between D/Pd and H/Pd systems. In order to observe this feature, the gas-loading system had been reconstructed to facilitate the calorimetric observation. A study along this line would be presented.

CHINA - TUNING RESONANCE TUNNELING

Xing Z. Li, Hai F. Huang, Zhi G. Bian (Dept. of Phys., Tsinghua Univ., Beijing), Jie F. Yang (Dept. of Phys., Hunan Normal

Univ., China), "Fine Tuning Mechanism for Resonance Tunneling in D/Pd Systems," p 88.

AUTHORS' ABSTRACT

There are two well established facts after 7 year searching in D/Pd systems, i.e., 1) Excess heat without commensurate neutron or Gamma radiation; 2) "Heat after death" or "heat after life" with a time scale of 10^4 seconds. A model of resonance tunneling via lattice confined ions is able to relate these two facts in terms of an assumption that there is a deuteron-deuteron nuclear state with a life-time of 10^4 seconds. The frequently asked question on this model has been whether there is any chance for such a narrow width resonance, since the life-time of 10^4 seconds corresponds to an energy level with a width of 10^{-19} eV.

To answer this question, the deuteron energy band in a palladium crystal lattice has been conducted. A grain size of 10^2 microns would be enough to construct an energy band with the state density of the order of 10^{19} per eV. The width of this energy band is shown to be of the order of meV, and be filled with deuterons when the loading ratio (D/Pd) is higher than a critical value. This deuteron energy band in lattice would have much more probability in resonance with the deuteron-deuteron nuclear state.

Based on this model, a "fine tuning" mechanism for resonance tunneling is proposed to explain the following features in various experiments.

(1) The "excess heat" phenomena happens mainly during the changing of the temperature. Particularly when the D/Pd system is cooling down, there will be a "self-lock" mechanism to keep this "fine tuning" as a result of "feed back" (see S. Pons & M. Fleischmann's paper in ICCF-4).

(2) When "excess heat" phenomenon is apparent, the neutron radiation is low; in contrary, when neutron radiation is higher than that of background, the "excess heat" is low (e.g. see A. Takahashi's paper in ICCF-3).

(3) The Australian scientists' experiments (T.A. Green & T.I. Quickenden, in *J. Electroana. Chem*., 1994 and 1995) showed that even if loading ratio was higher than 0.85, there was no excess heat at all. This was seemingly contradictory with SRI's experimental results. Now it can be understood in terms of "fine tuning" mechanism.

(4) The cracking or dilation of the palladium sample would have an adverse effect on the "excess heat" (eg. see E. Storms' paper in ICCF-3).

In addition, the life-time of d-d nuclear state was theoretically estimated to be of the order of 10^4 seconds. This is an additional support to this resonance tunneling model. As a consequence, we are supposed to see not only helium-4, but also helium-3 as the nuclear products. A calculation of the energy transferring mechanism from the d-d nuclear state to the electrons in the palladium lattice is underway,

CHINA - ELECTRON-ION BOUND STATE

Ren-bao Lu (Inst. of Applied Phys. and Computational Math., China), Two Topics: 1. "Electron-Ions Bound State and its Introducing of Nuclear Fusion," 2. "Solar Flare," p 90.

AUTHOR'S ABSTRACT

On the basis of fundamental concepts of physics for electron-ions bond state in the literature, a further strict description of quantum mechanics on electron-ions bound state of three-body system and two approximate solutions are given, which are (1)corresponding to p-e-p bond state X-ray with $E_p \approx$ 12.5 keV monoenergy emission, (2) corresponding to D^+-e-D^+ bond state X-ray with $E_D \approx$ 25 keV monoenergy emission and with a little (D,D) fusion to give out neutron, ^{3}He, proton, T, ^{4}He and γ-ray. Both bound states have the same electromagnetic radiation X-ray process essentially, and they can generate X-ray independently or together, according to different environmental conditions for the emission of X-ray. However, only the latter can initiate observable nuclear fusion.

In this paper the author points out that it is a misunderstanding that the experiments characterized by releasing "excess" heat, such as Ni-H, deuterium gas glow discharge etc., have been called "cold fusion" for many years. The excess heat is just a large quantity of X-ray energy released in the two electron-ions bound state mentioned above, and only (D^+-e-D^+) bound state can initiate a little nuclear fusion.

In this paper, the two typical experiments about Ni-H and deuterium gas glow discharge are taken for example to explain quantitatively the magnitude of excess heat released and the emission of X-ray observed in the experiments with the theory of the electron-ions bound state.

The paper includes following points on solar flare:

(1) p-e-p process with ~12.5 kev line emission and D^+-e-D^+ process with ~25 kev line emission;

(2) (D,D) fusion in solar flare: ^{3}He-rich, proton spectrum, 2.223 MeV γ-ray line emission;

(3) temporal and space characteristics of solar flare; and

(4) non-thermal electrons in solar flares.

The generation mechanics about so-called "cold fusion" and solar flare are two important problems of science that the scientists have not yet understood in the 20th century, and the author attempts to open a new channel through which men can understand the generation mechanism about cold fusion and solar flare with new concept on "electron-ions bound state and its introducing of nuclear fusion."

CHINA - TITANIUM CATHODE

Qingfu Zhang, Qingquan Gou, Zhenghe Zhu, Fusheng Liu, Jiaoming Luo, Yue Sun, Licai Chen (Inst. of Atomic and Molecular Science at High Temperature and High Pressure, Sichuan Union Univ., China), "The Relationship of Crystal Structure Transition of Ti-Cathode and 'Excess Heat' on Cold Fusion," p 97.

AUTHORS' ABSTRACT

This paper presents an experimental result of crystal structure transition of a Ti-cathode due to "excess heat" of cold fusion. It has been found that the crystal structure of a Ti-cathode is changed from hexagonal to a face-centered cube structure after cold fusion with "excess heat." On the contrary, there will be no observable change for [experiments not generating] "excess heat."

1. The X-ray analysis of Ti-Cathode before electrolysis experiment.

Before the electrolysis, the surface of the Ti-rod was analyzed by X-ray, which showed that it was indeed oxidized into TiO_2 identified by X-ray spectral lines: 3.201, 2.500, 2.305, 2.203, 2.200 and 1.695 in good agreement with the standard X-ray spectral lines of TiO_2: 3.24, 2.49, 2.29, 2.19, 2.06 and 1.69. It was also examined by X-ray analysis that the inner part of the Ti-rod is α-Ti identified by X-ray spectral lines: 2.563, 2.343, 2.240, 1.726 comparable with the standard lines: 2.558, 2.341, 2.244 and 1.729 of hexagonal α-Ti.

2. The crystal structure analysis of Ti-Cathode without "excess heat" during the electrolysis experiment.

The electrolytic solution was prepared to be a mixture of low purity D_2O and H_2O, therefore the "excess heat" was not observed after more than 20 days of electrolysis experiment. The Ti-rod we used was pretreated, so the X-ray analysis showed that the Ti-rod is α-Ti, and it was not changed after electrolysis.

3. The crystal structure analysis of the Ti-rod with "excess heat" during electrolysis.

The Ti-rod was pretreated, and the electrolytic solution consists of D_2O with 0.1 N (NaOD). After 70 hours or more, the "excess heat" happened. The effect of temperature ascent lasted on the Ti-cathode for more than 24 hours, where the highest temperature ascent is 24°C. Having been pretreated before the experiment, the surface structure of the Ti-cathode is that of α-Ti. However, X-ray analysis showed that surface structure of the Ti-rod changed into that of TiH_2 -- if there was "excess heat" the effect happened.

Standard spectral lines of TiH_2 are: 2.55, 2.21, 1.56, 1.33, 1.21, 1.10, 1.01. The spectral lines of Ti-rod after "excess heat" are: 2.533, 2.119, 1.535, 1.323, 1.261, 1.101, 1.008.

These 7 spectral lines correspond to the standard ones. We could say that the surface of Ti- cathode had been changed into TiD_2 structure.

4. Conclusion

From the experiment, we could come to the conclusion that a Ti-cathode absorbs D and then changes its crystal structure from hexagonal to the face-centered cube of TiD_2 owing to the electrolysis in D_2O. Because of these factors, the probability of collision will increase, which leads to nuclear fusion accompanied with remarkable "excess heat" effect.

FRANCE - HYDREX & DEUTEX STATES OF HYDROGEN

J. Dufour, J. Foos, and J.P. Millot (Lab. des Sciences Nucl. Conservatoire Nat'l. des Arts et Metiers, France), "From Cold Fusion to Hydrex and Deutex States of Hydrogen," p 84.

AUTHORS' ABSTRACT

Excess energy production has been constantly observed, when a metallic hydride forming metal (palladium, nickel...) is first loaded with an hydrogen isotope (hydrogen, deuterium) and then submitted to various types of activations (electrolysis, electrical discharge, pressure temperature variations ...). In order to shed light on the origin of this excess energy, we have measured the excess energy per atom of the hydrogen isotope involved in an electrical discharge experiment using palladium as one of the electrodes. Neutrons, tritium and helium were also monitored during these experiments.

