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

VOLUME 4 NUMBER 4 FUSION FACTS OCTOBER 1992

CONTENTS FOR OCTOBER 1992

COMING IN NOVEMBER

The November issue of *Fusion Facts* will cover the Third Annual Conference on Cold Fusion to be held in Nagoya, Japan from October 21 to 25, 1992.

ERRATA

On page 13, second paragraph, of the September, 1992 issue of *Fusion Facts*, please change the phrase Pd/Ni alloy to Pd/Ag alloy.

A. NAGOYA PREDICTIONS

By Hal Fox

As this issue of *Fusion Facts* goes to press, we would like to share with you some of the expected highlights of the Nagoya cold fusion conference. Our close communication with many of the scientists who will be attending the conference gives us a prediction vantage point. Here is what we expect will be the highlights of the conference:

FLEISCHMANN & PONS

We expect to see a video presentation showing some of the Fleischmann-Pons latest experimental work. We expect to see pictures of electrochemical cells in which the excess heat from the palladium/silver alloy cathode is causing the electrolyte to boil. We also expect to learn that there are still difficulties with replication and that not all batches of the palladium alloy that they use are effective.

TAKAHASHI

We expect to hear from several experimenters who have replicated or tried to replicate the Takahashi version of the heavy-water electrochemical cold fusion cell. Dr. Edmund Storms is expected to present his excellent research efforts in which he identified some of the reasons why two different batches of palladium from the same Japanese source did not function the same in replicating Takahashi's work.

LIGHT-WATER COLD FUSION

It is anticipated that at least three groups will present who have successfully produced excess heat in cold fusion cells using demineralized light water, nickel cathodes, and electrolytes based on various alkali-metal compounds (mainly the carbonates). We expect to hear that several groups have achieved over 300% excess heat with light water cells. In contrast to the experimental efforts using heavy water and palladium or palladium-alloy cathodes,

the nickel cathode, light-water cells work almost every time. The experimental work by Drs. Bush and Eagleton (Cal Poly) is expected to be presented. Other reports are expected from BARC and from Japan.

NUCLEAR CATALYSIS & TRANSMUTATION

To the extent that a nuclear reaction produces another element, transmutation is the expected result or byproduct of a cold fusion reaction. In previous cold fusion conferences much attention has been given to the production of neutrons, tritium, and helium. Some papers have given an indication of "isotopic changes" during cold fusion. This cold fusion conference, we predict, will be the first conference in which nuclear catalysis is seriously suggested and where transmutation byproducts are reported. *Fusion Facts* suggests that this subject may be the most controversial subject presented at the conference. Dr. Peter Glück is expected to present his SURFDYN (surface dynamics) paper on the possibility of nuclear catalysis. Bush and Eagleton are expected to present data on measurements of transmuted elements.

RECOGNIZING A NEW SCIENCE

If we define a "new science" as one in which some of the fundamental concepts of "received doctrine" will have to be modified, then cold fusion must be recognized as a new science. This third international conference on cold fusion will likely be the historic turning point for the scientific and news media both in recognizing cold fusion as reality and in recognizing that some cherished beliefs in some scientific specialties will require modification. It is hoped that this shift in science can be accomplished without further personal attacks and that Drs. Fleischmann and Pons will receive the credit they deserve as true science pioneers.

THEORIES AND MODELS

If we accept the definition of a model as being predictive of experimental results and a theory as being both predictive and giving insight into the precise nature of an observed phenomenon, then the Nagoya conference is expected to provide us with both. To date, the Bush TRM has been the most predictive model (in our opinion). Bush's new Transmission Resonance Model is expected to become more widely accepted. Dr. Peter Hagelstein has been one of the leading theorists and we expect further enlightenment from his latest work. Among other leading cold fusion modelers and theorists (alphabetically) are Aspden, Bass, Chubb & Chubb, Glück, Matsumoto, Mills, Preparata, Schwinger, and Leaf Turner. (My apologies to some whom I have left out.) We expect new and important insights into the nature of cold fusion from these and other scientists.

COMMERCIALIZATION

Fusion Facts has been harping about commercialization of cold fusion since early in its publication history. New scientific knowledge is important. More important for the new science of cold fusion (and other enhanced energy systems) is the application to solving energy and pollution problems of this planet. We strongly expect that the results of this Nagoya conference will be to place the timing of commercialization of cold fusion within predictable range. At least four American companies have been organized and/or funded to promote cold fusion. The business plans of these companies include the commercial development and/or marketing of cold fusion reactors. Two of these companies base their plans on the commercialization of light-water cold fusion reactors.

