FUSION facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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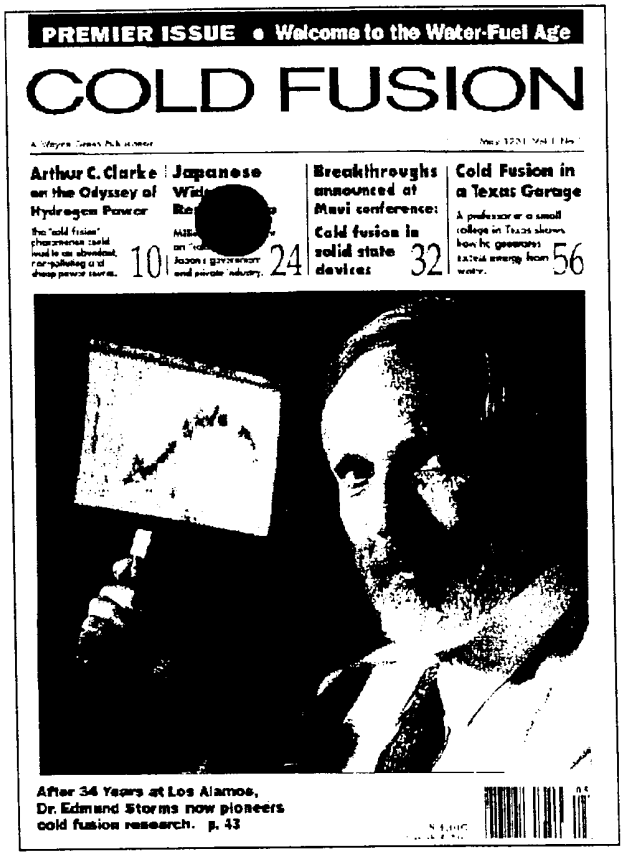


A. COLD FUSION MAGAZINE DEBUT

by Dineh Torres

A new star has risen on the horizon of popular-scientific publications. The name is "*Cold Fusion*." The magazine is bright, to say the least, both intellectually and visually, and promises more to come. The publisher is Wayne Green, who is known for starting *Byte* magazine (and a host of other computer magazines, books and software centers) and also the

well-known *Digital Audio* magazine. The editor is Eugene Mallove, who has been a science writer and proponent of cold fusion since its beginning. This first issue gives an overview of the history of the cold fusion research effort, a look at the people involved and the opposition against.

Looking at the Contents page, you will find:

"2001: The Coming Age of Hydrogen Power," by Arthur C. Clarke. The world's preeminent technology futurist and noted science fiction writer explains how difficult it is to predict the future when technology escalates. He says that the implications of the laboratory phenomenon called "cold fusion" might prove to be stupendous.

"Cold Fusion: Does it have a Future?" by Julian Schwinger. The noted physics Nobel laureate, a pioneering theorist in cold fusion, calls for an open mind on the subject. In his 1990 talk in Japan, reprinted here, he looks to that country to advance the field.

"Cold Fusion Quietly Takes Off in Japan," by Jed Rothwell. An expert on Japan chronicles the development of cold fusion in the land of the rising sun, and depicts the stark contrast between cold fusion's reception there and what has happened in the U.S. The author presents a translation of Minoru Toyoda's address to the Nagoya Third International Conference on Cold Fusion, and excerpts from a Japanese Science magazine poll.

"Report from Maui: The Fourth International Conference on Cold Fusion," by Eugene F. Mallove. *Cold Fusion Magazine's* editor reports on Maui's ICCF4, which revealed a host of new methods for generating excess energy -- including cold fusion in solid-state devices. Materials scientist Robert A. Huggins offers his initial impressions of ICCF4. This issue's cover scientist, cold fusion pioneer Edmund Storms, who has retired from Los Alamos National Laboratory, provides an unusual comment about the field.

"Load Cold and Slow, Run Hot and Fast!" by Dennis Cravens. Professor Cravens reveals the secrets of success in achieving excess heat from electrochemical cold fusion. His five years of experimentation -- in his Texas garage -- are in the finest tradition of experimental science. The professor of chemistry and physics at a small Texas college shows that some of the big universities, that gave up on cold fusion in 1989, prematurely threw in the towel.

"An Italian Cold Fusion Hot Potato," by Eugene Mallove. Late-breaking news from three physicists in Italy brings yet another apparent method of generating excess heat -- at high temperature, for prolonged periods, and at steady, high power. William Collis, an observer in Italy, proposes "an ideal cold fusion demonstration," which the recent experiments in Italy and others like it might permit.

Beside columns by the editor and producer, there will be an informative monthly column by Hal Fox, the editor of *Fusion Facts*. This month's article covers the attack of the skeptics vs. seven reproducible peer-reviewed experimental ways to produce nuclear reactions (and nuclear byproducts including heat), i.e. cold fusion. Dr. Mitch Swartz, with degrees in electrical engineering from MIT and an M.D. from Harvard, is writing a column on "Engineering and Materials in Cold Fusion." Dr. Swartz conducts research into cold fusion, as well as dye-catalyzed photochemical reactions and proton reactions in Group VIII metal electrodes (he is also editor of the *Cold Fusion Times* newsletter).

Other high points in this issue are:

ENECO and the Utah Patents - a portfolio of technology aimed toward furthering worldwide research, investment, and interest.

"The Solid State Alters Nuclear Behavior" - a discussion of Dr. Otto Reifenschweiler's paper in *Physics Letters A*, which might be the big breakthrough that makes believers out of doubters.

Alchemy Altercation - The accusation and exoneration of Prof. John O'M Bockris of Texas A&M (see article in this issue of *FF*, page 4).

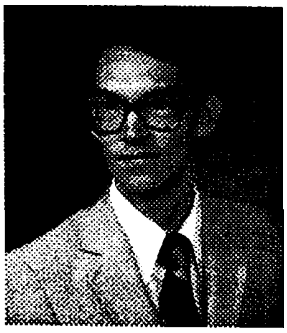
"A Cold Fusion Primer" - a really good overview of what is going on in cold fusion, with emphasis on different avenues of research.

Also covered monthly are research protocols and hints in the "Experimenter's Corner" and "Technical Note," current patent activity worldwide in "Patent File," selected abstracts in "Journal Picks," government reaction and involvement in "Washington Report," and what other publications are reporting in "Media Watch."

And these are just the highlights, this issue of *Cold Fusion* is packed with intriguing information from all over the world. It promises to be a showcase magazine for future technology in the new science of cold fusion.

B. 1994 FUSION SCIENTISTS

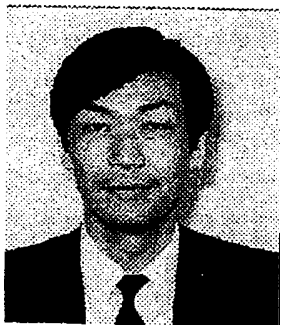
The following were named as the FUSION SCIENTISTS OF THE YEAR (*FF*, March 1994) but biographies were not available then. We honor them here:



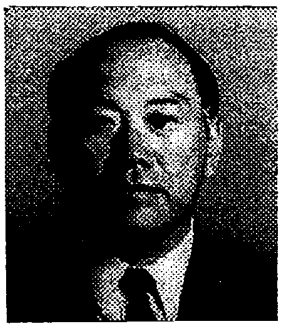
Dr. Dennis Cravens received his Ph.D. in Molecular Biophysics from Florida State University in 1977 after having completed previous degrees in Physics. Worked at Argonne National Laboratories researching Electron spin resonance studies of organic copper compounds before receiving his doctorate. After his Ph.D. he studied the vibrational molecular reaction between gaseous UF_6 molecules for data to be used in laser separation. From 1985 to 1990, Dr. Cravens studied innovative methods of electromagnetic propulsion using general relativistic correction terms (Electric Propulsion Study, U.S.A.F., Astronautic Laboratory). He is a consultant for Los Alamos National Lab and Scientific Application International Corp. Dr. Cravens has long been a correspondent for *Fusion Facts*.

Of recent research, Dr. Cravens says, "Lately, I have been trying to alter the heat release from loaded Pd and Ni containing materials by applying magnetic fields and the addition of magnetic dopants and additives to the alloys. Instead of trying to "prove" CF by elaborate calorimetry and nuclear searches, I have been trying to see what conditions will enhance or magnify the effects. Where most researchers have been trying to increase sensitivity of their systems, I have been using very crude equipment, but have tried to search the protocol parameter space to get larger and more consistent results. I would suggest it is more fruitful to gain skill at producing anomalous heat compared to a control before lengthy and costly experimentation is begun."

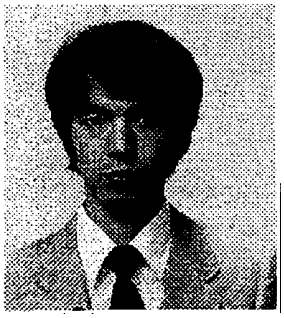
Dr. Michio Enyo received his Master of Science degree in Physical Chemistry from Hokkaido University. He then went on to the Graduate School of the University of Pennsylvania, where he studied with Professor John O'M. Bockris and received his Ph.D. in 1960. Dr. Enyo returned to Japan to become an Associate Professor at Hokkaido University Research Institute of Catalysis (RIC) in 1961 and was elevated to full Professor in 1983. He is presently Professor Emeritus at Hokkaido University and Director of the Catalysis Research Center there. He is also President of Hakodate National College of Technology. Professor Enyo has worked on Cold Fusion since 1989. In 1992 he received the Takei Prize from the Japan Electrochemical Society.



Dr. Tadahiko Mizuno is an alumni of Hokkaido University, where he obtained a Ph.D. in Applied Physics in 1973, and became a Research Associate in its Department of Nuclear Energy. Dr. Mizuno has been involved in research in developing a nuclear chemical method to investigate the behavior of hydrogen permeation into metals since his undergraduate studies. He has also worked extensively on research in hydrogen storage alloys and localized corrosion. From 1983 to 1985 he was a visiting researcher at Texas A&M University Department of Chemistry, under the supervision of Dr. John O'M. Bockris. Dr. Mizuno has been a part of Hokkaido University's Cold Fusion research team since 1989, where he is a Research Associate in the Department of Nuclear Energy.



Dr. Tadashi Akimoto has been a Research Associate in the Department of Nuclear Energy of Hokkaido University since 1966 when he got his first degree. His area of research was nuclear reactor engineering and radiation measurements. He received his Ph.D. in Electrical Engineering in 1992, and has been working in Cold Fusion research since 1989.



Dr. Kazuhisa Azumi received his Ph.D. in Applied Chemistry in 1990 from Hokkaido University, and has been a Research Associate with the Faculty of the Engineering Electrochemistry Lab since 1985. From 1992 to 1994 he was a Visiting Scholar in the Department of Materials Science and Engineering at Stanford University. His areas of research have included the semiconductive properties of films, the electronic properties of metals and semiconductor electrodes, scanning tunneling microscopy techniques, and since 1989 the electrochemical study of the palladium/hydrogen system (Cold Fusion).

C. BOCKRIS EXONERATED

By Eugene Mallove, from Update #2 of the new *Cold Fusion* magazine

Cold Fusion magazine reports that a group of 23 "Distinguished Professors" at Texas A&M has failed in its attempt to demote Professor Bockris for his investigations of low-energy nuclear reactions.