The experiments were run using a reactor, where an ozonizer type of discharge was struck through an hydrogen isotope, and which was placed in a mass flow calorimeter, having a high efficiency. The electrode in contact with the hydrogen isotope was made from palladium. The total excess energy was measured by subtracting the electrical power injected into the reactor from the heat recovered from it. The hydrogen consumption was precisely determined by measuring through all the experiments, the evolution of the pressure of the hydrogen (deuterium) reservoir feeding the reactor. The experiments lasted from 3 to 8 million seconds and total excess energy generation from 4,000,000 to 17,000,000 KJ were measured, several thousand times higher than the maximum energy recoverable from the totality of the hydrogen isotope involved (combustion).

From the data obtained the excess energy per hydrogen atom can be calculated. We find the following figures: hydrogen 8 KeV per atom, deuterium 18 KeV per atom.

These results suggest the formation of a shrunken hydrogen atom of very small size (hydrex and deutex). This formation could

explain the fact that we have measured no (or exceedingly small amounts) of the ashes which should be expected from fusion reactions. Moreover, the hydrogen mass balances show an unexplainable loss of hydrogen which could be attributed to the very small size of the hydrex (deutex). A number of blank experiments have ruled out classical explanations for this unexplained disappearance.

ITALY - STRONG RESISTIVITY REDUCTION

F. Celani, A. Spallone, P. Tripodi, D. Di Gioacchino, S. Pace (INFN Lab. Naz. di Frascati, Italy), P. Marini, V. Di Stefano, (EURESYS, Rome, Italy), A. Mancini (ORIM S.r.L., Italy), "Observations of Strong Resistivity Reduction in a Palladium Thin, Long Wire Using Ultra-High Frequency Pulsed Electrolysis at D/Pd > 1," p 107.

AUTHORS' ABSTRACT

We have tested thin and long pure Palladium wires (diameter of 100 μm, length of 160 cm), using medium-power (peak current up to 4A) ultra-high frequency electrolysis, (trapezoidal-like pulse shape: width about 20 ns, repetition rate 27 MHz, rise time < 4 ns) in a 0.25 mN LiOD-D_2O solution.

The experimental set-up consists of a PTFE cylinder (4 cm diameter), a Pd wire turned around it and a Pt wire (1 mm diameter) turned in the same way at 1 cm (constant distance) from the Pd wire. This device is located in a graduated cylindrical glass (chemical grade) filled with the electrolytic solution. A specifically designed electronic circuit has been developed to produce an ultra-high frequency high-voltage electrolysis. Read-out circuits are linked to a PC to acquire cyclically (every 2 seconds) few selected signals from the sensors. The device is kept at constant-as-possible temperature (about 20°Celsius) by massive cooling.

We have measured (with a special a.c. read-out circuit) the differences of potential along the wire, after switching off the electrolytic power supply (in order to avoid false reading due to ultra-high exciting frequency).

A wire segment (1/4 of total, the most cathodic) showed a very low resistance behavior in some tests (corresponding to R/Ro values much less than 0.05 and in one case less than 0.01): the typology of this effect occurred in different ways. In one case the low resistance was persistent for several minutes (18) and returned to the expected value in few seconds (10). In another case the low resistance lasted for few minutes (3) and returned to the normality in a short time (much less than 5 s). In other tests the low resistance lasted a few seconds and slowly (many minutes) returned to the expected value.

Taking in account the R/Ro vs. D/Pd curve reported in literature and extrapolating it (the R/Ro values found were never reached before), we assume to have overcome the D/Pd value of 1 (supposing that this value is not an asymptotic physical limit). The reproducibility of this effect is still under study.

ITALY - ACHIEVING HIGH LOADING RATIOS

A. DeNinno, A. La Barbera, V. Violante (ENEA/INN/NUMA, Centro Ricerche Casaccia, Rome, Italy), "Study of Palladium Metallurgical Parameters Aimed to Achieving Very High Loading Ratios," p 100.

AUTHORS' ABSTRACT

It has been extensively demonstrated that a threshold in the D/Pd ratio must be overcome in order to observe the production of heat excess during the electrolysis of heavy water with a Pd cathode. Conversely, it is found to be difficult to obtain high loading ratios on Pd in a reproducible way. As a consequence, the actual reproducibility of cold fusion experiments is still quite critical.

We will show that a strong concentration of gradients arise in the material during the loading procedure; this phenomenon can produce permanent deformation in the lattice. Thus, the loading dynamic and the original metallurgical parameters will both affect the maximum achievable loading ratio.

A procedure has been selected aimed at avoiding the inelastic strains of the α-ß phase, and its effectiveness in terms of elastic parameters has been evaluated. We also investigated, both experimentally and theoretically, the influence of the microstructure and of the dislocations of the Pd sample on the loading ratio, in order to be able to select the material that better matches the requirements for cold fusion experiments.

ITALY - LATTICE ION TRAP

V. Violante, F. De Marco, A. De Ninno (Assoc. EURATOM-ENEA sulla Fusione, Centro Ricerche Frascati, Roma, Italy), "Quantum Mechanic Approach for Lattice Ion Trap: Deuterons Approaching Mechanism in Condensed Matter," p 105.

AUTHORS' ABSTRACT

A possible mechanism producing "collisions" between deuterons embedded within the palladium lattice has been proposed in previous works. The classical system description taking advantage of a similarity between the quadrupole radio-frequency traps (used for ions confinement) and the palladium lattice structure, reveals an approach mechanism that strongly reduces the mean distance between light ions like deuterons moving around tetrahedral sites in the palladium lattice. The deuterons' distance, in the classic approach, is reduced up to 0.1 Å. The trap mechanism is due to coherent oscillations of the Fermi level electron clouds producing

an alternating electric field around the tetrahedral sites which affects the deuterons' dynamics.

This paper discusses the quantum mechanic behavior of ions confined within a lattice ion trap, considering the oscillating behavior of two deuterons one as to the other around the tetrahedral sites. The oscillating behavior of the deuterons is due to the alternating signal produced by the electron cloud's oscillations. The two deuterons system is approximated to a quantum harmonic oscillator and the probability to have the particles at distance ranging between zero (collision) and the trap radius is evaluated by means of a computer simulation.

A comparison between the classic approach results and the quantum mechanic results is also carried out. The calculations show that in the case of the two deuterons, initial relative energy is low, the classic and quantum descriptions are different and the quantum probability to have a collision is different from zero even if the classical approach is not effective to produce an interaction between the particles. In the case of high initial relative energy (however, always in the range allowed by the trap mechanism), the accordance between the classic and quantum descriptions increase.

JAPAN - COUNTING EFFICIENCY

T. Akimoto, T. Mizuno, T. Saito, I. Murai and T. Kumada (Nuclear Engr., Faculty of Engr., Hokkaido Univ., Japan), "Temperature Dependency on Counting Efficiency of NE213 Liquid Scintillator for Low-Level Neutron Measurements," p 112.

AUTHORS' ABSTRACTS

Many reports showed that the neutron counting rate in the foreground measurement was at a lower level in the background for experiments of nuclear reactions in solids. We have measured neutron energy spectra in an electrolytic experiment for a long time by a liquid scintillator NE213 with a gamma-neutron pulse shape discrimination to detect the 2.45 MeV neutrons. It was found that the counting rate of the detector slightly depended on the temperature; usually it increased with temperature decreasing. It is neccary to define the temperature dependence for the detector on the counting efficiency in neutron spectra measurements by NE213 under the conditions where the temperature at foreground measurement is usually different than the background. We report the temperature dependence on counting efficiency of NE213 system.

Experiments were performed in a laboratory underground in the LINAC Facility at Hokkaido University where the temperature is kept constant (0.3°C/month). The measurements of pulse height spectra around the 2.45 MeV neutrons have been performed by NE213. The counting rates integrated over the interesting energy range showed increase with decreasing the NE213 temperature. Neutron spectra were studied with changing the temperature of the detector and ^{252}Cf spontaneous fission source. The temperature of the detector was changed indirectly by wrapping the electrolytic cell in a heater coil. The temperatures of other electric circuits were kept constant during a run of the measurement.

The counting rate of NE213 decreases as the temperature rises. It is considered that the light output of NE213 under neutron (proton) and gamma-ray excitation increases with decreasing temperature. In the study of very low level neutron measurements where the foreground measurement and background measurement differ from each other in temperature, the appropriate correction is needed for background data, or it is necessary that the temperature at background measurement must be kept the same as foreground.

JAPAN - SEARCH FOR EMITTED NEUTRONS

T. Aoki, Y. Kurata and H. Ebihara (Isotope Ctr., Univ. Tsukuba, Japan), N. Yoshikawa (Inst. for Nuclear Study, Univ. Tokyo), "Search for Neutrons Emitted from Sodium Tungsten Bronzes," p 111, 1 ref.

AUTHORS' ABSTRACT

It has been reported that the neutron detections were nicely done at the moments when inner vacancies of the sodium tungsten bronze were filled with D^+ ions, and also when the occupying D^+ ions were removed. The vacancies were formed by extraction of Na^+ ions by applying D.C. voltage to the bronze at high temperature. Thinking of the importance of this experiment, we followed the procedures of the experiment after preparation of the bronzes and showed some results below.