SURPRISES ARE PROMISED

The editor of *Fusion Facts* will be in attendance at the Nagoya conference to bring our readers an early report on the conference papers. This conference report will be printed in the November 1992 issue of *Fusion Facts* which is expected to be mailed on or before November 15, 1992. We are sure that there will be some new surprises. We are equally sure that there will be almost no papers presented proclaiming that cold fusion is a fiasco or that cold fusion is not a scientific reality.

PREDICTED RESULTS

The Third Annual Cold Fusion held in Nagoya, Japan in October 1992 will become the media "turning point" for the gradual (and perhaps, grudging) acceptance of cold fusion as a new science. The media in Japan has already stated, "Cold Fusion can no longer be denied!" The news media and the popular science media in other countries, even in the United States, will gradually recognize cold fusion as reality after the Nagoya conference. Eventually, even the American Association for the Advancement of Science and the American Physical Society will accept cold fusion as a reality. It is predicted that Dr. Morrison will suggest that better work is now being done but that excess heat is probably the result of artifacts. Jerry Bishop of the *Wall Street Journal* will write a favorable article about cold fusion. The *New York Times* will ignore the issue or interview some skeptics, who have never performed a successful cold fusion experiment, and who will proclaim cold fusion to be a fiasco. The boldest prediction of all: a commercial version of a cold fusion reactor will be available in the form of a manufacturing prototype before the Fourth Annual Conference on Cold Fusion is held.

See "NEWS FROM ABROAD" under JAPAN for latest news.

B. OBSERVATIONS ON COLD FUSION

By Dr. Harold Aspden, Southampton, England

About the Author:

Dr. Aspden was Director of European Patent Operations for a large U.S. corporation before retiring to pursue research on anomalous electrodynamic energy transfer processes. The author has been a Visiting Senior Research Fellow at Southampton University in England from May 1983 to June 1992. He recently formed Thermodynamics Ltd, an U.K. company to commercialize some of his research findings. This paper is, in part, an outgrowth of the author's recent struggle with the U.S. Patent Office on the subject of cold fusion.

September 12, 1992

In England, a few days ago, Southampton was the host location of a Science Festival held under the auspices of the British Association for the Advancement of Science. Over 5,000 people visited the week-long event, which had extensive news coverage.

Professor Martin Fleischmann attracted favorable publicity. This publicity was in contrast to local university coverage of the 1989 cold fusion announcement and the following media reports in the U.K. which led to the belief that cold fusion was a dead issue. Now one is left to watch and wonder as the cold fusion situation develops.

The *New Reporter* (published by the Univ. of Southampton) published a September 9, 1992 article [pg 4] entitled, "The chemist who came in from the cold." The article explains that Prof. Fleischmann has backed up his previous claims by the public showing of a video of a cold-fusion cell bubbling intensely and emitting 1 kilowatt of excess heat per cubic cm. of cathode alloy. The report declares "Professor Fleischmann told the lecture [attendees] that the process needed to be made far more controllable and sustainable before anyone could think of building practical cold-fusion devices to generate energy."

Now, here we have a very interesting situation from a patent point of view. A video (which can no doubt be authenticated) which demonstrates excess heat generation on a scale that must imply new physics, if not a cold fusion reaction, should suffice to convince a U.S. patent examiner. The examiner has to be careful in checking that a patent application based on that heat generation is not frivolous and in defiance of natural law. However, the U.S. Patent Office may go further and insist that the patent specification must explain how to realize the invention by disclosing an embodiment which, if built, will work as stated. One may wonder if it suffices to have an invention that works in its own good time in a sporadic and irregular way!

This author's experience of filing two patent applications with the U.S. Patent Office relating to cold fusion is, first, a request to severely curtail the scope by "election of species", which in the circumstances of these particular applications (which were not chemically based) was a clear warning that the Patent Office intended to restrict patent grants in this field. Secondly, at the next action there came [in the mail] an overwhelming set of cited publications purporting to show that cold fusion was not possible. From the perspective of someone who has spent a lifetime in patent professional activity, it comes as quite a surprise to be told that your invention (which aims at enhancing the energy-producing reaction in a way only disclosed to the Patent Office) will not work because a publication in the *Wall Street Journal* [and the *New York Times*] said that others had tried to replicate the basic F-P process and failed!

One can, therefore, conclude having regard to the many patent applications now of record that, if Fleischmann and Pons eventually win through in proving that cold fusion is a reality, the U.S. Patent Office will be a repository for many patent applications that have been rejected because a Patent Examiner has acted on a false premise.

We will then see patents granted elsewhere in the world, patents which will block export of U.S. developed versions of the technology, but there will be no pioneer patents which foster United State's development and investment and protect U.S. interest at home. Such is the price which is, one presumes, now being paid for [the Patent Office] taking too dogmatic a stand on the issue of cold fusion [emphasis added].