The matter came to a head January 18, 1994, at Texas A&M at an academic hearing. Then on January 31, the four-member Committee of Inquiry into Scientific Misconduct exonerated Professor Bockris of ***all*** charges. The Conclusions and Recommendations of the Committee: "With regard to the charges against Professor John O'M. Bockris, pertaining to misconduct in science in proposing, conducting, or reporting of research in the 'Philadelphia Project,' the Committee of Inquiry unanimously finds there to be no evidence to sustain these charges. Consequently, the Committee holds Professor Bockris to be exonerated of these charges and does not recommend an 'investigation.' It is recommended that the members of the Texas A&M University community allow the process of experimentation and peer review of published data to resolve any scientific issues."

The Committee members were Duane C. Kraemer, Associate Dean, College of Veterinary Medicine; John J. McDermott, Distinguished Professor, Philosophy; Professor John C. Slattery, Chemical Engineering; John C. Calhoun, Jr., Distinguished Professor, Emeritus, Petroleum Engineering.

We await news of this exoneration in *Newsweek* and *Science* magazines, both of which ran articles before the exoneration that were highly unfavorable to Professor Bockris.

See the first issue of *Cold Fusion* magazine for a more complete coverage of this topic.

D. NEWS FROM THE U.S.

ARIZONA - A COLUMN OF WISDOM

Summary by Dineh Torres

G. Harry Stine (writer), "The Alternate View -- Energy," *Analog Science Fiction and Fact*, vol 94, no 5, April 1994, pp 132-137.

SUMMARY

Developing energy resources and technological civilization are certainly inseparable. To quote Dr. Carleton S. Coon, anthropologist, "Man has been converting energy into social structure at an ever-increasing pace. As he has drawn more and more energy from the Earth's storehouse, he has organized himself into institutions of increasing size and complexity."

Man has not, and will not run out of energy. Though shortages sometimes occur, they are usually the result of mismanagement [or through political machinations]

or failure to develop new ones fast enough to keep up with the demand.

As need increased, there was always a commercial incentive for fuel/energy development, from wood, to coal to oil and gas, then to nuclear energy. There have always been entrepreneurs to sell the energy product that the engineers and scientists developed. Each different source has brought with it different problems, pollutions and politics. And man has overcome these problems and in doing so, advanced to the next level of energy production.

So what about the shortages? Are we running out of energy? NASA did a multi-year study in 1977-79 to see if the scenario about "limits to growth" would be the driving force behind space utilization and industrialization. With the world's best data sources at their disposal, they looked but did not find shortages. "The doomsday futurists remind me of the investment expert who predicted nine of the last two recessions." But the energy picture is changing. Why?

Politics. As far back as 1978, the shortage scenario was disproved. So new rationales had to be formed by those who want to control people by controlling their access to energy resources. Certainly we have some environmental damage problems, but their extent is far different than most people are led to believe. Nearly all of the NO_x, which contributes to acid rain, comes from biological action and decomposition, and around 1% comes from internal combustion engines. So are you going to put a filter on your landfill? On your forests?

We will do all we can to eliminate industrial pollution but the problem is more one of perception. Stine calls it "Science by Perception" or a misdirection of information to control the *use* of our resources to "save the planet." Environmental disaster stories make the front page, scientific environmental studies refuting the disaster as an overall scenario get buried.

Energy crises have historically led men to search for new energy sources. Economics is a marvelous incentive. High priced energy sends the searchers looking for new sources.

Dr. Romualdas Sviedrys postulated 7 historical energy lessons two decades ago. They make perfect sense today. 1. The nature of an energy crisis changes with time. It may have been shortages of wood and waterfalls three hundred years ago, today it's perceived environmental damage. 2. Predictions of limits to growth are based on specific energy resources and have assumed no future technical developments. **Technology defines resources.** (Waterwheels and water, steam engines and coal, internal combustion engines and oil.) 3. At the time of a perceived crisis, inventors are already at work on new technologies that will provide commercial sources within 25 years, and largely displace old resources within 50. 4. Current technologies usually don't predict the next energy solution. 5. Technologists prefer to improve familiar technology a little, rather than gambling on something completely new. 6. New technology is created on a shoestring, usually not by major commercial interests. The small researcher has usually been the one to come up with the first real breakthrough that enables the research teams to have something to further develop with their better commercial backing. [Witness Pons and Fleischmann's cold fusion and dePalma's "N-machine."] 7. 'Quantum jump' is how energy usually changes. The change from steam power to oil power was wider than just transportation and industry. The availability, efficiency, applicability and concentration of a new energy source have been such that greater wealth and improved lifestyle have resulted.

Listening to these lessons, we can see how a new energy source can change our lives. **But there probably won't be one. There will be several**. And one will develop to have great advantages over the rest. That will be our energy future. Hydrogen power seems to be the way things are heading, that includes cold fusion. Only time and research will tell.

[Growth won't stop, that isn't in the human paradigm. There are only more ways to express our growth and technology. And when we meet another great Obstacle, some little inventor, working in his garage, will probably light the way over, under, around or through it. And then pass his ideas on to bigger hands, and so on to the next level of civilization/technology.]

[Mr. Stine's essay was so succinctly written that there are places I have been unable to paraphrase. Everyone would profit greatly from reading the original, and you can read more of his columns in other issues of *Analog.*

- D.T.]

All of the papers cited "to be presented at the Minsk Conference" will be published as Proceedings of the Conference and will be available for the Conference. This publication is designed to be a "Cold Fusion Source Book." Prepublication price will be $75, and is available in English from *Fusion Facts* and in Russian from Dr. Filimonov V.A., 14 Leningrad St., Research Institute of Physical and Chemical Problems, Minsk - 80, 220080, Belarus.

CALIFORNIA - L.I.N.T.

Robert W. Bass (Scientific Advisory Board, ENECO, Inc.), "LINT: A Semi-Classical Quantized Theory of Lattice Induced Nuclear Transmutations," paper to be presented at Minsk Conference, 11 mms pages, 20 refs.

AUTHOR'S ABSTRACT

In a frozen supersaturated or fully deuterated ("beta phase") $Pd{:}D_{[1.0]}$ crystal lattice, an incoming deuteron of energy 5.1 eV [above the elsewhere-estimated zero-point energy level of 6.257 eV] will collide with a zero-point energy level E_0 = 0.052 eV [+ 6.257 = 6.31 Ev] bound deuteron, losing 18 of its 31 quanta of linear momentum as measured by Duane's Rule (for Inelastic Collisions between a particle and a lattice), and knocking the bound deuteron, approximated as a quantized harmonic oscillator, into its 40th bound energy level above ground state E_1 = 0.156 eV [+ 6.257 eV = 6.41 Ev], i.e. E_{40} = 4.2 eV [+ 6.3 = 10.5 Ev] which, in the present admittedly over-simplified theory, ALSO coincides with a Resonant Transmission energy level, as in the Turner-Bush theory of transmission resonance, in which the de Broglie wavelength of an excited particle is in resonance with the lattice period. Elsewhere the WKB Approximation is used more realistically with a Madelung-Coulomb lattice potential to compute 88 Resonant Transmission energy levels for excited bound deuterons of energies between 6.32 eV and 13.74 eV, but no mechanism for exciting zero-point (or room-temperature!) deuterons to these resonant energy levels has been suggested. The present semi-classical scattering calculation exhibits an explicit quantal mechanism for exciting the bound deuterons and introduces two new integral quantum numbers (*J,K*) in terms of which all possible such resonant *scattering* scenarios may be enumerated.
[All theorists should carefully read this paper. - Ed.]

CALIFORNIA - C.F. PRODUCED HELIUM

B.F. Bush and M.H. Miles (Chem. Div., Research Dept., Naval Air Warfare Center, China Lake, CA), "Practical Aspects of Heat and Helium Measurements in Deuterated Palladium," paper to be presented at Minsk Conference, 6 mms pages, 6 refs, 3 tables.

AUTHORS' ABSTRACT

Metal flasks were used to collect electrolysis gas samples in Pd/D_2O + LiOD and Pd/H_2O + LiOH experiments in order to minimize effects due to helium diffusion through glass. For five control experiments yielding no excess power, the mean value for the background helium concentrations in our system was 4.4 ± 0.6 ppb or 5.1 ± 0.7 X 10^{13} ^{4}He/500mL. For five experiments producing excess power, the measured helium concentration was higher than the background level in each case. Three different laboratories have been used for measurements of the helium concentrations in various electrolysis gas samples from our experiments during the past three years. The helium measurements from all three laboratories yield helium production rates of 10^{11}-10^{12} ^{4}He/s*W, ie. 62.4-16.0 MeV energy generated per ^{4}He atom produced.

CALIFORNIA - Pd CATHODE TREATMENT

M. McKubre, S. Crouch-Baker, S. Smedley, and F. Tanzella (SRI International, CA.), "Chemical and Metallurgical Issues in the Loading of D into Pd and Associated Production of Excess Heat," paper to be presented at Minsk Conference.

AUTHORS' ABSTRACT

The establishment of reproducible [cold fusion] results is contingent on establishing reproducible and defined experimental conditions. A parameter found to be critical in studies of palladium deuterated electro-cathodically, is the D/Pd atomic ratio or loading, x, where the attainment of high loadings ($x \geq 0.85$), at

least initially during an experiment, has been observed to be a necessary criterion for excess power production.

The metallurgical condition of the host Pd, and the kinetic and net absorptive properties of the Pd-cathode/D_2O-electrolyte interface, are two variables which are difficult to control, but which nevertheless markedly influence the facility with which electrochemical reduction in D_2O electrolytes may be used to attain and maintain high loadings of deuterium in palladium. A presentation will be made comparing different samples of 3 mm diameter Pd from a single manufacturer, correlating the achieved loading and excess power production, with different chemical and metallurgical treatments, and different properties observed at the interface and within the specimen bulk.

CALIFORNIA - EXCESS POWER & HELIUM

M.H. Miles and B.F. Bush (Chem. Div., Research Dept., Naval Air Warfare Center, China Lake, CA), "Excess Power and Helium Production in the Pd/D_2O + LiOD Electrolysis System," paper to be presented at Minsk Conference.

AUTHORS' ABSTRACT

Continuing research has led to numerous reports of excess enthalpy and other anomalous effects in deuterated metal systems. A critical analysis of the calorimetric measurements of several key publications that reported no excess enthalpy in 1989-1990 reveals major errors that undermine the acceptance of these studies. Our previous results presented a correlation between the measured excess power and helium production in Pd/D_2O + LiOD electrolysis cells. Because helium is present in the atmosphere (5.22 ppm), it is difficult to convince everyone that the ^4He measured in the electrolysis gas is a product of a fusion reaction within the cell. It is indeed a very challenging experimental problem to clearly establish the production of ^4He from Pd/D_2O electrolysis cells. This situation is compounded by difficulties in obtaining large excess power effects in these experiments.

We have now completed 28 experiments involving measurements of excess power and the corresponding helium content of the electrolysis gas stream. Gas samples were collected in metal flasks as well as in glass flasks. Excess power was measured in 16 of these experiments while no excess power was observed in 11 control experiments. One experiment was omitted due to a low D_2O level that exposed the palladium cathode to the gas phase. All 16 experiments involving excess power yielded higher levels of ^4He in the electrolysis gas samples. The 11 control experiments yielded either no detectable ^4He or 4.4 ± 0.6 ppb as the background level of ^4He depending on the sensitivity of the analysis.

The statistical probability of obtaining this set of heat-helium results due to random errors is extremely small. Furthermore, the helium measurements for experiments producing excess power consistently yield helium production rates of 10^{11} - 10^{12} $^4He/s \cdot W$. This value is the correct magnitude for typical deuteron fusion reactions that yield helium as a product.

GEORGIA - EXCESS HEAT PUMP

James L. Griggs (Hydro Dynamics Inc., Cartersville, GA), "Calorimetric Study of Excess Heat Production Within the Hydrosonic Pump System Using Light Water," paper to be presented at Minsk Conference, 7 mms pages.