The cubic single crystals of sodium tungsten bronzes Na_xWO_3 ($x = 0.9$) with $(1.5\ cm)^3$ dimensions were prepared at 710°C by electrolysis of a molten mixture of Na_2WO_4 and WO_3. The crystals were sliced by a diamond saw to get some pieces of square disks with thickness of 0.2 cm. Two disks were put on a heater plate in a vacuum chamber, which was evacuated at pressure of 1.0×10^{-6} Torr. The disks were heated up to 970°C and then the negative D.C. voltage of 1000 to 2500 V was applied between the disks and a cathode to extract the Na^+ ions from the disks. The current ranged from 30 to 70 μA. The gap between the surface and the cathode was 0.2 cm. After several hours of extraction, the disks were cooled down to room temperature. The D_2 gas was pressurized for a while into the chamber to occupy the vacancies in the disks and then was evacuated from the chamber for the occupying D^+ ions to leave the vacancies. During these processes, the neutron countings were made once a minute as a function of D_2 gas pressure.

Two ^3He neutron detectors, which were surrounded by a cylindrical neutron moderator, were set on the top surface of the chamber with many neutron shielding plastic blocks. The signals from these detectors were led to two scalars, respectively. A personal computer controlled the scalars and monitored the pressure of D_2 gas.

It was interesting to observe the increases of the neutrons just at the beginning of the pressurization and exhaustion of the D_2 gas. However, the counting rates were in agreement with the background rate of 1.7 ± 1.3 cpm. Net rates of both detectors did not simultaneously exceed the 3 x σ value of the background rates up to now.

JAPAN - ELECTROLYTIC H_2 ABSORPTION

Nobuyuki Kamiya, Yuzuru Sakai, Yasuyuki Watanabe, Osamu Yamazaki, Naobumi Motohira, Ken-ichiro Ota (Dept. of Energy Engr., Yokohama Nat'l. Univ., Japan), and Kenya Mori (Tanaka Kikinzoku Kogyo, Japan), "Effect of Cold Work of Palladium on Electrolytic Hydrogen Absorption," p 102.

AUTHORS' ABSTRACT

It is often pointed out that the amount of absorbed hydrogen in Pd depended on electrolysis conditions (such as current density, electrolysis temperature, etc.) and Pd bulk. In this study, we have investigated the effect of cold working of Pd on hydrogen absorption by measurement of the H/Pd ratio and electrochemical analysis in order to know the controlling factors of Pd bulk.

Pd rods of 1 mm diameter (Tanaka Kikinzoku Kogyo) having different cold working ratio, i.e., 30, 60 and 90% were used for electrode specimens. Electrolyte was 0.1 M-H_2SO_4 light water solution prepared by ultra-pure water. Electrolysis was carried out at 100 mA/cm^{-2} and 296 ± 2 K in an acrylic cell.

The H/Pd ratio was measured by two methods, i.e., volumetry and gravimetry methods. The former is to measure the volume of gas evolved from Pd cathode for 4 hr. after electrolysis by means of a buret, and the latter is to determine the weight of hydrogen remaining in the Pd cathode after the volumetry measurement by a semi-micro balance.

The cross and parallel section of Pd cathode before and after the electrolysis were observed by a SEM. The grain size of 30% cold working specimen was 30 ~ 200 μm. On the other hand, the size of 90% cold working was 5 ~ 30 μm and was distributed with the elongation toward the cold working direction.

The H/Pd ratio depended on the degree of cold working. At 30% cold working Pd the H/Pd ratio got the maximum 0.92 at 70 hr. and decreased to 0.89 after 290 hr. For 90% cold working Pd, the maximum H/Pd was 0.85 at 70 hr. Since the grain boundary diffusion of hydrogen in Pd was not observed and the cut off potential of Pd cathode well coincided with the H/Pd ratio, the H/Pd ratio might be affected by the hydrogen desorption over voltage of Pd cathode.

JAPAN - HEAT MEASUREMENT

Ken-ichiro Ota, Taichi Kobayashi, Hiroki Kabumoto, Kazuhiko Yamaki, Naobumi Motohira and Nobuyuki Kamiya (Dept. Energy Engr., Yokohama Nat'l. Univ., Japan), "Heat Measurement During the Electrolysis Using Modified Palladium Cathode," p 93.

AUTHORS' ABSTRACT

The excess heat production in heavy water electrolysis using Pd cathode is not reproducible in most groups. We have planned to get reproducible results using modified Pd cathodes and measure the accurate heat production by flow calorimetry in a closed cell.

The 1 M LiOD heavy water solution was electrolyzed at a constant input power (usually 5 W). The heat balance was measured in an acrylic cell having the catalyst for the recombination of deuterium and oxygen. The heat balance was defined as the ratio of the output power to the input power. The output power was picked up by cooling water which flows in a copper tube surrounding the cell. We used two types of measurement systems. One is "the high heat recovery system" with enough thermal insulation. Another is "the high accurate system" with a fine temperature controlled bath. Using the high accurate system, we could measure the heat balance with less than ± 1.4% error. In this case, we could evaluate relatively small amounts of excess heat.

Several kinds of Pd cathodes were used for the calorimetry. Excess heat balance was observed with a B-added (about 500 ppm) Pd and a Ni-coated (10 μm plated) Pd. Two short time heat bursts were observed during the same run for the B-added Pd cathode. The excess heat of 1 W and 1.8 W were detected at 5 W input. However, the heat burst was not observed in four other runs using the same cathode. As for the Ni-coated Pd cathode, we observed small excess heat continuously in two runs, although the extent of the excess is not big enough to distinctly exceed the error limit.

JAPAN - INTERFEROMETRIC MICROSCOPY

N. Oyama, M. Ozaki, J. Suzuki, S. Tsukiyama, O. Hatozaki (Dept. Appl. Chem., Tokyo Univ. Agr. and Tech., Japan), K. Kunimatsu, (IMRA Japan Co., Ltd., Japan), "In Situ Interferometric Microscopy of Pd Electrode Surface and Calorimetry During Electrolysis of D_2O Solution Containing Sulfur," p 108.

AUTHORS' ABSTRACT

In this study, in situ measurements of a Pd electrode surface were carried out using interferometric phase measurement microscopy (PMIM) to examine surface changes accompanying hydrogen absorbing and desorbing processes at the Pd electrode. PMIM is a nonconducting laser interference microscopy which utilizes computerized phase measurements and gives a direct optical image of a Pd surface with a vertical resolution of better than 1 nm. PMIM optical images of a Pd cathode obtained during constant-current electrolysis (3-20 mA/cm^{-2}) of 0.1 M LiOH aqueous solution clearly showed that the hydrogen absorption into the Pd brought about significant surface

roughening in the course of the electrolysis. Development of the surface roughening was observed to occur at a very low hydrogen content in the Pd (H/Pd ≈ 0.005), while there observed a retention time before the surface change. The original surface topography was readily restored by desorbing the absorbed hydrogen from the Pd by electrolyzing the solution with the Pd electrode being the anode or, more slowly, leaving the Pd in air for 24 hrs. PMIM experiments were also carried out using a $Pd_{0.9}$ - $Ag_{0.1}$ alloy as the cathode which showed resistivity against surface topographical changes: the surface remained relatively smooth for 3 hr. at a current density of 30 mA/cm^{-2} (H/Pd ≈ 0.13). On the contrary, the surface roughening at the Pd-Ag cathode was observed to begin in less than 5 min at a higher current density (80 mA/cm^{-2}, H/Pd ≈ 0.01). We also carried out PMIM measurements in 0.1 M LiOH/H_2O solution containing 0.1 mM Li_2S. The rates of the surface topographical change of Pd surface accompanying the hydrogen absorbing and desorbing processes were found to be much slower than the Li_2S free solution. Similar surface topographical changes were observed during electrolysis of D_2O solutions.

We have established a fine closed system for calorimetry and studied the heat balance of the system during electrolysis of D_2O and H_2O solutions for more than 6 years. We observed occasional heat bursts up to 4% of the input energy a few times during the electrolysis of D_2O containing 0.1 M LiOD. On the other hand, recently calorimetry has been carried out during electrolysis of 0.1 M LiOD/D_2O containing 10 mM Na_2S to examine effects of sulfur on the heat balance of the system. The electrolysis was conducted using a Pd or $Pd_{0.9}$ - $Ag_{0.1}$ alloy cathodes in a closed system at a constant current density of 80 mA/cm^{-2}. The addition of sulfur to the electrolysis system induced to generate occasional heat bursts up to 10% for several hours after 150-200 hours electrolysis.

JAPAN - ANOMALOUS HEAT INCREASE

R. Takahashi (Univ. Tokyo, Japan), "Anomalous Increase in Excess Heat in Electrolysis of Heavy Water and Light Water for use of Drilled Cathode of Charcoal," p 96, 1 ref.

AUTHOR'S ABSTRACT

The excess heat measured for the use of the charcoal cathode in the electrolysis of heavy water was previously reported at only about 10% of the input power. In this one year efforts were made to improve the excess heat by varying every factor which affects the phenomenon. At the present time the highest value obtained reached 150%.

The experimental condition and procedure were as followings. Cathode: very hard charcoal. Anode: 0.3 mm dia. Pt wire. Electrolyte: 50 cc of D_2O and H_2O with 0.25 N LiOH. The anode and the cathode were suspended in the Electrolyte several cm apart in usual case. **As long as the distance was large, the excess heat remained small, however, by decreasing the distance the value became improved with some unknown factor.** After many trials, it was found that making a hole in the cathode by drilling is very effective to increase the excess heat; only a small hole, 0.3 mm dia., made 70% of the excess heat. Further research for the hole size and the location in the vertical or the horizontal plane of the cathode was carried out. It was found also that the presence of a notch at the edge of the hole much improves the excess heat. In each case, the anode was placed near the hole. After many experiments it was concluded that the method of creating turbulence in the electrolyte produces much excess heat. The excess heat produced in the electrolysis of H_2O was generally about half of that of D_2O. Cold fusion is supposed to take place in a thin region of the hole edge.