Another aspect of the U.S. Patent examiner's posture on the cold fusion applications filed by this author is the extremely long statement of rejection, which resembles, in the most part, a pre-formatted word-processor standard "cold fusion" rejection. The parts which this author finds particularly irritating are those paragraphs which state that no reputed authority has published anything indicating that cold fusion is a reality or that there is any excess heat generated in processes where deuterium is absorbed into palladium.

This series of false statements has caused the author to draw the U.S. Patent Office's attention to the authoritative book on the subject which certainly relies upon peer-reviewed research by reputable academic and government contributors and which points to verified evidence revealing excess heat anomalies when deuterium is present in palladium.

Reference is made to volume 29 in the series Topics in Applied Physics, published in English by Springer-Verlag (Berlin, Heidelberg and New York). Volume 29 is entitled Hydrogen in Metals II and was published in 1978, which is years before the emotion on cold fusion arose. Obviously, if there is excess heat generated in a metal which hosts hydrogen or deuterium, that excess heat must affect the specific heat property as measured. The U.S. patent examiner, in declaring that there is no reputable evidence of record that indicates excess heat, was therefore not aware of the anomaly indexed in the above text under the heading "specific heat, excess" which directs the reader to page 115 of that work. On page 114 one reads, "They obtained a continuing heat evolution at temperatures below the anomaly, also investigated by ..."

The book and the reference therein cited show that the plot of specific heat against temperature for palladium hosting hydrogen or deuterium has peaks which probably relate to the phase changes and resemble the specific heat anomaly observed as a ferromagnet passes through the Curie temperature. This effect is the action we know occurs as a ferromagnet, in cooling through that temperature, delivers more heat than one expects from its normal thermal excitation. That heat can be said to come from the zero-point background field energy source which primes the Planck quantum of action. Indeed, the analogy with the cold fusion situation warrants more than cursory attention. [Reference is: J Am Chem Soc, Vol 79, (1957), pg 3627 ff.]

With reference to the palladium that is hosting hydrogen or deuterium, the referenced data reveals specific heat peaks at around 55K for PdH and PdD but the measurements reported only extend to room temperature conditions, although it is evident from the data that there is a developing anomaly in the PdD plot at the higher temperature portion around 280 and 300 K. [E.g., Fig. 2 in D.M. Nace & J.G. Aston, J. of Am Chem Society, Vol 79, (1957) p 3657.]

The author does not suggest that these energy processes are of the same nature or magnitude as encountered in the Fleischmann and Pons cells, but here is evidence of "reputable record" that shows anomalies exists on a small scale. It is such anomalies, in all fields of alternative energy research that are the pointers to new processes and it is the task of the inquiring scientist to follow such hints of excess heat to find ways to enhance a process to secure a technological advantage and improve the understanding of nature.

It is to the credit of *Fusion Facts* that the scope of this process is being extended to reporting on other energy processes. This author's interest is founded in research concerning anomalous energy activity in the electrodynamic action between heavy ions, such as protons, and electrons. Note that deuterons moving through the palladium cathode in the cold fusion cell are candidates of interest when one considers the long-standing anomalies found in plasma research and cold cathode discharges, and also in the anomalous explosive forces for electrical discharges through water.

The Intersociety Energy Conversion Engineering Conference was held on August 3-7, 1992 in San Diego, California. Gary L. Johnson there reported on "Electrically Induced Explosions in Water." This research confirms earlier work which shows us that when a capacitor charged to a few kV is discharged through water there can be explosive actions of "loudness distinctly greater than an equivalent amount of gunpowder" without any evidence of the water having been turned into steam in this process. Johnson suggests that there is an "over-unity" action, meaning that energy in excess of that supplied is being produced.

In the author's opinion, this experimental observation may be related to cold fusion research. The electrodynamic forces between currents carried by heavy ions (hadrons) and currents carried by electrons (leptons) will, in theory, breach the conventional formulations in physics. The evidence point to a breach of Newton's third law of motion when those hadrons (if in a vacuum or low-density medium) experience a potential drop of the order of 3 kV or higher. This breach means that an anomalous force (which implies anomalous energy transfer from whatever background, e.g. the zero-point energy field) defines the seat of the electromagnetic reference frame. In palladium, in a cold fusion cell, the metal lattice is predominant in holding the local electromagnetic reference internal to the cathode in place and the deuterons are free to migrate through that lattice without needing the 3 kV potential to activate their freedom. A palladium cathode filled with mobile deuterons and connected in a circuit carrying electron current may replicate the conditions of the discharge through water (featured in those explosive experiments). Note here that the drift velocity of the deuterons may be less important from an electrodynamic energy enhancement viewpoint than is the thermal motion.