AUTHOR'S ABSTRACT

The Hydrosonic pump is a device that has shown "excess heat" in steady state running conditions continually for a number of years. The basic premise of the pump is that when shock waves are generated in a fluid that a small amount of energy would be given off in the form of heat. The pump has been specifically designed to create millions of controlled shock waves per minute, which in turn generates an acoustical wave in the range of 36K Hertz.

The pump's excess output varies as input parameters are intentionally varied and the phenomenon can be controlled.

In this paper three different experiments will be presented to show the pump in its different stages of production.
1. An experiment where all the input supply water provided to the systems will be converted to a gas (steam).

2. An experiment where the output from the pump is a combination of gas and liquid.
3. An experiment where a liquid state is maintained throughout the entire experiment.

A complete overview of the pump and its related system will be given with a complete description of the experimental procedure.

The calorimetry for the experiments will be a combination of computer generated and human data collection and reported in detail. Final conclusions and authors comments will be given. [The excess heat is more likely to be a product of tapping zero-point energy than cold fusion. See *FF*. Feb. 1994, p 2. -Ed.]

HAWAII - MOLTEN SALT & LOADING

Bor Yann Liaw (Hawaii Nat. Energy Inst., Sch. of Ocean & Earth Sci. & Tech., Univ. Hawaii at Manoa, Honolulu, HI), "Molten Salt Techniques for Excess Heat Production and the Loading Issue," paper to be presented at Minsk Conference, 6 mms pages, 13 refs.

AUTHOR'S ABSTRACT

Molten salt techniques for excess heat production at elevated temperatures have shown great potential for practical applications. This approach promises improved efficiency due to high-temperature operation, high-grade heat, and fast kinetics for hydrogen-metal reaction. Although the origin of the excess heat phenomenon is still an open question, the reality of producing high magnitude of excess power from electrolysis has been demonstrated in molten salt experiments. This paper will give an overview of our earlier work in the molten salt experiments that used Ti and Pd as the anode in deuteride-charging electrolysis and more recent results that used Ni and steel as anode materials for hydride-charging electrolysis. In both cases, the excursions of the cell potential exhibited similar patterns, which are important for the understanding of the electrochemical reactions involved in the cells. The temperature excursions were, however, different and difficult to be explained by the enthalpies associated with the reactions in each system.

If the phenomena observed in these experiments were similar to those anomalies detected at room-temperature, many believe that the loading is an important parameter for excess heat production in heavy-water electrolysis. This threshold loading, as illustrated in the SRI/EPRI and IMRA-Japan work led by McKubre and Kunimatsu respectively, is about 0.83-0.85 at room temperature. It is difficult to conceive how such a loading can be achieved at elevated temperatures, according to the phase diagram of the Pd-H(D) system, in which the p-c-T curves indicate that the H(D) concentration in Pd decreases with temperature. We want to discuss this issue in two folds. First, although the equilibrium H(D) concentration in Pd is rather low at elevated temperatures, the electrolysis is under a dynamic situation which could be significantly different from the equilibrium condition. Secondly, the mechanism connecting the critical loading to excess heat production is not fully understood yet. We thus speculate it from a thermodynamic point of view and propose that the threshold loading possibly associates with some crystal structure change and defect interaction. Wagner has shown from thermodynamic principles the significance of the curvature of the p-c curve and the relation to the stoichiometry of a compound. Applying this principle, we found some interesting insights to the H(D) behavior in metals. The relevance of this behavior with critical loading will be discussed.

MASSACHUSETTS - Q1D MODEL

Mitchell R. Swartz (Jet Technology, Weston, MA), "Generalized Isotopic Fuel Loading Equations," paper to be presented at Minsk Conference, 4 mms pages, 14 refs.

The quasi-one-dimensional (**Q1D**) model, including the coupling to a material, have offered insights into electrodes and materials filled by an isotopic fuel. Past examinations have discussed both competitive gas-evolving reactions at the surfaces of the electrode, the impact of the ratio of the applied electric field energy to thermal energy [k_B*T], and other factors which appear decisive in controlling the loading. Following the demonstration of sonic-induced loading, and cold fusion, reactions and complexities at the metal-double layer junction, the derived fusion flux equation links the deuteron loading flux from the region external to the materialons to potential reactions at that site. This

relationship must be extended to include any ordering force including those derived from sonic fields.

There may be implications upon calculations of the activities and fugacities following aqueous loadings to derive distributions of deuterium in the palladium and the solution. Our present calculations attempt to account for induced drift by the applied electric field, electric field distributions altered with complex conduction and polarization phenomena, secondary space charge polarization, propagation of solvated deuterons, deuterons in clathrates, and L-,D-deuteron defects with their ferroelectric inscription in the heavy water, and the formation low dielectric constant bubbles. The double layer between the solution and the metal, created both by the cathode fall of ions and other polarization reactions, is significant. At this boundary, intermolecular deuteron transfer from the solution to octahedral sites within the palladium may control the loading. Within the metal, the deuteron diffusion involves optical and acoustic phonon spectra, material defects, grain boundary dislocations, "zeolite"-like diffusion and fissures.

MASSACHUSETTS - LATENT HEAT EFFECT

K.H. Johnson (M.I.T., Cambridge, MA), "Jahn-Teller Symmetry Breaking and Hydrogen Energy in γ-PdD Cold Fusion as Storage of the Latent Heat of Water," paper to be presented at Minsk Conference, 12 mms pages, 12 refs, 6 figs.

AUTHOR'S ABSTRACT

In 1989, we proposed a common quantum-chemical basis for superconductivity and anomalous electrochemical properties of palladium loaded with hydrogen and deuterium, derived from H-H/D-D bonding molecular orbitals at the Fermi energy between tetrahedral interstices ("γ-phase" PdD). Symmetry-breaking anharmonic vibrations of the protons/deuterons, induced by the dynamic Jahn-Teller effect, promote superconductivity in PdH/PdD at T_c = 9/10°K, while the large vibronic anharmonicity explains the inverse H/D isotope shift of T_c. The calculated deuteron vibronic amplitude of 0.46Å implies a closest D-D approach of 0.76Å between neighboring tetrahedral sites and fusion rate of only ~10^{-24} per deuteron pair per second in γ-PdD at ambient temperature, much too small to explain reported excess heat. *Ab initio* quantum-chemical computations for γ-PdD further indicate that the "channels" connecting tetrahedral sites provide, via the Jahn-Teller effect, an "orbital pathway" for bulk catalytic recombination of atomic deuterium to rapidly diffusing dideuterium, $4D \rightarrow 2D_2$, the recombination heat equaling 9.4eV per Pd atom per unit diffusion cycle time, equivalent to the storage and release of latent vaporization heat of 2.5 moles of D_2O. While the diffusion cycle time depends on cell conditions, for cycles between 1 and 100 minutes, this process could generate 17 to 1700 watts/cm^3 of stored latent heat in γ-PdD. The inverse isotope effect implies a slower hydrogen reaction, $4H \rightarrow 2H_2$, and diffusion in γ-PdH, leading to negligible latent heat power from Pd-based light-water cells. However, this mechanism could explain reported heat generation in light-water cells using nickel cathodes, where $2H \rightarrow H_2$ catalysis is a rapid (110) surface or near-surface phenomenon.

MINNESOTA - REPEATABILITY PROBLEMS

R.A. Oriani (Dept. Chem. Eng. & Mat. Sci., Univ. Minn., Minneapolis, MN), "A Brief Survey of Useful Information about Hydrogen in Metals," paper to be presented at Minsk Conference, 4 mms pages, 15 refs.

AUTHOR'S ABSTRACT

To help understand the irreproducibility that cold fusion experimentation exhibits, the behavior of hydrogen in transition metals is surveyed. Equilibrium aspects such as the dissolved state, lattice expansion, stress thermodynamics and interactions with lattice singularities are briefly discussed. Hydrogen diffusion and the accompanying stress generation which produces plastic deformation, voids and microcracks are presented.

NEW MEXICO - SUCCESS PROCEDURES

Edmund Storms (Santa Fe, NM), "Methods Required for the Production of Excess Energy Using the Electrolysis of Palladium in D_2O Based Electrolyte," paper to be presented at Minsk Conference, 4 mms pages, 27 refs.

AUTHOR'S ABSTRACT

As first proposed by Drs. Pons and Fleischmann, excess energy can be created by electrolyzing palladium as the cathode in D_2O using an electrolyte containing 0.1-1.0 M LiOD. Reproducibility of this amazing result can now be greatly improved by following procedures described in this paper. A variety of other environments and materials have been found to produce the effect but these will not be discussed here.

Nuclear reactions can be initiated in a special condition of matter (SCM) that is formed from β-PdD having a sufficiently high deuterium content combined with several other factors. These factors include the presence of still unknown impurities in the palladium and the application of various forms of energy. Apparently, an activation energy exists for the formation of the SCM and this energy is lowered by a suitable deuterium and impurity concentration. This barrier is overcome by the application of some externally generated energy. The closer the chemical conditions are to the ideal condition, the less external energy is required to initiate SCM formation. Once the SCM forms, it is more stable than is ß-PdD thereby suggesting the existence of an activation energy for decomposition as well.

Heat production is not consistently associated with γ-ray, X-ray, neutron or radioactive isotope production. However, all of these products of nuclear reactions have been seen many times both with and without significant heat production while using the electrolytic technique. While these easily detected products do not prove that the excess energy is being produced by a nuclear process, they do demonstrate that various unexpected nuclear reactions can be made to occur in this environment. **The most likely source of significant heat production appears to be the formation of ^{4}He.**

NEW YORK - REACTIONS WITH HEAVY ICE
Chemical Abstracts, 21 February 1994

Y.K. Bae, R.J. Beuhler, Y.Y. Chu, G. Frielander, L. Friedman (Chem. Dept., Brookhaven Natl. Lab, Upton, NY), "DD Nuclear-Fusion Reactions with Small D_2O and H_2O Clusters Impacting Heavy Ice," *Phys. Rev. A*, 1993, vol 48, no 6, pp 4461-4466.

AUTHORS' ABSTRACT

The large DD-fusion-yield enhancement reported earlier by the authors' group (1989) and (1990) in the bombardment of deuterated targets by large heavy-water clusters was shown by postacceleration magnetic and electrostatic filtering to be due to small-ion impurities produced in the acceleration column. With the filtering arrangement in place the authors have carefully studied DD-fusion rates with small $(D_2O)_nD^+$ and $(H_2O)_nH^+$ ions ($n \leq 10$) which produced detectable fusion rates. Formation of carbon films on the polydeuteroethylene surfaces caused the observed fusion rates to decrease rapidly with time. This problem was solved by using D_2O ice targets which are "self-cleaning." No enhancement was observed for the fusion rates of the small D_2O clusters after the oxygen knock-on corrections were made. However, the fusion yields for knock-on processes produced by $(H_2O)_nH^+$ clusters ($4 \leq n \leq 10$) showed approximately a two-fold enhancement over the yields for H_3O^+ ions at the same velocity. The stopping power of clusters was measured and shown not to be responsible for this enhancement.

OHIO - REACTIONS ON LITHIUM
Chemical Abstracts, 21 February 1994

G. Raimann (Dep. Phys., Ohio State Univ., Columbus, OH), "Reaction Rates of Proton- and Deuteron-Induced Reactions on Lithium," *Z. Phys. A: Hadrons Nucl.*, 1993, vol 347, no 1, pp 73-4.

AUTHOR'S ABSTRACT

Reaction rates are calculated for recently available low-energy data on ^{7}Li(p,α)^{4}He, ^{6}Li(p,^{3}He)^{4}He and ^{6}Li(d,α)^{4}He and compared to literature values. While the new rates are considered to be more accurate, their absolute magnitude agrees within about 10% with the most recent compilation.