RUSSIA - FERROELECTRIC DEUTERATED CRYSTALS

A.G. Lipson, V.A. Kuznetsov, M.D. Sakov, E.I. Saunin (Inst. Phys. Chem., Russ. Acad. Sci., Moscow), "Cold Fusion and Electrophysical Processes in Ferroelectric Deuterated Crystals. Influence of Thermal Neutron Background Level D-H Substitution and Crystal Mass," p 89.

AUTHORS' ABSTRACT

Cold fusion (neutron and tritium yield) and electrophysical (change in Polarization reversal) processes in ferroelectric partially deuterated crystals (TGS and DKDP) under conditions of different thermal neutron background level upon the transition through the Curie point have been studied.

It was established in common case of $K(D_xH_{1-x})_2PO_4$ crystals at deuterium D-H substitution index (x) in the range of $0.5 < x < 1$ the neutron yield N_n (that is the change in external thermal neutron flux upon the pass through the crystal) can possess either positive or negative value. In this case a balance between the magnitudes of thermal neutron fluxes being generated and absorbed is determined by three parameters simultaneously: D-H substitution index (x), crystal mass (m), and relative value external thermal neutron flux I_x/I_0 (where I_x = thermal neutron flux from external neutron source incidented on crystal; I_0 = thermal neutron cosmic background flux incidented on crystal).

Depending on this parameter's correlation, the crystal may either generate excess neutrons (that it means amplification of external neutron flux) or absorb them (that it means attenuation of this flux).

It has been shown in $K(D_{0.98}H_{0.02})P_2O_4$, crystals under conditions of thermal neutron background level increase up to the value of I_x/I_0

= 100, the neutron emission intensity in the vicinity of T_C rises as much as 20 times in comparison with cosmic background conditions. Tritium yield under conditions of I_x/I_0 = 100 rises only about 10 times in comparison with this yield for crystals that were temperature cycled through T_C under cosmic background conditions.

The semiempirical expression for neutron yield which satisfactory describes experimental data was revealed. This yield depends on x, m, and I_x/I_0 parameters.

The effect of suppression of spontaneous deformation for partially deuterated TGS and DKDP crystals under the action of ultra-weak thermal neutron flux (I_X = 0.l - 10 n/s -cm_2) in the vicinity of T_C, has been discovered.

RUSSIA - NUCLEAR REACTIONS

V.A. Romodanov, V.I. Svain (State SRI SPA "LUTCH," Moscow), Ya.B. Skuratnik (State SC RF "Karpov SRPCI," Moscow), V.N. Majorov (RSC "Kurchatov Inst.," Moscow), "The Nuclear Reactions in Condensed Media for Interaction of Charge Particles in Energy Region is Forming by Maximum Elastic Losses," p 123.

AUTHORS' ABSTRACT

We have made formation the main demand to reproduce generation of the nuclear reactions in condensed media (NRCM), which appear to influence the rapid hydrogen ions on target solid state plasma powerful glow discharge. This work was accumulated the phenomena of three physical branches of science: Nuclear physics, physics of solid and low energy plasmas have opened new directions of fundamental research. The essence of this direction is that we realized the nuclear reactions for interaction low energy plasma with a solid target, which have the rate on several orders higher then give calculation for these conditions.

The main experimental results allowed us to declare the formation of new directions for nuclear research as follows: 1) the rate of NRCM in range 10 - 10,000 eV for energy ions, which determined the tritium generation, exceeded the calculation for thermonuclear channels by several orders; 2) the nutrient-tritium branch ratio in NRCM is equal 10^{-9} - 10^{-7}; 3) the rate of nuclear reactions is increasing with the increasing atomic number of target materials and hydrogen concentration; 4) the dependence of effectiveness for NRCM from energy hydrogen ions has the threshold at about 100 eV; 5) the dependence of effectiveness for tritium generation from current density is close to linear; 6) the dependence of nuclear interaction coefficient from pressure of plasma-formation gas in NRCM has the maximum range of 10,000 - 30,000 Pa.

It was considered and showed the possible advantage of NRCM for a solution of the applied problem to nuclear engineering in regeneration; 1) it is the creation of the power engineering system; 2) it is the generation of rare isotopes; 3) it is remaking of radioactive wastes; 4) it is the utilization of low active wastes (tritium).

RUSSIA - NUCLEAR EMISSIONS

A.S. Roussetski (Lab. of Elementary Particles, Russ. Acad. Sci., Moscow), "Investigation of Nuclear Emissions in Process of Deuterium Escape from Deuterized Palladium Foils," p 124.

AUTHOR'S ABSTRACT

Emissions of charged particles were investigated in the process of deuterium escape from electrolytically deuterized PdO-Pd-PdO and PdO-Pd-Ag samples. The measurements have been carried out by three methods: 1) by scintillation detector, 2) by Si-SSD, 3) by CR-39 track detector.

The spectra obtained by the scintillation detector and Si-SSD exceeded the background spectra in the energy range 0.5 - 3.0 MeV. The measurements with CR-39 track detector demonstrated the excess in the number of proton-like tracks for deuterized samples as compared to the background. This makes it possible to conclude about the emission of protons with energies E ≅ 3 MeV created in the fusion reactions:

$$d + d \rightarrow p(3.02\ MeV) + T\ (1.01\ MeV)$$

which takes place in the process of deuterium escaping from the samples.

The neutron yield in the reaction:

$$d + d \rightarrow n\ (2.45\ MeV) + He\ (0.82\ MeV)$$

was also measured. It was estimated that the ratio of proton and neutron fluxes from reactions above is Np/Nn ≅ 1.

TAIWAN - COLD FUSION MIRACLES

S.K. Chen (Matls. Sci. Ctr., Nat'l. Tsing Hua Univ., Taiwan), "On the Cold Fusion Miracles," p 115.

AUTHOR'S ABSTRACT

In the paper entitled "Opposition and Support for Cold Fusion" by Rabinowitz et al. (*Transactions of Fusion Technology*, vol 26, no 3, 1994), they mentioned the challenge of cold fusion with three miracles by Huizenga (Cold Fusion: The Scientific Fiasco of the Century, Rochester, NY, Univ. of Rochester Press, 1992, p. 110); i.e., 1) the fusion rate miracle, 2) the branching ratio miracle, and 3) the no-nuclear-products miracle. The review of experimental observations by Storms has listed all the up-to-date data reported

before 1991 (*Fusion Technology*, vol 20, pp 433, 1991), which shows the fact of Huizenga's challenge. Most of the support came from experimenters, while those of the opposition came from theorists. The miracles result from the fact that experimental data cannot fit the conventional fusion theory and observations, it is no wonder that the effect is hard to consider as a fusion.

In a "Letter to the Editor," *Fusion Technology*, May 1996, Chen proposed a "fast neutron model" or "secondary nuclear fusion model" to explain Huizenga's three miracles. According to the fusion reactions there are two near-equal branches, i.e., (1) d + d = t (1.008 MeV) + p (3.025 MeV), and (2) d + d = ^{3}He (0.817 MeV) + n (2.452 MeV). Since they occur in the solid state, and neutrons with 2,452 MeV are fast neutrons, a "free" neutron with half-life of 12.8 min (J.M. Rabson, *Phys. Rev.*, 77, 747 (1950)), produced by Reaction (2), can react with a proton from Reaction (1) to form a new deuterium. The latter reaction, Reaction (3): n (2.452 MeV) + p (3.025 MeV) = d (6.41 keV) + γ (7.696 MeV), for d in ground state, or d (7.703 MeV) in excited state, is a secondary nuclear reaction. One can name Reactions (1) and (2) as primary reactions. In case of both the primary and subsequent secondary reactions involved in the reaction, one can easily check the equivalence of equal branching ratio to that of $t/n \sim 10^4$ to 10^8. The total enthalpy produced in one event in this case will be Q = (4.033 x 0.5 + 3.269 x 0.5 + 2,226) MeV = 5.877 MeV. Thus, to a certain degree, Huizenga's cold fusion miracles are solved.

The densities of the sun and white dwarf are 1.76×10^2 and 4×10^8 kg/m^3, respectively. Although most solid materials have relatively small density (on the order of 10^1), the density in a nucleus is 2.3×10^{17}kg/m^3. From the phase diagram of a d-Pd binary system, one can see that a high d/Pd ratio means a high d fugacity. The high d/Pd ratio is one of the essential factors for generation of the cold fusion effect. If the above-mentioned secondary fusion reaction is possible, there should be a field related to pressure and pycno-reactions (A.G.W. Cameron, *J. Astrophys*., vol 129, p 676, 1959) in stars. Treating the field, where the primary and secondary fusion reactions can occur, like that of the meson field, herein a "pycnon" field is proposed (see also a "Letter to the Editor" in *Fusion Technology*, May, 1996 by Chen) and discussed.

UNITED STATES:

CALIFORNIA - NON-STEADY-STATE CONDITIONS

S. Crouch-Baker, M.C.H. McKubre and F.L. Tanzella (SRI Int'l., Menlo Park, CA), "Mass Flow Calorimetric Studies Under Non-Steady State Conditions," p 82.