OREGON - POSSIBLE TRANSMUTATION

J. Dash and G. Noble (Dept. Phys., Portland St. Univ.) and D. Diman (Carleton College, Northfield, MN), "Changes in Surface Topography and Microcomposition of a Palladium Cathode Caused by Electrolysis in

Acidified Light Water," paper to be presented at Minsk Conference, 10 mms pages, 6 refs., 5 figs.

AUTHORS' ABSTRACT

A thin palladium cathode became bent and torn during electrolysis in acidified light water. Localized changes in composition were observed, including the occurrence of chlorine and possibly silver. Transmutation by neutron absorption may have caused the formation of silver.

AUTHOR'S DISCUSSION

The results illustrate the drastic changes in surface morphology of a palladium cathode which occur during electrolysis with an electrolyte containing H_2O and H_2SO_4 and a platinum anode. The violent interaction of hydrogen with palladium caused inhomogeneous distortion and tearing. Analysis of a surface protrusion revealed the presence of chlorine (probably as a compound) on the protrusion but not on the adjacent area of the palladium cathode. The source of chlorine is not known.

The morphology of the lower edge of the cathode, where current density most likely was highest during electrolysis, shows a large number of submicron-sized surface pits. Analysis shows a large change in ratio of x-ray fluorescence peaks of palladium. The ratio of Pd $L\beta_1$ at 2.99 KeV to Pd $L\alpha_1$ at 2.84 KeV changed from about 0.50 for the upper part of the palladium cathode to 0.75 for the lower edge. It is known that changes in this ratio can be caused by changes in absorption by the sample (4). But it is not clear why the absorption from a region near the edge should change in such a way as to cause the observed change in intensity ratio. It seems more likely that the change in intensity ratio was caused by the presence of silver which produces an $L\alpha_1$ peak at 2.98 KeV. If this is the correct explanation, then the region in Fig. 5a from which the spectrum in Fig. 5b was obtained contains about 20% Ag. This is much less than was found in localized areas of a similar palladium cathode electrolyzed in heavy water (3).

If silver is present, then it either diffused from within the palladium, was electroplated, or was produced by transmutation caused by neutrons produced during nuclear fusion of hydrogen or deuterium. The results show that platinum electroplates onto the palladium, but that the platinum probably peeled off of the lower edge during ultrasonic cleaning after electrolysis due to poor adherence of the electroplated layer. Therefore, if silver had been electroplated, it probably would have peeled off with the platinum. The likelihood that silver would diffuse from the interior and concentrate at selected sites on the surface seems extremely remote because silver and palladium are miscible in all phases (5).

We previously concluded that a nuclear fusion reaction may have resulted in silver deposits on a palladium cathode electrolyzed in an electrolyte containing D_2O and H_2SO_4 (3). It seems most probable that the enhanced x-ray intensity at 3 KeV in Figs. 4b and 5b may also be due to transmutation caused by neutrons from a fusion reaction. If a neutron is captured by Pd^{108}, an abundant isotope, it becomes Pd^{109}, which rapidly decays to Ag^{109}, a stable isotope (6). [All figs. refer to original paper.]

TEXAS - ELECTROCHEMISTRY, TRITIUM AND TRANSMUTATION

J. O'M. Bockris and R. Sundaresan (Dept. Chem., Texas A&M Univ., College Station TX), "Electrochemistry, Tritium and Transmutation," paper to be presented at Minsk Conference, 13 mms pages, 18 refs, 3 figs, 2 tables.

AUTHORS' ABSTRACT

It is known that nuclear phenomena can be brought about in the cold, e.g., in cells containing D_2O in contact with a palladium electrode, in molten salt cells which contain lithium hydride, in light water cells in contact with nickel electrodes, in cells involving arcs in hydrogen and deuterium, in cells involving high potential differences across a series of palladium electrodes separated by membranes and those involving nickel electrodes under the influence of high frequency radiations.

However, most of these nuclear reactions at low temperatures have been carried out under electrochemical confinement and for this reason a brief outline of these cells us given as a background here.

Two other topics are briefly reviewed: the first published synthesis of tritium from deuterium in the

cold, and some aspects of transmutation under conditions which have temperatures in the region of 1000 degrees.

UTAH - FINAL REPORT
Chemical Abstracts, 21 February 1994

S.E. Jones, M. Berrondo, J.B. Czirr, D.L. Decker, K. Harrison, G.L. Jensen, E.P. Palmer, L.B. Rees, D.S. Shelton, et al. (Brigham Young Univ., Provo, UT), "Investigation of Cold Nuclear Fusion in Condensed Matter: Final Report," *Report*, 1992, DOE/ER/12105-2, 24 pages; *Energy Res. Abstr.*, 1993, vol 18, no 3, Abstr. no. 7154.

AUTHORS' ABSTRACT

Recent research has been directed towards finding means to produce neutron emissions at will, to demonstrate reproducibility, and to permit in-depth studies of the origin of neutral emissions. This goal has been pursued in the Kamiokande detector in Japan and has led to the development of a deep underground lab in a tunnel in the Wasatch mountains near Brigham Young Univ. New counters for low-level neutron emissions are being utilized. Calorimetric tools have also been developed.

VIRGINIA - ION BAND STATES

Talbot A. Chubb and Scott R. Chubb (Research Sys., Inc., Arlington, VA), "Ion Band States: What They Are, and How They Affect Cold Fusion," paper to be presented at Minsk Conference, 6 mms pages, 13 refs, 1 fig.

AUTHORS' ABSTRACT

Free space fusion is not like cold fusion in a solid. The only thing the two processes hold in common is a requirement for wave function overlap. To understand radiationless, cold fusion inside a solid, it is necessary to think in a different way from the normal way that is used to understand hot fusion using conventional nuclear physics. In hot fusion we think in terms of collisions between randomly moving ions. These collisions are analogous to the electron-electron collisions that electrons undergo in the electron cloud surrounding the hot filament of a vacuum tube. To understand cold fusion, it is necessary to switch from thinking about the localized discrete particles encountered in "vacuum tube thinking" to "transistor thinking", i.e., to thinking in terms of the collective action of the delocalized wave-like "particles" that are responsible for making it possible to construct transistors and other semiconductor devices.

At the heart of "transistor thinking" is the notion of the energy band. An energy band is a collection of states provided by a periodically ordered crystalline host. When a particle occupies one of these states it acts like a stationary wave. The energy of each wave varies with the wave direction within the crystal. There is evidence that hydrogen (H) and deuterium (D) can be forced to occupy such states on metal surfaces and in metal-like crystals such as Ni and PdD. The H and D nuclei then behave like electrons in semi-conductors and metals. These nuclei can participate in nuclear reactions because their charges are spread-out and are insufficiently concentrated to prevent overlap. For example, when a small number of indistinguishable deuterons are forced into a fully loaded PdD crystal, they can undergo the reaction $D+D \rightarrow {}^4He$, in which the ^4He product is in the same spread-out form as the feedstock. In the process, small and equal amounts of nuclear reaction heat are liberated in each unit cell of the crystal. It is statistically impossible for this spread-out energy to become concentrated into a normal nuclear-size volume, with the result that the reaction is radiationless. This type of reaction proceeds through specific rules which preserve crystalline order, minimize energy, are consistent with the underlying electronic structure, and constrain the reaction products. We have used these rules to account for and predict a number of effects that were subsequently observed.

E. NEWS FROM ABROAD

BRITAIN - GOOD MONEY, BAD SCIENCE?
Summary by Dineh Torres

David Swinbanks, "Is Japan Throwing Good Money After Bad Science?" *Nature*, (vol 367, 24 February 1994, p 670.

SUMMARY

This is a sidelight to an article about the Japanese scientific budget for 1994. After describing the highlights of Japan's research budgets for various government ministries, reflecting the lower revenues

due to the prolonged recession in Japan, the *Nature* writer gave a disparaging look at two "questionable" research grant receivers: earthquake prediction and cold fusion. Cold fusion research grants through the Ministry of International Trade and Industry (MITI) have been raised 145.5% over last year's figures, bringing the total to an equivalent of $5.1 million. According to *Nature*, this research will be conducted at the new laboratory in Hokkaido, which has only been operating a few months now. The new Hokkaido Research center is fully funded, but, in reality, the cold fusion effort in Japan is much more widely dispersed, with both government and commercial funding for nearly 30 Universities and more than a dozen large private research labs. The author claims that the researchers at the Hokkaido lab have had no success, but neglects to mention that the IMRA research facility, in the same building already achieved reproducible excess heat experiments, and reported on them at the 4th International Conference on Cold Fusion last December.

About Japan's interest in cold fusion research, *Nature* makes this comment, "Japan's increased investment in earthquake prediction and cold fusion illustrated the lack of any effective system for reviewing government research projects." Maybe Japan's government is just paying more attention to worldwide peer-reviewed research in cold fusion, something the UK's *Nature* magazine and the U.S. DOE have perennially ignored.

CHINA - MULITSTAGE REACTION

Yi-Fang Chang, Chuan-Zan Yu (Dept. Phys., Yunnan Univ., Kunming) "The Physical-Chemical and Nuclear Multistage Reaction Mechanism and the Multistage Ignition Condition on Cold Fusion," paper to be presented at Minsk Conference, 3 mms pages, 3 refs.

AUTHORS' ABSTRACT

Combining the known theories we propose the physical-chemical and nuclear multistage reaction mechanism on cold fusion. Then the multistage ignition condition, which is analogue with the Lawson criterion, and its various forms are obtained, and a concrete threshold value is estimated for the D-Pd system.

Nowadays cold fusion not only has been confirmed by more and more experiments, but also we believe that it is a kind of nuclear reaction. For this purpose we have proposed the multistage nuclear reaction mechanism of cold fusion, in which, first $D+D \rightarrow T+p$ or He^3+n; next p-nuclei reacts; then various nuclei react, etc. Moreover, some results are calculated quantitatively and some predictions are discussed. But the recent theories are unsatisfactory still for cold fusion at very low energy, in which the nuclear reaction probability is too small according to the quantum mechanics, even though the Coulomb screening effect is considered.

So far, the nuclear reaction mechanism of cold fusion is mainly two types, 1. Deuterons accelerated by an electric field react directly with Pd nuclei or deuterons, etc., on the cathode. The multistage nuclear reaction belongs to this type, and 2. Deuterons accumulate continuously on the cathode, and finally, a plasma is formed. [The process] includes some Coulomb screening theories. But both probabilities at low energy are very small. Therefore, some adhere to one's opinion: cold fusion is only a physical or chemical reaction. Of course, non-nuclear processes cannot be an explanation for many experimental phenomena of cold fusion.

We combine both mechanisms and extend the multi-stage nuclear reaction mechanism, then propose the physical-chemical and nuclear multistage reaction mechanism of cold fusion. First, a physical-chemical reaction happens between the cathode material and deuterons, etc., under action of electric current, etc. In this process, on the one hand deuterons accumulate continuously on the cathode, on the other hand the plasma on the cathode is heated. Next, when the time reaches a threshold value, the multistage nuclear reaction may appear.

From the general consideration we propose the ignition condition of cold fusion, which is analogous to the Lawson criterion of thermonuclear fusion, and research its various forms.