AUTHORS' ABSTRACT

Since 1989, we have utilized mass flow calorimetry in order to study enthalpy changes in closed heavy water electrolytic cells which employ palladium cathodes. In these experiments, measures were taken to ensure that the calorimeter and its contents did not experience significant departures from steady state operation as a result of large, uncontrolled, electrochemical input power transients. Furthermore, the average cell temperatures employed were relatively low, in the range 15 - 50°C.

It has been noted that, in well-insulated, open electrolytic cells operated at constant current and maintained initially at temperatures above approximately 60°C, a spontaneous increase in effective cell resistance occurs such that, over an extended period of time (up to two weeks), the electrolyte is brought to boiling by the increasing input electrolysis power. Further, in some cases, this behavior appears to be accompanied by large, unexpected rates of change of the system enthalpy. At SRI, we have observed that such anomalous cell resistance behavior may also occur at high currents in closed cells. Here, we report the results of non-steady state mass flow calorimetric measurements on such systems, and the differences in behavior observed between palladium and platinum cathodes.

CALIFORNIA - IMPROVED CALORIMETRY

Kendall B. Johnson and Melvin H. Miles (Chem. & Matls. Branch, Res. & Tech. Div., Naval Air Warfare Center Weapons Div., CA), "Improved Open-Cell Heat Conduction, Isoperibolic Calorimetry," p 86.

AUTHORS' ABSTRACT

Accurate, sensitive calorimetry that is appropriately scaled to the electrode size and has sufficient time resolution is essential to the study and elucidation of the so called "Cold Fusion" effect. Significant calorimetric improvements have been realized in our laboratory. These improvements include improved calorimetric hardware design, theoretical modeling, and computerized experimental control, data acquisition, and averaging.

A significant experience base exists with the previous open-cell isoperibolic calorimeters used in this laboratory. Hardware design improvements over previous cells include:

- an inner Cu jacket replacing the integrating water jacket,
- foam insulation,
- an outer Cu jacket (reduced water bath level effects and air temperature effects),
- wire leads thermally slaked to the bath temperature,
- controlled temperature atmospheric box over the bath (reducing ambient temperature effects), Teflon cell plugs with Viton O-rings,
- an internal resistance heater for improved calibration and active cell temperature control.

Theoretical modeling improvements include a review and modification of the terms included in the equations for open cell, heat conduction, isoperibolic calorimetry of electrochemical systems. The most significant change is the replacement of the

$K\Delta T$ linear heat conduction term with $K'[(T_{cell})^{3/2} - (T_{bath})^{3/2}]$. A term of this form is theoretically appropriate for heat conduction through motionless gas, which good foam insulation approaches. The term arises from the integration of the heat conduction through a gas which is proportional to $T^{1/2}$. The $K'[(T_{cell})^{3/2} - (T_{bath})^{3/2}]$ term is shown to model the calorimetry much better than the $K\Delta T$ term.

Data acquisition and computer control of experiments consisted of a PC computer with a GPIB interface board connecting the computer to the power supplies, a 6½ digit volt meter and an electronic switch system. The computer controlled these instruments and recorded data as fast as the switch allowed. Data was typically averaged every 5 minutes and was recorded to disk. VI (virtual instrument) software allowed computer control of the experiment and provided real time display of dam including calculated excess power.

Finally, data is shown for several experiments performed with these cells. Control experiments have consisted of Ag cathodes in 0.1 M LiOD. Live experiments have consisted of Pd and Pd-B alloys. All control experiments showed no excess heat to within experimental error. In live experiments the heat of loading is always seen and is readily measurable. Small amounts of sporadic excess heat were seen in one experiment.

CALIFORNIA - REPLY TO JONES & HANSEN

Melvin H. Miles (Chem. & Matls. Branch, R&Tech. Div., Naval Air Warfare Center Weapons Div., China Lake, CA), "Reply to S.E. Jones and L.D. Hansen Concerning Claims of Miles et al., in Pons-Fleischmann-Type Cold Fusion Experiments," p 91.

AUTHOR'S ABSTRACT

The major allegations by S.E. Jones and L.D. Hansen concerning our experiments have been explained in our previous publications as well as in a 1992 published discussion. Our first 5 months of investigating the Fleischmann-Pons effect in 1989 experiments produced no significant excess enthalpy. The November 1989 report of the Energy Research Advisory Board to the U.S. Department of Energy listed China Lake with Caltech, Hatwell, MIT, and other laboratories as one of the groups not observing excess heat. Later experiments using palladium and palladium alloys from other sources, however, produced significant amounts of anomalous excess power. I would like Jones and Hansen to explain why our 1989 calorimetric results are acceptable and more recent results are rejected.

The simultaneous measurements of power and the rate of evolution of the electrolysis gases in our experiments prove that faradaic efficiencies less than 100% cannot account for our reports of excess heat. Furthermore, our calorimetric results are strikingly similar to reports from other laboratories, including measurements in closed calorimetric systems where faradaic efficiencies are not a factor. Excess enthalpy for the Pd/D_2O system generally involves high current densities that exceed 100 mA/cm^2. Therefore, the report by S.E. Jones et al. of low faradaic efficiencies during water electrolysis using current densities of only 1-2 mA/cm^2 is not applicable to our cold fusion experiments. For the large current densities used in most cold fusion experiments, the arguments of S.E. Jones et al. will fail.

Based on experiments at our laboratory, there is compelling evidence that the anomalous excess heat is correlated with helium-4 production. For example, 30 out of 33 heat and helium studies yielded either excess helium when excess power was measured or no excess helium when no excess power was present. The probability of obtaining this result by random errors in our heat and helium measurements is less than one in a million. Permanent laboratory records always defined the presence or absence of excess power prior to any helium measurement. The measurements of helium in the electrolysis gas samples at three different laboratories places our rate of helium-4 production at 10^{11} - 10^{12} atoms/s per watt of excess power. This is the correct magnitude for typical deuteron fusion reactions that produce helium-4 as a product. Experimentation will ultimately provide the final answers to this debate as well as to the many aspects of the cold fusion controversy. Guidelines are provided to assist others in reproducing our experimental results. The selection of a calorimeter capable of measuring excess power in the range of 1 W per cm^3 volume of the palladium cathode is essential for these studies.

CALIFORNIA - ELECTROCHEMICAL LOADING

Melvin H. Miles and Kendall B. Johnson (Chem. & Matls. Branch, R& Tech. Div., Naval Air Warfare Center Weapons Div., China Lake, CA), M. Ashfar Imam (Physical Metallurgy Branch, Matls. Sci. and Tech. Div., Naval Research Lab., Washington, DC), "Electrochemical Loading of Hydrogen and Deuterium into Palladium and its Alloys," p 103.

AUTHORS' ABSTRACT

Hydrogen in metals has possible applications in various energy storage devices. For the palladium-deuterium system, excess power production and other anomalous effects have been reported. This study focused on hydrogen and deuterium loading into palladium and palladium-boron alloys. The condition of the metal surface is a major factor in the insertion of hydrogen or deuterium into palladium or palladium-boron alloys. Cracks or other surface defects prevent high loading levels of hydrogen in metals. The addition of boron to palladium does not affect the initial loading rate but slows further loading to higher levels. The presence of boron in the palladium significantly slows the rate of the deloading process.

MASSACHUSETTS - HEAT TRANSPORT BY BUOYANT FORCE

Mitchell Swartz (JET Energy Tech., Inc., MA), "Heat Transported by Buoyant Force may Augment Solution Convection in Flow Calorimetric Systems," p 95.

AUTHOR'S ABSTRACT

Thermometry may not be sole limiting factor for obtaining semi-quantitative information from flow calorimeters if the non-dimensional number, N_b (defined as the ratio of heat transfer by buoyancy to the heat transfer by convection) is greater than zero. This does not imply that such systems do not exhibit 'excess heat;' but rather that any such reported 'excess heat' parameters may be inflated, if the information was indeed collected with a vertical flow calorimetric system, in the absence of confirmatory calibrations under low to moderate flow conditions where the non-dimensional number N_b (as the ratio of heat transported by the buoyant forces to the heat transported by solution convection) is not trivial. Suggestions for improvement will be discussed.

MISSISSIPPI - TRIODE CELL EXPERIMENTS

Evan L. Ragland (The Boiler Works, Diamondhead, MS), "Triode Cell Experiments for Controlled Fleischmann/Pons Effect," p 94.

AUTHOR'S ABSTRACT

Experimental research and evaluation of three-electrode (triode) cold fusion electrolysis cells is reported herein. Apparatus development began, after patent application, in June 1995. The triode apparatus introduces controlled loading and operation of Fleischmann/Pons-type cells. In August 1995 excess heat generation was observed in triode apparatus experiments by Dennis Cravens in his laboratory in New Mexico. In November 1995 the Boiler Works laboratory in Diamondhead began experimental evaluation of the triode apparatus. Understanding gained from these experiments led to development of a triode fusion reactor. The reactor has been in continuous operation since 20 March 1996.

The experimental reactor data base is being applied in further triode apparatus developments. Near-term goals are the completion of a reactor test bed for "quick change" cathode specimen evaluation, and the engineering design of a 5 to 10 KW reactor cell. Thin-film cathode specimens prepared by the Materials Science and Engineering Laboratory of the Univ. of Alabama in Birmingham are presently ready for test and evaluation. These include Pd film on Ag, Al, Cu, and quartz substrates and Pt films on Si bead specimens.