CHINA - HV DISCHARGE RESULTS

Jingtang He, Yingping Zhang, Guoxiao Ren, Guoyi Zhu, Xiaoli Dong, Duanbao Chen, Hongguang Han (Inst. High Energy Phys., Academia Sinica, Beijing),

Long Wang, Sunsheng Yi (Inst. Phys., Academia Sinica, Beijing), Shangxian Jin (Grad. School, Academia Sinica, Beijing), "Detection of Characteristic Gamma Rays from Electrodes in Pd-D System by HV Discharge," paper to be presented at Minsk Conference, 5 mms pages, 8 refs, 5 figs.

AUTHORS' ABSTRACT

Evidence is presented to show different characteristics of gamma rays from electrodes in Pd-D system, by HV discharge. It might be explained as the elements of electrodes excited by high energy charged particles originated during HV discharge de-exciting radiations.

During HV pulses no neutron signal was detected. Neither neutron signal nor gamma signal was detected in the intervals between the HV pulses.

CHINA - X-RAY EMISSIONS

Ren-bao Lu (Beijing Inst. Appl. Phys. & Comput. Math., Beijing), "The X-Ray Emission from Elements of First Period and Cold Fusion," paper to be presented at Minsk Conference, 3 mms pages, 6 refs.

AUTHOR'S ABSTRACT

The elements of first period and their isotopes can produce A+-ion when they are electrolyzed or ionized or under the action of photoelectric effect. If these A+-ions run into the range of Bohr orbit radius of the A-atom or He^{+}, under the electromagnetic interaction they can form the bound states A^{+}-e-A^{+}, A^{+}-e-He^{++}, He^{++}-e-He^{++},..., and then emit X-rays from bremsstrahlung. The probable distance between the cations is nearly 10^{-12}cm at this time. For the particles among which the nuclear attractive force exists, cold fusion can happen from the strong interaction and the electromagnetic interaction.

CHINA - ENHANCING GAS-LOADING

Xing-Zhong Li, Gui-Song Huang, Da-Wei Mo (Dept. Phys., Tsinghua Univ., Beijing), "Enhancing the Loading Ratio (D/Pd) in the Gas Phase," paper to be presented at Minsk Conference, 6 mms pages, 22 refs.

AUTHORS' ABSTRACT

SRI International has confirmed the correlation between the excess heat and the loading ratio -- the atom number ratio of deuterium to palladium (D/Pd). It was announced that there is a critical value of loading ratio, above which the excess heat appears. However, it is not clear how to reach this critical value. Most of the experiments in the last four years failed in reproducing Fleischmann & Pons experiment because the loading ratio might be less than this critical value.

A systematic study of the loading ratio has been done since 1991. Instead of electrolysis, we are using gas-loading method. Usually, the normal p-v-T curves anticipate a low loading ratio at room temperature and tens atm. of pressure. Nevertheless, the experiments show that it is possible to enhance the loading ratio at room temperature and ten atmospheres of pressure. Particularly, the loading ratio (H/Pd or D/Pd) has been greater than 0.80 in a series of experiments. This value has been checked by resistance method and weighting method.

Based on this technique, further experiments to study the anomalous phenomena in deuterium/solid systems are proposed.

FRANCE - NEW HYDROGEN BOHR ORBITS

Jean-Pierre Vigier (Grav. et Cosmol. Relativ., Univ. Paris VI- CNRS/URA), "New Hydrogen (Deuterium) Bohr Orbits in Quantum Chemistry and Cold Fusion Processes," paper to be presented at Minsk Conference, 7 mms pages, 10 refs.

AUTHOR'S ABSTRACT

It is suggested that recent confirmation of the existence in dense matter of very small quantities of fusion "ashes" both in electrolysis and glow-discharge experiments, can be heuristically interpreted (within the frame of conventional Quantum Mechanics and Nuclear theory) if one combines screening (i.e. tunneling) and the introduction of spin-spin and spin-orbit couplings with the usual effects of the Coulomb Potential in atoms and molecules.

The new Quantum Chemistry associated to the corresponding new tight Bohr orbits in dense matter explains the observed excess heat (above break even) and predicts the existence of fusion processes which become dominant at high energy current input.

As we shall now see the formation of a new stable tight phase $\bar{H}_2^+$ and $\bar{D}_2^+$ of $\ddot{H}_2^+$ and D_2^+ can be justified, within the frame of present quantum theory (i.e. quantum chemistry), as a consequence of the introduction of spin-spin and spin-orbit forces (which always exist but cancel out in free-space due to random spin orientations) when they resonate with the surrounding electron plasma oscillations.

FRANCE - SPARKING IN HYDROGEN ISOTOPES

Jacques Dufour (SRSA/CNAM, Lab. Sci. Nucl., Paris), J. Foos and J.P. Millot (CNAM), "Cold Fusion by Sparking in Hydrogen Isotopes," paper to be presented at Minsk Conference, 6 mms pages, 6 refs, 4 figs.

AUTHOR'S ABSTRACT

From 1989 to 1992, experiments have been performed at the Shell Research Laboratory of Grand'Couronne, to achieve cold fusion by sparking between palladium electrodes, through hydrogen isotopes. A reproducible excess power production has been measured, both with hydrogen and deuterium. This excess power is typically 2 W and has been measured continuously in one period up to 250 hours.

Round one hundred active and blank experiments have been performed, showing that the excess power production is statistically very significant. No systematic error has been found, that could account for this excess power. The main results of this work have been published in *Fusion Technology* (September 93, "Cold Fusion by Sparking in Hydrogen Isotopes"), together with a possible nuclear reactions scheme that can explain the experimental observations.

In order to check whether this excess power production is indeed related to nuclear reactions, a research contract has been signed between Shell Research and the CNAM (Laboratoire des Sciences Nucléaires, headed by Prof. F. Foos), to identify possible nuclear by-products. The project is thus now on-going in the CNAM.

Main results so far obtained will be discussed, with emphasis put on the precautions that are required to try to avoid artifacts that can occur in that type of experiments.

INDIA - LOW ENERGY EMISSIONS

Chemical Abstracts, 21 February 1994

R.K. Rout, A. Shyam, M. Srinivasan, M.S. Krishnan (Neutron Phys. Div., Bhabha At. Res. Cent., Bombay), "Update on Observation of Low Energy Emissions from Deuterated and Hydrated Palladium," *Indian J. Technol.*, 1993, vol 31, no 8, pp 551-554.

AUTHORS' ABSTRACT

Low energy radiations were observed to be emitted from deuterated and hydrated palladium samples. The radiations were not observed when the samples were kept in vacuum or in an atmosphere of nitrogen, helium, or argon. However, radiographs of reduced intensity were observed when the samples were kept in pure oxygen or hydrogen. Using a sensitive densitometer, it was observed that a small fraction of the radiation is transmitted through a 2μm thick aluminized polycarbonate filter.

INDIA - LIGHT WATER HEAT & TRITIUM

M. Srinivasan‡, P. Adi Babu† , M. B. Bajpai*, D. S. Gupta*, U. K. Mukherjee†, H. Ramamurthy†, T. K. Sankarnarainan*, A. Sinha‡, A. Shyam,‡ (‡Neutron Phys. Div., *Chem. Eng. Div., †Process Instru. Sys. Div., Bhabha Atm. Res. Ctr., Trombay, Bombay), "Excess Heat and Tritium Measurements in Ni-H_2O Electrolytic Cells," paper to be presented at Minsk Conference, 6 mms pages, 18 refs.

AUTHORS' ABSTRACT

A large number of open cell electrolysis experiments of the Mills and Kneizys type [or Bush-Eagleton design] have been carried out in light water solutions of 0.6M K_2CO_3, 0.1M Li_2CO_3 (natural and enriched in Li^6) and

0.6M Na_2CO_3 using Ni as cathode and Pt as anode, at the Bhabha Atomic Research Centre in Bombay. The cells were fabricated of double walled glass dewars with either vacuum or air between the inner and outer glass vessels. In the more recent experiments there was no silver coating in the dewar, rendering the cells transparent.

A variety of nickel samples were tested as cathodes: some were solid nickel foils; others were in the form of porous sheets sintered from fine nickel powder; some cathodes were produced by electrodepositing nickel onto a stainless steel rod and later peeling it off; yet others were in the form of a mesh made of Ni fibres (procured from National-Standard Co., USA). While most of the experiments deployed planar geometry for the electrode assembly, a few cells used cylindrical geometry.

In some cells a mixture of H_2O and D_2O was used. No external stirrer was employed. However during the electrolysis runs, the vigorous bubbling caused by the escaping H_2 and O_2 gases served to mix the solution well and reduce temperature gradients. Typically a bank of five operating cells and one dummy cell was run at a time. Experiments with a given bank lasted for two to six weeks each.

Two type-T copper-constant thermocouples, either bare or encased in a stainless steel or glass tubing were deployed in each cell for temperature measurements. The difference (ΔT) in average temperature at steady state between the operating cell (T_c) and that of the reference cell (T_{ref}) was taken as a measure of the heat generation in the cell. The accuracy of the differential temperature measurements is estimated to be better than 0.5C. The cells were calibrated using resistance heaters. For each cell ΔT was measured at steady state for different input joule powers. The maximum input joule power [(V-1.482) * I] varied from 1.0 to 6.5W depending on the cell design and calibration constant. Cell currents varied from ~ 0.1A to ~1.5A.

Calorimetric measurements have so far been carried out in over 70 cells, since January '92. Results as of October '92 were reported at ICCF-3 in Nagoya and those of the further studies (up to August '93) were presented at ICCF-4 in Maui. A few similar open cell measurements have also been carried out by one of the authors (MS) at SRI International in Menlo Park, California, during the winter of 93-94 employing very sensitive RTDs for the temperature measurements.

As a general observation it was noted that for the results to be reliable, the ambient air and reference cell temperature variations/fluctuations should be much smaller than the ΔT given by (T_c - T_{ref}) being measured. Likewise, the difference in reading between the two temperature sensors of a cell, which is a measure of temperature gradients in the cell, should be << ΔT being measured. It was observed that even minor changes in electrode assembly design, or the height-to-diameter ratio of the solution region of the cell (this influences the pattern of convection currents), the presence of structural components, if any, which may impede convection induced mixing, etc. can result in unacceptably large (T_1 - T_2) values, giving rise to poor reliability of the ΔT measurements. This aspect was given due attention in cell design as there was no separate mechanical stirrer in our cells.

ITALY - HIGH D/Pd LOADING

F. Celani, A. Spallone, P. Tripodi, A. Petrocchi, D. Di Gioacchino, M. Boutet (INFN, Laboratori Nazionali di Frascati), P. Marini, V. Di Stefano (SKITEK, IRI, Pomezia), "D/Pd Loading Ratio up to 1.2:1 by High Power μs Pulsed Electrolysis in Pd Plates," paper to be presented at Minsk Conference, 6 mms pages, 4 figs, 2 refs.

AUTHORS' ABSTRACT

We tested metallurgically different Pd plates made with cold working procedures. We focused on the Deuterium absorption for these plates during pulsed electrolysis. We used high peak current intensity (up to 100 A) with very short (1 μs) pulse duration, up to 20 KHz of repetition rate. The peak power of each pulse can be as large as 50 KW. The LiOD 0.3 M/l D_2O solution has a Pt net [mesh] as anode.

Very high D/Pd ratio (up to about 1.2:1) have been reached and the Deuterium absorption behavior versus time is strongly dependent on the metallurgy of the plates. Even surface preparation of the plates seems to play a role in the absorption phenomena. Metallurgical and electrical parameters like hardness, over-voltage and absorption rate can give useful indications about the

absorption of the Deuterium into the plate: they behave like cross-correlated parameters.