Details of triode apparatus operation, control, and experimental results will be presented. The suggestion is made in conclusion that present experimental and theoretical understandings of cold fusion are sufficiently advanced for engineering design and development. If possible, a physical display and/or a demonstration will be available for inspection.

OREGON - CATHODE COMPARISON

J. Dash (Phys. Dept., Portland St. Univ., Portland, OR), "Heat Output During Electrolysis of Heavy Water: Comparison of a Palladium Cathode with a Platinum Cathode," p 83.

AUTHOR'S ABSTRACT

Two closed cells of 25 ml capacity were constructed. Both had Pt anodes, an electrolyte with 0.06 tool fraction H_2SO_4 in D_2O, and recombination catalyst suspended above the electrolyte. One cell had a Pd foil (0.055 g) cathode, and the other had a Pt foil cathode. Each cell was placed in an identical insulated container. The cells were connected in series, and electrolysis was performed at constant current density of about 0.25 A/cm^2. The cell voltages were almost the same. The temperature of the air surrounding the cells inside the insulated containers and the ambient temperature were monitored.

During the first 20 hours of electrolysis, there was no difference in heat output of the two cells. For most of the next 50 hours of electrolysis, the cell with the Pd cathode produced more heat (as much as 0.3 watt more) than the Pt cathode cell. During this period, the Pd deteriorated and a solid black substance accumulated on the bottom of the cell. The Pt cathode cell did not appear to change.

After lying dormant for 75 days, electrolysis was again performed. In five consecutive experiments totaling 20 hours over a period of two weeks, the cell with the Pt cathode produced more heat (as much as 0.3 watt more) than the Pd cathode cell.

These results suggest that a Pt cathode, under suitable conditions, can serve to catalyze the production of excess heat, consistent with the work of Ohmori and Enyo, who also found that excess heat is produced both by hydride-forming and non-hydride-forming cathodes.

Results of scanning electron microscope and microchemical analysis of the electrodes will also be presented.

UTAH - HEAT IN CLOSED CELLS

H.E. Bergeson, S.C. Barrowes, and S.H. Bergeson (Phys. Dept., Univ. Utah), "Excess Heat Experiment at 95°C in Closed Cells," p 85.

AUTHORS' ABSTRACT

Excess heat production may be easier where "positive feedback" exists or at the associated high temperatures. Following this ground-breaking observation of Pons and Fleischmann, G. Mengoli et al. have done an important series of controlled experiments at 95°C, using constant temperature calorimetry, with a report of excess heat in five out of five experiments using Pd cathodes and heavy water electrolyte (0.6M K CO_3). A sixth experiment using light water showed approximately no excess heat.

If these results can be confirmed, they open an important new regime: (1) higher grade heat produced, (2) higher reliability, (3) instant, sustained excess heat (starting within an hour), (4) higher levels of excess heat, and (5) lower loading currents required.

We have started experiments to determine whether these results can be verified at 95°C in closed cells with high precision calorimetry, and possibly extended in future runs to temperatures above the boiling point, up to 150°C.

The experiment of Mengoli et al. has several possible weaknesses which are overcome in our experimental design. They use an open cell, which raises the question of recombination as a source of false excess heat. In addition, heat losses due to evaporation at the near-boiling temperature require major corrections and are a possible source of error. Our cells are closed and pressurized, eliminating these concerns.

The cells of Mengoli et al. have only one temperature sensor inside, but their calorimetry depends on the unproven assumption that cell temperature is uniform. In our Seebeck-type calorimetry heat flow measurements are essentially independent of cell temperature distribution. Our calorimeters are considerably more accurate, resulting in greater confidence if we are able to confirm their results in this important new regime.

UTAH - SLOW EXCITATION MODEL

Yan Kucherov (ENECO Inc., Salt Lake City, Utah), "Slow Nuclear Excitation Model," p 87.

AUTHOR'S ABSTRACT

A phenomenological slow nuclear excitation model is proposed on the basis of interaction of non-uniform electric field induced by oscillations of a two-component solid state lattice with the internal structure of a nucleus, i.e. through the nuclear quadruple moment. Interactions are considered on the basis of droplet and nuclear shells models of nuclei.

This approach suggests that interaction occurs only with nuclei that have a pronounced quadruple moment. Among the nuclei with such properties are some isotopes of Ni, Nb, Ru, Pd, Hf, Ta, etc.

It is shown that energy can only be transferred in portions smaller than 10^{-8} eV, yet allowing the transfer of MeV-level excitations needed to overcome nuclear barriers in a reasonable time of 10 - 10^5 s.

This approach allows the explanation of the role of a hydrogen sublattice and loading in excess heat experiments. **As the excited state moves from a ground state in small energy portions at a rate higher than possible relaxation through the electron system, it fills all the possible quantum levels and explains why energetic nuclear emissions are practically absent in this kind of nuclear excitations.** The resulting relaxation can show itself through the random IR to X-ray photons from the electron system or Auger-type effects. As the spectrum of the corresponding photons should have specific features, it is possible to detect them.

The extreme case is when excitation energy approaches values close to nuclear barrier energies, allowing nuclear reactions. Excitation time is much longer than nuclear interaction time, allowing resulting products to form stable shells. Heavy stable fission products do not give a lot of secondary nuclear radiation and are not easy to detect.

VIRGINIA - RESULTS OF ION BAND STATE THEORY

S.R. Chubb and T.A. Chubb (Oakton Intl. Corp., Arlington, VA), "Hidden Results of the Ion Band State Theory," p 116, 9 refs.

AUTHORS' ABSTRACT

Using the ion band state theory, we predicted a number of important effects that were subsequently observed in Cold Fusion anomalous heat experiments. Despite this fact, the theory has inspired controversy and confusion. By addressing the skeptics, we have learned that both the success of the theory and the controversy have a common origin: our application of conventional mainstream, solid state, many-body physics ideas that are known to describe the physics of hydrogen inside and on the surface of transition metals, to the PdD Cold Fusion problem. Our application of these mainstream ideas is inconsistent with the predominant Paradigm that is commonly applied to Cold Fusion because of the first "hidden result" of the theory: it assumes that near full-loading (defined by $x \rightarrow 1$ in PdD_x), to reduce lattice strain, ion band state occupation by D^+ nuclei becomes possible. When this occurs, additional not generally recognized (or "hidden") requirements of the band state, many-body physics paradigm apply: 1) identical particles (in this case D^+ nuclei) really are indistinguishable; 2) at room temperature, in ordered solids, crystalline order may alter our ability to determine the locations of these identical "particles," and 3) provided these "particles" are bound to the solid, discontinuous changes in their momenta are permitted (through wave-function cusps).

From the first two of these requirements, additional important "hidden results" follow: 1) because the D^+ are indistinguishable, they may exchange places with each other arbitrarily, and thus,

their behavior is dominated by coherent interactions, reminiscent of those associated with Bose Condensation and Light Amplification through Stimulated Emission of Radiation (LASER), but 2) as a consequence of crystalline order, these coherent interactions involve coupling between occupied and unoccupied energy states (similar to the way electrons and holes couple to each other in metals and semi-conductors). For D^+ ion band states, the resulting coherent interactions involve all occupied and unoccupied states within each partially occupied band.

A third hidden result occurs from wave-function cusps: by including cusps, it is possible to show that when the number of unit cells exceeds 10^4, the cusp dependence provides "hidden" coherent kinetic energy at each cusp point, leading to significant nucleus-nucleus overlap in regions of large particle-particle Coulomb repulsion where overlap is precluded in the conventional "Barrier Penetration" paradigm. Additional "hidden results" follow from the allowed couplings between ion band states. These have been used to explain a number of important effects (by-products, modes of energy release, etc.) that are consistent with observation. The paper provides an overview of these "hidden results" of the ion band state theory, as well as their implications.

WASHINGTON D.C. - ACCURATE HEAT MEASUREMENT

D.D. Dominguez and P.L. Hagans (Naval Res. Lab., Washington, D.C.) and R.M. Hart (Hart R&D, Inc., Mapleton, UT.), "A High Accuracy Heat Conduction Calorimeter for Measuring Excess Power in Metal Hydride and Metal Deuteride Systems," p 98.

AUTHORS' ABSTRACT

Measurement of "anomalous heat" or excess power in a palladium deuteride electrochemical system is difficult and often controversial. Input/output powers to electrolysis cells are typically on the order of several Watts and the power difference (P_{out} - P_{in}) is usually only 10s of milliwatts. As a result, a high accuracy, high precision calorimeter is needed for the measurements. The design features of a heat-conduction calorimeter that meets these criteria will be presented. The calorimeter is designed to accommodate open electrolytic cells containing a palladium cathode fitted with wires for in-situ measurements of the cathode resistance. The basic design consists of aluminum blocks with a number of thermoelectric modules wired in series in between the blocks. An environmental bath stable to ± 0.002°C is an important part of the design.

Calibration of a reference cell in the heat-conduction calorimeter was done with resistance heaters in two different positions: one located inside the wall of the calorimeter and the second located in the reference cell with the cell either empty, filled with 0.1 M LiOH electrolyte or filled with silicone oil. Calibration of electrolysis cells was carried out with either a non-hydrogen-absorbing silver rod or a palladium rod cathode in 0.1M LiOH electrolyte solution. The bath temperature was maintained at 27.000 ± 0.002°C during all of the calibrations. The input power to the resistance heater in the wall of the calorimeter was kept under 1 Watt but in the other calibrations the input powers varied between 3 mW and 10 W.