ITALY - HEAT IN NICKEL SYSTEMS

S. Focardi (Dip. di Fisica, Univ. di Bologna, INFN, Sezione di Bologna), R. Habel (Istituto de Fisica, Fac. di Medicina Univ. di Cagliari, INFN, Sezione di Cagliari), and F. Piantelli (Dip. di Fisica, Univ. di Siena, IMO Siena and INFM, Sezione di Siena), "Anomalous Heat Production in Ni-H Systems," *Il Nuovo Cimento*, vol 107A, no 1, January 1994, pp 163-167, 1 ref, 5 figs.

EDITOR'S DESCRIPTION

A 5 mm x 90 mm nickel rod (control is stainless steel) is placed in a vacuum vessel and surrounded (without contact) by a Pt heating element. The chamber is evacuated and filled with hydrogen gas. At elevated temperatures, the Pd rod reportedly produces excess thermal power.

AUTHORS' DISCUSSION AND CONCLUSIONS

Up to now we are not able to formulate any consistent model which comprehends the phenomenon. Nevertheless, we can state a few standpoints on the basis of the measurements performed.

i) The system can be reliably controlled, as the curves of fig. 4 show, allowing for different working points.

ii) The system has been maintained at a mean "power imbalance" of 44 W for a period of twenty-four days (corresponding to about 90 MJ), after that it has been stopped. This amount of energy is beyond that produced in any known chemical reaction involving H_2 and Ni, being at least three orders of magnitude larger.

iii) From fig. 4 it appears that the power required to maintain the unloaded Ni sample at a fixed temperature can be up to twice the one required for the loaded Ni. This power "imbalance" can be considered the "gain" of the system.

iv) No penetrating radiation (neutrons, gamma-rays) was detected above the background level during the process.

These four points are all we can state so far on the basis of the work done. Work is now in progress to verify as a possible candidate for the heat generation, the reaction (p,D), where D is that naturally contained in hydrogen.

INVITED COMMENT ON THE ITALIAN EXPERIMENTS

The layout of the experiment does not describe any kind of calorimetry system. Apparently, the authors recorded the sample temperature and then interpreted the shift in the temperature of the hydrided sample rod when heated by a definite input power heater as being generated inside the sample.

This interpretation may be accurate, however it is suggested that a more thorough calorimetric study be made. One can suggest several various reasons for the hydrided nickel sample to gain higher temperature when being heated with a separate heater. Some of them are as follows:

Change in heat conduction and hence in heat dissipation ability of the hydrided material in comparison with the initial sample material or dummy rod.

Change in heat radiating capability of the sample after having been loaded with hydrogen.

Change in the dimensions of the sample after having been saturated with hydrogen which can cause the surface of the sample to be closer to the heater thus providing higher heating of the sample at the same input power consumed by the heater.

Some other reasons may apply.

From reading the paper, it is not known if the authors took into consideration any of these above mentioned factors. In order to verify their results, the authors should add a high-grade calorimetry system.

Igor Goryachev, ENECO, Inc.

[We look forward to further reports on these interesting experiments. -Ed.]

ITALY - HELIUM MEASUREMENTS

D. Gozzi, R. Caputo, P.L. Cignini, M. Tomellini, G. Gigli, G. Balducci (Dip. di Chimica, Univ. *La Sapienza*, Roma), E. Cisbani, S. Frullani, F. Garibaldi, M. Jodice, and G.M. Urciuoli (Lab. di Fisica, Ist. Superiore di Sanità, Roma), "Helium-4 Quantitative Measurements in the Gas Phase of Cold Fusion Electrochemical Cells," presented at ICCF4, 19 mms pages, 11 refs, 21 figs.

AUTHORS' ABSTRACT

The quantitative determination of the ^{4}He content in the gaseous products of a cold fusion Pd-D_2O electrolysis experiment lasting 1200 hours is reported. The details of the mass spectrometric method, which allows a sub ppb detection limit, are described. In order to check air contamination the ^{20}Ne content has also been, nearly simultaneously, measured. The method employed, while involving an off-line determination on collected samples, nevertheless allowed the collection of an amount of data capable of providing a description of the time dependence of the phenomena.

ITALY - EXCESS HEAT & BYPRODUCTS

D. Gozzi, R. Caputo, P.L. Cignini, M. Tomellini, G. Gigli, G. Balducci (Dip. di Chimica, Univ. *La Sapienza*, Roma), E. Cisbani, S. Frullani, F. Garibaldi, M. Jodice, and G.M. Urciuoli (Lab. di Fisica, Ist. Superiore di Sanita, Roma), "Excess Heat and Nuclear Product Measurements in Cold Fusion Electrochemical Cells," presented at ICCF4, 31 mms pages, 38 refs, 15 figs.

AUTHORS' ABSTRACT

We present the results of a new experiment with our multicell set-up implemented with mass spectrometric measurements of ^{4}He and a highly improved neutron detector. The excess heat measured is *in linea* with the other previous results as well as with other laboratories, while no neutrons and a tritium excess lower than expected from power excess were found. ^{4}He has been measured in the electrolysis gases and a tentative correlation of ^{4}He with excess power is presented and discussed.

ITALY - 3 MeV PROTON MEASUREMENTS

F. Kayumov, B.N. Lomonosov, D.I. Minasyan, V.A. Tsarev (P.N. Lebedev Phys. Inst., Russian Academy of Sci., Moscow, Russia, Dept. di Fisica Univ. di Roma III, Italy), A. Asmone, M. Corradi, F. Ferrarotto, V. Milone, B. Stella (INFN Roma I and Dept. di Fisica Univ. Roma, "La Sapienza", Italy), F. Celani, A. Spallone (Lab. Naz. INFN - Roma, Italy), "Upgrade of the FERMI Apparatus with Charged Particles Detection and Identification of 3 MeV Protons," paper to be presented at Minsk Conference.

AUTHORS' ABSTRACT

The FERMI apparatus is mainly a neutron moderator-detector developed for cold fusion research, situated in the Gran Sasso INFN underground laboratory. It has 40%-8% detection efficiency for neutrons in the range 1KeV-20MeV (25% at 2.45MeV), low background, pulse shape acquisition, and good time resolution for neutron bursts; it also allows us to perform a good statistical reconstruction of the average neutron energy. Gamma rays are revealed mostly by a complementary low background NaI detector with 26% solid angle coverage. The performances are controlled by a full MC simulation, experimentally tested.

The samples are put in the central axial gap. Aside, close to the sample two MWPC's and a CsI scintillator provide charged particles detection, dE/dx and E measurement, with identification of protons in the region of 3 MeV. The performances are tested with α-particles, giving ~ 10% FWHM for each of two MWPC and 20% for scintillation counter (25% and 15% respectively are expected for protons). A three-fold coincidence with very low background drives the data acquisition for protons.

Once assembled together, the system will have the possibility to detect multiple correlations of neutrons, gammas, protons, tritium, thermal effects and deuterium loading. Search for ^{4}He could be possible in the future.

ITALY - NEUTRONS INCREASE C.F.

M. Corradi, A. Asmone, F. Ferrarotto, V. Milone, B. Stella (INFN Roma I and Dept. di Fisica Univ. "La Sapienza" and Univ. Roma III, Italy), F. Celani, A. Spellone, P. Tripodi (Lab. Naz. INFN - Roma, Italy), "Search for Confirmation of Evidence for Stimulated Emission of Neutrons in Deuterated Palladium," paper to be presented at Minsk Conference.

AUTHORS' ABSTRACT

If Pd-lattice "catalyzes" d-d fusion (in non-equilibrium situations), an external nuclear projectile is likely to encounter in Pd-D_x much larger cross sections than with free deuterons. We use moderated neutrons, to perturb the equilibrium deeply in the volume of Pd-D_x without providing substantial kinetic energy. The resulting neutron intensity is measured by the FERMI apparatus, an advanced detector for moderated neutrons.

In a first experiment, we observed an excess of 14.7 ± 0.6 neutrons s^{-1} (≈ 4% of the total measured rate), corresponding to several outgoing neutrons for each neutron impinging on the Pd-D samples. We found <1 MeV average energy of the excess. Similar measurements with fast neutrons gave lower effects.

We have repeated the experiment with the same Pd samples in somewhat different conditions, obtaining a much lower excess. The distribution of the time interval between two subsequent neutron pulses has been also independently studied.

Systematic errors in the first experiment, due to the slightly movable position of the source cannot be excluded, but it doesn't seem to be a likely explanation for the whole of our results.

The process can be interpreted as enhanced d-d fusion in a Pd-D_x lattice perturbed by slow neutrons. This effect would demonstrate that the palladium lattice strongly increases the probability for d-d fusion even almost at rest, addressing a key issue of solid state fusion.

Recently a Russian group tested the same concept with Iodine projectiles, obtaining also a neutron excess.

We are designing a repetition of our experiment, with a more efficient moderator-collimator of neutrons and the extensive use of FADC's for time correlations.

ITALY - PULSED CURRENT EXPERIMENTS

B. Stella, M. Alessio, A. Asmone, M. Corradi, F. Croce, F. Ferrarotto, S. Improta, V. Milone (INFN Roma I and Dept. di Fisica and Chimica Univ. "La Sapienza" and Univ. Roma III, Roma, Italy), F. Celani, A. Spallone , P. Tripodi (Lab. Naz. INFN - Roma, Italy), F. Kayumov, B.N. Lomonosov, D.I. Minasyan, V.A. Tsarev (P.N. Lebedev Physical Inst., Russian Academy of Sci., Moscow, Russia, Dept. di Fisica Univ. di Roma III, at Univ. "La Sapienza", Roma, Italy), "Search for Protons, Tritium, Neutrons, Gamma Rays and Thermal Effects Produced in a Pulsed Current Electrolytic Pd-D Experiment," paper to be presented at Minsk Conference.

AUTHORS' ABSTRACT

In a first experiment with FERMI detector at Gran Sasso underground laboratory, a D_2O-LiOD electrolysis with Pd cathode (previously outgased) was monitored twice a day for tritium content in the solution and in the recombined gases.

Loading the Pd with variable currents, an elongation of 130 mm (with much larger radial broadening) was observed in the first few days, accompanied by a 60 % (in one cell) and 100 % (in another cell, out of three cells) tritium excess detected in the recombined water. Outside this period, the observed Isotopic enrichment compares with time-dependent expectations.

The measured neutron rate in the same period was consistent with the background (95% confidence upper limit of 13×10^{-3} neutrons/s), giving an upper limit of 10^{-6} for the ratio neutrons/tritium. A careful analysis of the measured γ rays spectrum and rate gives a 95% confidence level upper limit of 1.5×10^{-3} relative possible excess respect to the measured background in the range 160 KeV - 7.5 MeV in the same period of the observed cathode elongation and tritium excess. Thermal effects are still being analyzed.

Later on, a special cell has been designed to allow for 3MeV proton detection and for careful monitoring of deuterium loading and of thermal effects. A high current pulsed generator has been designed to provide pulsed electrolysis and high loading. The FERMI apparatus has been implemented with proton detection and identification.

The results will be presented at the Conference.

ITALY - Pd MEMBRANE CATHODE

L. Bertalot, F. De Marco, A. De Ninno, R. Felici, A. La Barbera, F. Scaramuzzi, V. Violante (ENEA, Centro di Frascati, Italy), "The Dynamics of Deuterium in Palladium Investigated Through the Electrolysis of Heavy Water."

AUTHORS' ABSTRACT

At ICCF3 [Nagoya, 1992] a new approach to the study of the dynamics of D in Pd has been presented, with the concurring evidence of excess heat production. The method consists of the use of an electrolytic cell with a special configuration, with the cathode acting as a membrane between the electrolyte and an ambient in which gaseous D_2 can be collected. The permeation of D through the membrane could be related to the appearance of excess heat production. In 1993 new experiments have been performed with the same kind of apparatus, and are reported here: a further evidence of heat excess has been detected, and a correlation between the pressure of D_2 on the gas-side of the cathode and the phase of the palladium deuteride is proposed.