Calibration results showed that the response of the calorimeter was linear in the power range studied. The calorimeter had a baseline noise level of ± 2 mW in a reference cell filled with electrolyte and in an electrolysis cell. It also showed good long term stability. A variation in the calorimeter calibration constant, K, with input power was noted, however. For a reference cell, K decreased from 11.48 W/V at 0.003 W input power to 9.287 W/V at 0.85 W input power. From 1.07 - 8.68 W the calibration constant of the reference cell was 9.280 ± 0.002 W/V. Similar variations in K values were also noted for electrolysis cells. In addition, in electrolysis cells the uncertainties associated with the K values were several times larger at high input powers than the uncertainties associated with reference cells. As a consequence of these observations, procedures for making accurate excess power determinations in electrolysis cells with high input powers will be discussed.

WASHINGTON D.C. - MICROSTRUCTURE'S EFFECTS

D.D. Dominguez, P.L. Hagans and M.A. Imam (Naval Res. Lab., Washington, D.C.), "The Effect of Microstructure on Deuterium Loading in Palladium Cathodes," p 109.

AUTHORS' ABSTRACT

The effect of microstructure on deuterium loading in palladium cathodes was investigated. Cathode microstructure is determined by thermomechanical processing that includes electrode deformation (swaging) and the annealing conditions (time and temperature). Results will be presented on the extent of deuterium loading in rod-shaped (0.4 cm diameter and 3.5 cm long) palladium cathodes with controlled microstructure, produced at The Naval Research Laboratory (NRL). Loading results on NRL palladium cathodes will be compared with loading obtained on commercially available palladium electrodes routinely used at other laboratories.

Deuterium loading of the electrodes was accomplished electrochemically in 2.5 cm diameter by 15 cm length borosilicate-glass cells containing 0.1 M LiOD in D_2O as the electrolyte and a cylindrical platinum anode. Loading was monitored in-situ by measuring the change in the axial resistance of the cathode and comparing the measured values with the known relationship between resistance and the D/Pd atomic ratio. Comparison of deuterium loading in well-controlled

electrochemical experiments on palladium cathodes with different microstructure indicate that loading is facilitated in cathodes with large grains. In addition, it was found that commercially processed, high purity palladium (99.99% or better) produced limited grain growth compared to lower purity material under the typical annealing conditions (1100°C for 20 hours in vacuum) because of small residual stress.

F. LETTERS

CETI SELLS SAMPLES
by Gene Mallove, courtesy of Jed Rothwell

November 11, 1996

Dear Colleagues:

This is a very big day for cold fusion. I just spoke this morning (11/11/96) with CETI's CEO, Jim Reding, who gave me more details about the demo cells they are selling at the American Nuclear Society Meeting – The Global Benefits of Nuclear Technology – at the Washington, DC Sheraton hotel. (The exhibit at the American Nuclear Society Meeting was Nov. 11-12, 1996.)

CETI has sold 40 kits already at $3,750.00 each – about one-third of those kits were sold at the Washington meeting.

Licensing or leasing a Research Kit entitles one to the following: a 1-year license; a test chamber; two research cells; 4 loadings of three different microsphere (MS) configurations; ability to participate in the CETI Corporate Organization Research Program; admittance to two CETI corporate conferences per year (exclusively for people who have leased cells); a monthly newsletter of research progress – edited by Prof. George Miley; access to special new microsphere configurations; and mandatory on-site training at the University of Illinois in use of the cells.

The next CETI Corporate Meeting is Dec. 10, 1996. The one after that will be June 1997.

A price list for the purchase of additional beads will be available in a few months. Note well, all this info and right-to-buy beads comes only with the lease of the $3,750.00 cell.

The demo cell in Washington has microspehres with “ceramic substrates,” designed to achieve temperatures up to 500°C. However, the cell at the meeting is only running at 5 watts out with about 1.5 watts in, just to show proof of concept. This small level of heat is designed to let researchers draw conclusions about the correspondence of the transmutations to the excess heat. It is not optimized for power production.

Possibly the biggest news – other than that there are now 40 groups/people who will have commercially purchased cells – is a new patent that the USPTO has notified CETI that it has allowed. The patent will be issued within the next few weeks. It is titled: "System in Electrolytic Cell and Method for Producing Heat and De-Activating Uranium and Thorium by Electrolysis."

This patent describes a method by which radionuclides are inserted into a special matrix designed for radioactive elements. According to Reding and inventor Dr. Patterson, with whom I also spoke, "conservatively" they have demonstrated the reduction by up to 50% of the radiation activity from uranium and thorium. The process takes only from 2 to 24 hours. Generally, the process occurs within only 4 hours. It is said that the de-activation can be as high as 90%, which would make for a pretty conclusive finding, I would assume. Anyone in the nuclear industry who can verify this result ought to know that we are"no longer in Kansas." In fact, the allowance of this patent by the USPTO should tell them that already.

According to CEO Jim Reding, "an organization has already purchased the “*exclusive* world rights" to licence and sub-licence this patent. The organization has paid CETI $1 million dollars ($1,000,000) for this. The organization's identity, for now, is private.

Jim Reding reports that response has been very polite. There is a lot of interest in this technology among those who were initially skeptical. I guess the sale of about 1/3 of the 40 kits at this meeting speaks for itself.

It seems, at last, that "cold fusion" has truly been commercialized with the sale of these units – with every prospect for increasing sales. As soon as other former non-involved but ranking people observe these effects with these cells, the opposition to cold fusion will be dramatically lessened, to say the least. This is exactly what we at *Infinite Energy* magazine have been hoping for all along.

Reding reports there is great interest in Prof. Miley's transmutation paper. He has been given a slot at the American Nuclear Society meeting in June to deliver his latest findings. There was no slot available at this meeting. From 1,000 to 1,200 attendees are expected at the meeting.

Eugene F. Mallove, Sc.D.
Editor-in-Chief and Publisher, *Infinite Energy* Magazine
Cold Fusion Technology
P.O. Box 2816 Concord, NH 03302-2816
Phone: 603-228-4516 Fax: 603-224-5975
76570.2270@compuserve.com

[A preliminary version of Dr. Miley's and Dr. Patterson's transmutation paper was published in *Infinite Energy*, issue #9 – printed in October 1996. The complete paper is published in the *Journal of New Energy*, published this month by Fusion Information Center.]

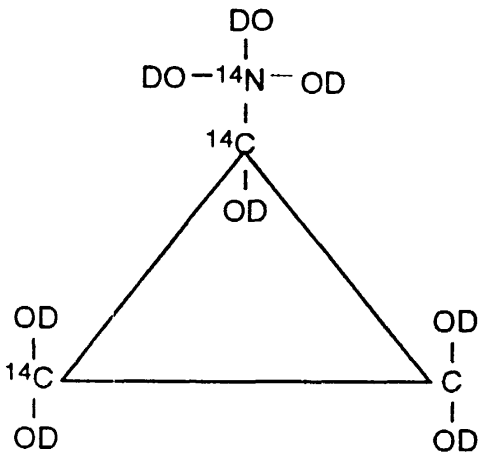
LETTER FROM DR. TRIBURT, RUSSIA

Dear Gentlemen,

I do research in theoretical works of cold nuclear synthesis (Fleischmann & Pons, 1989, USA). I have prepared a paper, "Conceptional Model of Cold Nuclear Transmutations in Higgs Field." My model contains the theoretical supergravity model and some other models. The calculations are results of reactions in negentropy systems, represented by the bioradical. The results of this biogenesis process are vital.

Reagents: Quasiparticle - W-.
$(9D + LiOD + Ps) * 2 + e^- + r.\Sigma J_1 = 11.5$
$m_1 = 80.261871$ Gev - cluster mass.
Where: ΣJ_1 = summary nuclear spin; Ps = atom of positronium; r = quantity of reagent; D, Li, O = ions; e^- = electron

Emerging from reaction: Bioradical / bioquasiparticle - $(Wz\gamma)^-$ /



$+ e^- + G$

$m_g = 182.71546$ Gev, $\Sigma J_9 = 11.5$
Where: G = graviton; W, Z, γ = calibration particles;
$m_g = m(W+Z+\gamma)$

I would be thankful for any information concerning cold nuclear synthesis or about sponsor support.

My address is: 432064, Russia, Ulyanovsk 64, pr. Leninscogo Komsomola 43,45. Triburt, V.P

/s/ Triburt, V.P.

If I had thought about it, I wouldn't have done the experiment. The literature was full of examples that said you can't do this."
- Spencer Silver concerning the work that led to the unique adhesives for 3-M Post-It notes

G. MEETING

GLOBAL SCIENCES CONGRESS
The honor of your presence is requested at the 15th Year Mid-Winter, **GLOBAL SCIENCES** Congress at the Doubletree Hotel, Tampa Airport Westshore, 4500 West Cypress, Tampa, Florida 33607, January 16-20, 1997
Registration: for entire Congress $160.00 at the door; early bird rate $125.00 (before December 15, 1996). First 200 early birds have front seat options, daily rates $20.00 per session (am, pm, or evenings) available at the door. To register, send name, address & Phone/fax to: **GLOBAL SCIENCES**, 669 Peoria #345, Aurora, CO 80011, phone: 303-343-6461, Fax 303-344-1578

Commercial Column

The following companies (listed alphabetically) are commercializing cold fusion or other enhanced energy devices:

COMPANY: PRODUCT

American Pure Fusion Engineering and Supply: Information and trouble-shooting for the fusion research and development industry. Developing "Fullerene Fusion Fuel™." Salem, Oregon. The president, Warren Cooley, can be reached at 1-800-789-7109 or 503-585-6746. Email to: Coolwar@aol.com

CAI, Inc., CAI has acquired rights to develop and produce a new-type of thermal power based on the controlled production of clean nuclear reactions from micro-miniature tokamaks (provided by nature). Contact Hal Fox, 801-583-6232, Fax 801-583-2963.