The same type of apparatus is also used in two other experiments:
- in the first one, in collaboration with ISM/CNR of Frascati, the surface of the cathode immersed in the electrolyte is investigated during electrolysis with the help of a X-ray spectrograph, in order to study the variation of the cell parameter, and thus to follow in real time the D charging.
- another experiment, which will be started shortly, will be performed in collaboration with a Group of INFN of Bologna. The measurement of the heat excess (and related parameters) in one of our cells will be performed while the cell is sitting inside a quite sophisticated neutron detector mounted in the Gran Sasso National Laboratory of INFN, where the level of neutron background is 10^3 times less than at the sea level: the possible correlations between charging of D in Pd and heat excess production on one side and the emission of neutrons on the other side will be investigated, with the expectation of giving a clear answer to this still obscure issue in cold fusion research.

JAPAN - SONOLUMINESENCE

Kenji Fukushima (Phys. Dept., Joetsu Univ. of Edu., Niigata), and Tadahiro Yamamoto (Dept. Phys., Tokyo Metro. Univ.), "The Upper Bound of Hot Spot Temperatures Induced by a Supersonic Field," paper to be presented at Minsk Conference, 6 mms pages, 5 refs, 3 figs.

AUTHORS' ABSTRACT

Sonoluminescence has attracted a great deal of attention from researchers in a variety of fields of science and technology. A brief introduction of the phenomenon is as follows: As well known, a supersonic field applied to a liquid induces the cavitation in the liquid and cavities thus created radially oscillate more or less in phase with the applied supersonic pressure field. In their contraction phase the gas content is greatly, adiabatically compressed and as a result a spot of high temperature and high density is periodically created in the liquid. The luminescence phenomenon of a liquid exposed to a supersonic field is just the direct evidence for the formation of a hot spot.

Recently Flint and Suslick succeeded in directly measuring the temperature of a hot spot in a silicon oil through analyzing the spectra of the luminescence from C_2 molecules and obtained the value $T = 5{,}075 \pm 156$ K.

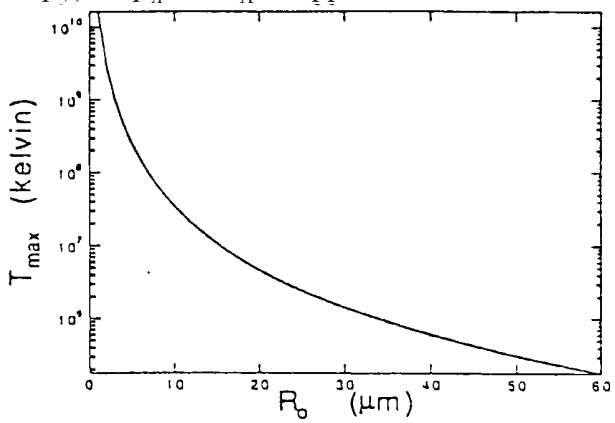
After a year Hiller, Putterman and Barber obtained the hot-spot temperature $T \sim 6$eV by fitting the spectra of the luminescence from an air bubble in water to those of black-body radiation. It seems, therefore, to be an urgent, interesting scientific problem to determine the upper bound of the hot-spot temperatures.

Before entering the subject, we would like to note the following: Since its discovery about sixty years ago the sonoluminescence has intensely been studied and now constitutes a well-established branch of science and technology. Particularly, starting with fundamental hydro- and thermodynamic principles the bubble dynamics has been developed enough and applied successfully to the cavitation phenomena. In the present work we shall extensively use the bubble dynamics.

For simplicity, however, let us at first ignore the compressibility and bulk viscosity of a liquid, assume the stability of a spherical cavity and the spatial uniformity

of a gas content and so on, and then calculate the maximum temperature reached by a hot spot.

We assume that a cavity of radius R_0 is initially in a dynamical equilibrium with a liquid and a supersonic field $p(t) = -p_A \sin \omega_A t$ is applied at t = O.



The Figure depicts the T_{max} against the initial value R_0. In the calculation we assumed the isothermal process for the expansion phase of the gas content and the adiabatic process with specific heat ratio $\gamma = 1.4$ for the contraction phase. Furthermore we used p_A = 4 bar and ω_A = 15 kHz.

It is remarkable that the T_{max} exceeds 10^8 Kelvin when R_0 is less than 10 micron, which is high enough to cause the high-temperature fusion if the gas content is deuterium and preferably the liquid is heavy water.

Needless to say, we have made a lot of simplifications in the calculation and thereby the above statement should not be accepted literally. Particularly we found that the velocity of wall of the cavity exceeds the sound speed of water when R_0 is less than 5 micron, which means the inadequateness of the assumption of the incompressibility of the liquid.

We want to show what happens for a compressible liquid in this paper. [See also *FF*, vol 5, no 9, March 1994, p 6, for review of Schwinger's explanation of sonoluminesence. -Ed.]

JAPAN - NUCLEAR EMULSION TRACES

Takaaki Matsumoto (Dept. of Nuc. Eng., Hokkaido Univ., Sapporo), "Extraordinary Traces on Nuclear Emulsions Observed During Electrical Discharge in Water," paper to be presented at Minsk Conference, 4 mms pages, 4 refs, 2 figs.

AUTHOR'S ABSTRACT

The Nattoh model has been proposing that cold fusion reactions occur when a hydrogen-cluster is compressed into a tiny particle. In the compressed state, internuclear distances are so short that various kinds of fusion-like reactions can take place: (1) a new two-body fusion reaction that mainly produces helium-4 instead of helium-3, (2) multibody fusion reactions that contribute to the production of new elements and (3) in the most significant case, the production of tiny black holes and white holes. The compression process can be enhanced by electrical discharge that induces additional electrons into the hydrogen-cluster.

Here experiments of cold fusion were performed using electrical discharge in water. Pulsed AC (50 Hz) of up to 100 V were applied to wire electrodes of nickel and palladium (0.5 mm o) in ordinary water mixed with 0.50 Mol/1 potassium carbonate. The reactions were observed by a system utilizing a microtelescope and VTR and nuclear emulsions. The following results were obtained.

a. Cold fusion reactions were easily induced on the surface of the metal with the mediate voltage.
b. Strange traces indicating the cold fusion reactions were recorded on the nuclear emulsions. For example, explosive traces of multiple neutrons, stars resulted by multibody fission reactions and combined rings of tiny ball lightning.

The similar experiment of the AC cold fusion will be demonstrated at the conference.

JAPAN - Fe PRODUCTION ON Au ELECTRODES

Tadayoshi Ohmori and Michio Enyo (Catalysis Research Ctr., Hokkaido Univ., Sapporo) "Detection of Iron Atoms on Gold Electrodes Used for Electrolysis of Neutral and Alkaline H_2O and D_2O Solutions," paper to be presented at Minsk Conference, 18 mms pages, 8 refs., 6 figs, 3 tables.

AUTHORS' ABSTRACT

Detection of any products possibly produced during the excess heat evolution by electrolysis was attempted on Au electrodes, in parallel with the excess heat observations. The electrolytes used were K_2CO_3, Na_2CO_3, Na_2SO_4, KOH and NaOH. The electrolysis was performed for 7 days with a constant current of 1 A.

The electrode surface was then analyzed by means of AES spectroscopy. In every solution a notable amount of Fe atoms were detected, being in the range of 1.1 to 9.9 x 10^{16} atoms. These values are much larger than those contained as impurities in the reagents used (ca. 7 x 10^{14} atoms for Na_2SO_4) or possibly originated from the cell materials. The mean excess heat observed was in the range of 187 to 723 mW. The amounts of Fe atoms observed were approximately proportional to the total amounts of the excess energy observed during the electrolysis. These results suggest that the iron formation reaction may be responsible for the excess heat evolution.

JAPAN - SONOLUMINESENCE - UV CAUSED?

Thomas V. Prevenslik (Consultant, Tokyo), "Sonoluminescence, Cold Fusion, and Blue Water Lasers," paper to be presented at Minsk Conference, 4 mms pages, 5 refs, 1 fig.

AUTHOR'S ABSTRACT

The blue light observed in sonoluminescence experiments with water is explained by Rayleigh scattered ambient UV light reflected in a blue Raman line of water. The ambient UV light incident on the spherical liquid geometry is concentrated to a high intensity and reflected in a Raman line that appears to the observer as blue light. The spherical liquid geometry functions as a spherical UV lens that concentrates ambient UV light at the center of the water compression field. By providing an external spherical UV laser cavity driver concentric to the spherical liquid lens, the concept of a cold fusion blue water laser is developed where the laser driver is pulsed with the acoustic field to fuse the deuterium in heavy water molecules. The blue water laser is a cold fusion device because the liquid structure required in concentrating the UV light would only operate below about 50 C, say in an application as a residential heater, even though the local hot fusion reaction is actually producing the heat.

JAPAN - FISSION WITH COLD FUSION

Reiko Notoya (Catalysis Res. Cntr., Hokkaido Univ., Sapporo, Japan), "Cold Fusion Accompanied with Fission During Electrolysis in Alkali Ions' Solutions on Porous Nickel Electrode," paper to be presented at Minsk Conference.

AUTHOR'S ABSTRACT

During electrolysis of light water solution of potassium ion using the specially designed porous nickel cathode, more than 200% excess heat and the increase of the concentration of calcium ion in the electrolyte measured by flame photospectrometry were observed, which seemed to be due to the alkali-hydrogen cold fusion.

A considerable heat evolution was also observed in each case of the other alkali-metallic cations on the same cathode. The several kinds of fission fragments proved to be produced in the order of ppm as well as the fusion products during electrolysis in each electrolyte as the results of the analysis in terms of ICP-MS and a liquid scintillation spectrometer, simultaneously with the calorimetry and the flame photospectrometry.

The kinetic consideration about these nuclear processes will be undertaken in the paper.

JAPAN - PRESENT C.F. RESEARCH

Chemical Abstracts, 21 February 1994

Akito Takahashi (Dep. Nucl. Eng., Osaka Univ., Suita), "Cold Fusion Research: Present Research," *Koon Gakkaishi*, 1993, vol 19, no 5, pp 179-185, in Japanese.
A review with 11 refs. is presented with the emphasis on the important experimental results and theoretical model.

ROMANIA - LOGICAL NETWORK APPROACH

Peter Glück (Inst. of Isotopic and Mol. Tech., Cluj-Napoca) "Cold Fusion - A Logical Network Approach," paper to be presented at Minsk Conference, 4 mms pages, 16 refs.

AUTHOR'S ABSTRACT

The great obstacles in the way of general acceptance and rapid development of cold fusion are: the difficult-to-comprehend diversity of systems, phenomena and results: the difficult-to-recognize difference from plasma hot fusion and the most difficult-to-accept difficulty of both experiment and theory. A strategy, based on the author's SURFDYN

concept, on a breadth-first approach and on cooperation is presented. The aim is to stimulate discussions on the subject `strategy' at the Symposium.

AUTHOR'S CONCLUSION

Due to the immense theoretical and experimental problems, the future development of the new science and technology of cold fusion will be based mainly on know-how data and working hypotheses (as our SURFDYN). However, some fundamental theoretical issues as the nature of the reactions have to be explained in the near future. The keyword for this action just as for the essence of catalysis is cooperation: both international cooperation and cooperation of the theories which have to be considered complementary and not contradictory. For example, SURFDYN has a lot in common with Filimonov's synergetic activation model (self-organization) as well as with the catalysis by trapped neutrons of Mizuno and so on... An efficient strategy has to rely on cooperation, in all the three meanings of this word used in this paper.

F. LETTERS TO THE EDITOR

LETTER FROM DAVID MOON

Dear Hal,

Thank you for the coverage of "A Cold Fusion Theory" in the November issue. Enclosed (see page 21, *FF*, March 1994) is a short addendum to the theory, which deals with 17-MeV protons (ref. *FF*, Nov. 93, J. Kasagi, Japan - Energetic Charged Particles, pp 14-15). In the same issue, the letter from Leland Hosford (p 22) caught my attention. His discussion of "resonant frequencies of the hydrogen atoms" in the metal lattice strikes a similarity with resonant oscillations of trains of deuterons, hypothesized to be in the microwave range, given in the theory.

I commented to Dr. Glück that if the theory should prove to have merit, it would be nice to see it given consideration in the proceedings of the Minsk Conference in May.

Your assistance is continually appreciated,
/s/ David Moon

ADDRESS

[One criticism of Moon's work is that he needs to check to see if some of the "possible" reactions are "allowed" when considering the conservation of spin. - Ed.]

LETTER TO *NATURE* FROM PETER GLÜCK

9 March 1994

Dear Sirs,

Nature is received in our town in two libraries (the Lucian Blaga Central University and that of the Soros Foundation) and I read it every week, mainly on Saturdays with a real intellectual pleasure: it is up-to-date, it has excellent papers, clever comments, a good staff ... it is a delight to read your Journal.

However, there is one very unfortunate exception: the manner in which you present the news regarding cold fusion. Your rhetorically entitled comment "Is Japan throwing good money after bad science?" is a typical example (vol 367, 24 Feb. 1994, p 670).

From this note the readers can learn that the poor Japanese lack good reviewers and therefore they invest money in a problem which actually doesn't exist. O.K., this is your opinion and we have to admit you are entitled to it. However, you further suggest that this money will be spent by a single new lab somewhere in Hokkaido, working with only 6-7 scientists hired from the great Japanese companies and that these researchers are unable to demonstrate the slightest traces of cold fusion. In other words the activity in this field in Japan is minimal.

Actually, justified or not, the Japanese effort is impressive, and comprises both State and private funding; a lot of institutes, universities and companies are wasting money, time and creativity for this dead problem. [See *FF* review, this issue p 12] I have serious doubts that Dr. Swinbanks is aware of the extent of this effort as well as of the similar useless activities in some U.S. research centers, in Russia, Ukraine, Belarus (27 institutes working in the former Soviet Union), China, India, Italy (ENEA, Fiat, Montedison, a brand-new lab now at Siena), Spain and coming very fast, France. I will consider that you are really not informed and will send the list of the Japanese papers presented at the Fourth International Conference on Cold Fusion, Maui, 6-9 December 1993. This will help

you to see what actually is happening. Otherwise, at Maui 300 participants have presented 150 papers: 52 from the U.S., 33 from Japan, 25 from Russia, 15 from China, 8 from Italy, 6 from France, 5 from India, 2 from Spain and 1 each from Canada, Belarus, Poland, and Switzerland.

I know well that it is quite difficult to explain to your readers how an "obviously" nonexistent field has such an incredible vitality, why it is so far from retreat, how it is possible that it is studied by professionals and how could it get even some modest but constantly increasing funding. Or is it some really unexpected, very different class of nuclear phenomenon?

When I read such biased reporting as that, worrying for the Japanese money, I feel I have to ask: are these the same people who have published so many good papers and who have published e.g. Vladimir Koliadin's letter (vol 367, p 6462, 3 Feb. 1994) which blames such campaigns as theirs against cold fusion?

I want just to mention that earthquake and cold fusion are connected, the common keyword is exoelectrons (please see *Chemical Abstracts* 119:260064).

For your information, I am sending you my paper describing my explanation of the cold fusion mystery, as well as two of my essays, one demonstrating that no essential subfield of solid state science has a complete theory and the other depicting some historical roots of the situation of cold fusion.

I know that *Nature* is planning to celebrate its anniversary this year with a series of events that may reinforce its international and public reputation. Couldn't you include there an open discussion with the people working in the field of cold fusion? (Here is a list of 32 Japanese papers, with authors, addresses from ICCF-4.)

Your computer can easily find (in *Chemical Abstracts*) the 58 cold fusion patents of Japanese companies issued until the end of 1993. However, the future patents of Hitachi, Sanyo, Seiko-Epson, Nippon Telephone & Telegraph, Matsushita, Fuji Electric, Canon, etc., will be much more important. They are on the way.

The involvement of the Japanese (or according to you, the amount of wasted money) is even greater. I will give you some data from *Fusion Facts*, one of the four American newsletters specializing in cold fusion, or to be really correct, Chemically Stimulated Nuclear Reactions (Aug. 1993, vol 5, no 2, p 2). The author is Jed Rothwell, an American who speaks Japanese. "In 1992, MITI organized a cold fusion research and development consortium including 10 of Japan's largest corporations... The members of that consortium include: the Chubu Electric Power, Hitachi, Toshiba, Fuji Electric, Toyota and others. The research is directed by a team of top scientists (however, bad reviewers) from these corporations, lead by ... Drs. Fleischmann and Pons, in their role as senior advisors to MITI. They work for Toyota, but they also help direct the government program... The head of the Government program, Professor Ikegami, estimates that 20 of the big corporations are "serious about this research." Some of the smaller companies... had only one or two people [in this research]. Big companies appeared to have 10 to 20 and Toyota (the IMRAs on my list!) have at least 80..."

I want to mention that F&P's new lab near Nice (IMRA Europe) has wasted at least 6 million dollars, it's a real marvel.

May I hope that you will read my letter before throwing it into the wastepaper basket? I really envy the authors of those 'farewells' and 'out, out brief candles' given they will soon know which was the greatest mistake of their life... actually it wasn't because cold fusion is so much different from plasma fusion.

Do you want to know how different? Have the kindness to read my Fusion Technology paper to understand the problem of reproducibility, my essay about the 'neighbor's goat' to realize why cold fusion has no complete theory as yet, and my scipiology essay to know the future of cold fusion. To solve the mystery of the reactions I advise you to read -- for a first idea -- Jacques Dufour's paper (*Fusion Technology*, 24 Sept. 1993, pp 205-228).

And please send a very young, completely innocent scientific collaborator who doesn't know that cold fusion doesn't exist to the Minsk Conference!

Yours faithfully, Peter Glück

[How good are the chances that *Nature* will really read the suggested material? And would the reading do them any good if they do read Glück's material? Their future editorial policy will tell. Perhaps, like a MIT scientist said, "I guess I'll be a believer when someone

drives a [probably Japanese] cold fusion powered auto into the parking lot." --*FF*]

G. MEETING & MISCELLANEOUS

REFERENCE ALERT

EBSCO's Magazine Article Summaries (MAS) are available on CD-ROM/PC at many libraries. Many new sources of information can be found simply by using this resource. A Keyword Search in Titles and Summaries only, not in full-text, for the keyword "cold fusion" brought up 195 references, dating from the present back to a *Science News* article in February of 1987. References included news articles, book reviews, product/equipment reports, and interviews. With the addition of Full Text to the search directive, references to cold fusion may be found in articles on completely different subjects (28 more references added to the list).

COLD FUSION 2001 ESSAY CONTEST

The editors of *Cold Fusion* Magazine are pleased to announce an essay contest. The rules are simple and the rewards are high. It is an opportunity to expand your horizons and publish your thoughts in the same magazine with authors like Arthur C. Clarke, Nobel laureate Julian Schwinger, and others.

First prize: 7-year subscription to *Cold Fusion* magazine, and an engraved one-ounce palladium medallion and your essay to appear in *Cold Fusion* magazine. **Second prize:** 3-year subscription to *Cold Fusion* magazine and an engraved pure nickel "cold fusion" rod, and your essay to appear in *Cold Fusion* magazine. **Third prize:** 1-year subscription to *Cold Fusion* magazine, and your essay to appear in *Cold Fusion* magazine.

Contest Rules

1. Type or print an essay of 2,000 words or *less* (no need to write 2,000 words -- quality, not quantity is important) on the general theme: "How 'cold fusion' will change the world between May 1994 and January 1, 2001.

Suggested areas of focus:
· How the technology will develop; · How the technology will be applied for consumer use, industry, agriculture, health, space exploration, etc.; · How scientific understanding of cold fusion will emerge; · The social effects, economic effects, and the geopolitical effects; · The effects on the human condition, art, religion, philosophy, etc.

2. You are encouraged to create an interesting title for your essay (other than using the theme as title), but you must stick with the theme given above.

3. The judging and awarding of prizes for this essay is the *sole discretion* of the editors of *Cold Fusion* Magazine. Additional honorable mention prizes may be awarded, which may include being published in *Cold Fusion* Magazine.

4. Entries must be the original work of the author.

5. Please submit three paper copies of your essay (and please include a computer diskette with the text, if possible).

6. Entries must be postmarked no later than August 31, 1994.

7. **Warning:** *Nasty* essays may win "booby prizes" AND *may* be published.

Mail entries to: Gene Mallove, Editor, *Cold Fusion* Magazine, 70 Route 202 North, Peterborough, NH 03458.

MINSK COLD FUSION CONFERENCE
MAY 24-25-26, 1994

A bilingual, international conference on cold nuclear fusion and affiliated energy systems will be held in Minsk, Republic of Belarus during the last week of May, 1994. Papers accepted will be published in English and Russian editions of proceedings, the Cold Fusion Source Book, that will be provided to attendees at the start of the conference. Presentations of the papers can then concentrate on the latest developments and the answering of questions. The proceedings are expected to provide a tutorial overview of the new science of cold nuclear fusion for a multi-disciplinary audience and provide the latest experimental and theoretical findings.

Registration fee of $250 includes full room and board. 80% of the registration fee (US$ 200) is to be sent to **Joint Stock Commercial Bank, "Priorbank" account**

N707955 with a note "Symposium Registration Fee", to bank address: **31/A Khoruzhaya Str., Minsk, 220002, Belarus immediately**. The other 20% (US$ 50) is to be paid in cash to the organizing committee on arrival.

Institute for New Energy's
INTERNATIONAL SYMPOSIUM ON NEW ENERGY
A symposium for Professionals, Industry, Lay people and News Media

The Institute for New Energy will sponsor an International Symposium on New Energy to be held in the Denver Hilton South in Denver, Colorado on **Thursday, May 12, 1994 through Sunday, May 15, 1994**. Fees: Registration between April 1 and May 1, $175; Registration after May 1, $200; Workshops $20 each, and Banquet $25. Checks should be made payable to the **Institute for New Energy** and sent c/o *New Energy News*, to P.O. Box 58639, Salt Lake City, UT 84158.

Expected Speakers: Harold Aspden - Ferromagnetics; Shiuji Inomata - "N" machine; Stefan Marinov - Perpetuum Mobile; Harold Puthoff - Zero Point Energy; Prof. John Searl - Electro-Gravity experiments; Paramahamsa Tewari - Space Power Generator; Dennis Weaver - Ecology/ Economics.

Some of the speakers will present concurrent workshops on the evenings of May 12, 13 & 14, from 6:30 to 9:30 p.m. The Banquet will be held Sunday at noon.

Subjects to be presented at the conference will include all types of **New Energy** topics such as those covered in each issue of *New Energy News.* Specifically, papers are solicited covering both theory and practice of energy producing devices and systems such as **cold nuclear fusion**, rotating N-Machines, Solid-State energy systems, Magnetic over-unity machines, Tapping Space Energy (Zero-Point Energy), gravity control techniques, energetic transmutations (nuclear reactions), and other new energy research.

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