CETI (Clean Energy Technologies, Inc.): Developers of the Patterson Power Cell™. Dallas, Texas. Voice 214-982-8340, FAX 214-982-8349.

Clustron Sciences Corp.: New energy research consulting and information. Contact: Ron Brightsen, 703-476-8731.

ENECO: Portfolio of intellectual property including over thirty patents issued or pending in cold nuclear fusion and other enhanced energy devices. Salt Lake City, Utah. Contact Fred Jaeger, Voice 801-583-2000, Fax 801-583-6245.

E-Quest Sciences: Exploring The Micro-Fusion™ process. Seeking qualified research partners for their sonoluminesence program. Contact Russ George, FAX 415-851-8489.

Fusion Information Center (FIC): Research and development of new energy systems. The world's most complete resource

depository for cold fusion research information, as well as other new energy research including zero-point energy; space energy research; electronic, electromagnetic, and mechanical over unity devices and transmutation. We are the publishers for ***Fusion Facts, New Energy News***, and *the* ***Journal of New Energy***. Voice 801-583-6232, Fax 801-583-2963. Contact Hal Fox.

Holotec AG: Clean Energy Technology, contact André Waser, Gen. Mgr., Bireggstrasse 14, CH-6003, Luzern, Switzerland. Phone 011 41-41 360 4485, or Fax 011 41-41 360 4486.

Hydro Dynamics, Inc.: Hydrosonic Pump, heat-producing systems using electrical input with thermal efficiencies of 110 to 125 percent. Rome, Georgia. Contact James Griggs, Voice 706-234-4111 Fax 706-234-0702.

JET Energy Technology, Inc.: Design and manufacture of π-electrode systems, calorimeters, and associated equipment and systems. Consulting regarding radiation, materials, and other scientific and engineering issues. Weston, MA. Contact Dr. Mitchell Swartz, Voice 617-237-3625. Fax 617-237-3625.

Labofex, Experimental and Applied Plasma Physics: R&D of PAGD (Pulsed Abnormal Glow Discharge) plasma technology. Applications under development include protable power supplies, electric vehicles and autonomous housing. Licensing. Ontario, Canada. Contact Dr. Paulo N. Correa. Tel 905-660-1040 Fax 905-738-8427

Magnetic Power Inc.: Solid-state, heat to electric transducers, for temperatures up to 300°F (low energy nuclear reactions, waste heat, etc.) featuring Ultraconductors[tm] under development by ROOTS, a subsidiary. Sebastopol, CA. Contact Mark Goldes, voice 707-829-9391, Fax 707-829-1002.

Nova Resources Group, Inc.: Design and manufacture ETC (Electrolytic Thermal Cell); EG (commercial power cogeneration module); and IE (integrated electrolytic system). Denver, CO. Call Chip Ransford, Phone 303-433-5582.

UV Enhanced Ultrasound: Cold Fusion Principle being used for an ultrasonic water purifier. Hong Kong. FAX 852-2338-3057.

"YUSMAR"- Scientific-Commercial Company: manufacture, licensing, research and development of water-based generators: thermal (5 sizes), electrothermal (up to 2 MW), and 'quantum' types. President: Dr. Yuri S. Potapov, 277012 Kishinev, Moldova. Phone and Fax 011-3732-233318.

Zenergy Corporation: Founded in 1996 to facilitate the introduction of commercially viable energy alternatives. 390 South Robins Way, Chandler, AZ 85225. Contact Reed Huish: 602-814-7865, Fax 602-821-0967, e-mail: info@zenergy.com

Note: The Fusion Information Center has been acting as an information source to many of these companies. We expect to augment our international service to provide contacts, information, and business opportunities to companies considering an entry into the enhanced energy market.

INFORMATION SOURCES

Academy for New Energy (ANE) is a subsidiary organization to the International Association for New Science, which has specific goals directed toward the field of alternative and "New" energy research. 1304 S. College Ave., Fort Collins, CO 80524. Tel. 970-482-3731

ANE Newsletter, quarterly publication of ANE, providing an open forum for discussion, and disseminating newsworthy and inspirational information on invention and new energy. Edited by Robert Emmerich.

Advanced Energy Network Newsletter, quarterly, a reprint of articles and papers from other energy publications, with book reviews and worldwide conference list. Advanced Energy Network, P.O. Box 691, Rondebosch 7700 Capetown, Rep. South Africa.

Cold Fusion, monthly newsletter, edited by Wayne Green, 70 Route 202N, Petersborough, NH 03458.

Cold Fusion Times, quarterly newsletter published by Dr. Mitchell Swartz, P.O. Box 81135, Wellesley Hills MA 02181. Home Page: http://world.std.com/~mica/cft.html

Cycles, a R&D newsletter, published by Dieter Soegemeier, Editor, GPO Box 269, Brisbane, QLD.4001, Australia. Phone/Fax: +61 (0)7 3809 3257.

Electric Spacecraft Journal, quarterly, edited by Charles A. Yost, 73 Sunlight Drive, Leicester, NC 28748.

Electrifying Times, 3/year magazine, covers electric vehicles extensively, magnetic motors, and battery development. 63600 Deschutes Market Rd, Bend, OR 97701 541-388-1908, Fax 541-388-2750, E-mail <etimes@teleport.com> www.teleport.com/~etimes/

Fusion Facts monthly newsletter. Salt Lake City, UT. 801-583-6232, also publishes Cold Fusion Impact and Cold Fusion Source Book. Plans on-line database access.

Fusion Technology, Journal of the American Nuclear Society, edited by Dr. George Miley, publishes some papers on cold nuclear fusion. 555 N. Kensington Ave., La Grange Park, IL 60525.

Infinite Energy, new bi-monthly newsletter edited by Dr. Eugene Mallove (author of **Fire from Ice**), P.O. Box 2816, Concord, NH 03302-2816. Voice: 603-228-4516. Fax: 603-224-5975 E-mail 76570.2270@compuserve.com

Institute for New Energy (INE), organization to promote and help find funding for new energy research.
Home Page: www.padrak.com/ine/ contains many important scientific papers and current reports on all areas of research.
E-mail: ine@padrak.com Salt Lake City, Utah.
Voice 801-583-6232, Fax 801-583-2963.

New Energy News monthly newsletter for INE, highlighting the research and development in the worldwide new energy arena. Edited by Hal Fox.

Journal of New Energy, quarterly, presenting papers representing the new areas of energy research, leading-edge ideas in the

development of new energy technology, and the theories behind them. Published by the Fusion Information Center, Inc. Editor: Hal Fox.

KeelyNet BBS - Science and health oriented information exchange that specializes in nonstandard research, much of it on new energy. Jerry Decker, 214-324-3501
Internet: www.keelynet.com E-mail: jdecker@keelynet.com

Planetary Association for Clean Energy Newsletter, quarterly, edited by Dr. Andrew Michrowski. 100 Bronson Ave, # 1001, Ottawa, Ontario K1R 6G8, Canada. Web page: http://energie.keng.de/~pace

Now available: *Clean Energy Review*, a technical and scientific discussion on nuclear fuel wastes disposal. Discusses transmutation as one possible solution. $5 U.S. and Canadian, $7.50 other countries.

Space Energy Journal, quarterly, edited by Jim Kettner & Don Kelly, P.O. Box 1136, Clearwater, FL 34617-1136.

The above list of commercial and information sources will be growing. New listings will be added as information is received. Send information to *NEN*, P.O. Box 58639, Salt Lake City, UT, 84158.

Fusion Facts Subscription Office
P.O. Box 58639
Salt Lake City, UT 84158
Phone: (801) 583-6232 NEW FAX: (801) 583-2963

Street Address: 540 Arapeen Drive, Suite 209
University of Utah Research Park
Salt Lake City, UT 84108

***FUSION FACTS* Each Issue Mailed First Class.**
12 ISSUES.....(University or Corporate)..... $ 300
36 ISSUES.....(University or Corporate)..... $ 800

***FUSION FACTS* SINGLE ISSUES**
CURRENT ISSUES EACH..... $ 30
3 MONTHS OR OLDER ISSUES EACH..... $ 10
All back issues available.

SUBSCRIPTION REQUEST
For your convenience you can order by phoning (801) 583-6232, or **FAX** (801) 583-2963, or use the **Mail.**

Send *Fusion Facts* to:

NAME:_____

COMPANY:_____

PO BOX, DEPT:_____

CITY:_____

STATE_____ ZIP_____

Please pay with a check in U.S. dollars drawn on a bank located in the U.S. or with a Postal Money Order.
Send check or money order with order and receive one extra issue free. Make checks payable to *Fusion Facts.*