Long before the Fleischmann and Pons announcement this author had published work on the structure of the deuteron which argues that it is constantly changing states between three forms, one of which prevails for one-seventh of the time. This form of the deuteron has a neutral core associated with a satellite "hole" or positive beta particle. [See "The no-neutron deuteron" in *Fusion Facts*, March 1990, Vol 1, No 9, pp 1-6.] The deuteron, when within a palladium host metal in which it is in a free conduction electron environment, presents a neutral state during transitory periods which exposes it to collision situations (in the metal lattice) that cannot occur, except violently at high energy, in the free state.

It therefore follows that if the anomalous electrodynamic actions which we know are asserted on the heavy ions (which are anomalous by factors measured in thousands) are caused to enhance the mobility of the deuterons in the palladium host, then we have conditions that might well be the trigger for a fusion reaction.

If, as Fleischmann and Pons suggest, the use of cathodes comprising alloys of palladium and silver are giving better results in cold-fusion research, then this fact has implications which cast new light upon the theoretical factors involved.

Referring again to that authoritative volume 29 of Topics in Applied Physics, and keeping what has just been said in mind, as well as the Fleischmann problem with the time-lag aspects of the cold-fusion process, it is appropriate to examine the time-lag data presented on page 141 of the cited work. The data in that 1978 volume show that there is a time-lag before the hydrogen concentration in palladium begins to build. Similarly, the flux of hydrogen, the rate at which the hydrogen flows through the metal lattice, is subject to a time delay before building up to its steady level. The latter involves the shorter delay, which means that there is an intercept value that gives a characteristic "breakthrough" time.

As applied to deuterium, the incidence of the cold-fusion reaction is governed by the parameters of concentration density and flow rate being matched in some way, and the time-lag factor does become critical. The suggestion is that the deuterons have to have **room to move** under the anomalous acceleration conditions that are indicated from electrodynamic considerations. If there are too many deuterons then they all drift together and do not get up the speed needed for a fusion collision. If there are too few deuterons then the chance of collision is reduced anyway. One needs **room to move** plus something that enhances the acceleration and collision processes.

It was for this reason that the author proposed apparatus in his patent applications by which, separate from the anode-cathode current, a circulating current was caused to flow confined within the cathode. Electrons might dominate the current flow but the potential driving those electrons also acts on the deuterons and the ohmic heating of the electron current could be worth discounting against the heat gain from enhanced fusion. By using a mixed metal cathode with segments of palladium and another metal such as silver, the circuit conditions for generating the anomalous electrodynamic effects would be further enhanced. The point here is that the leptonic action of electron current through metal that is a poor host for deuterons when acting upon the deuteron flow in palladium will bring into play the actions that can generate those very high anomalous forces driving the hadronic deuteron motion. The segmented metal cathode circuit powered as a short-circuited secondary winding on a transformer was the feature of the author's second patent application, already mentioned.

It is not the purpose of this paper to present a complete physical theory, but in the section beginning on page 290 in the referenced volume 29, there is the intriguing discussion of the apparent enormous negative charge associated with the mobility of deuterons within the metal silver. Whereas deuterons in palladium exhibit from their mobility a positive charge of about half the normal unit charge e, for some reason those same deuterons in silver become charges of -18e. Hydrogen in silver exhibits a charge of -6e.

This fact could point to the "secret" underlying the cold-fusion process in a palladium-silver alloy. It appears that in the metal silver deuterons exhibit a charge -18e which is really caused by a mobility imparted to them by what is, in the referenced book, call **electron wind**. The deuterons are forced, by a current which transports electrons, to be dragged along in the wrong direction against the normal field potential, so that in silver they travel with the **electron wind**. Now, in palladium, they travel against that wind and the effective charge is about half of the unit charge e as a result. Imagine therefore the activity at the interface of a small crystal of silver embedded in the palladium in an alloy of palladium and silver. Imagine that deuterons are present in large measure, albeit with enough room to move, as it were, when a current is caused to flow through the cathode composed of that alloy. Imagine further that those deuterons are, as this author suggests, transiently neutral each with a satellite positive beta particle in close attendance. At the interface between the palladium and the silver the flow of current will bring deuterons in the palladium into head-on collision with deuterons in the silver, as the latter are forced to travel in the electron flow direction. The electrons will neutralize the satellite positive beta particles, leaving transiently neutral deuteron states subject to collision. With no mutual repulsion to contend with, this situation must provide the basis for a fusion reaction. Hence, in conclusion, the suggestion is to use a palladium-silver alloy cathode of large grain structure and connect the cathode as a closed secondary winding of a transformer powered with low frequency alternating current, while feeding direct current in the normal way around a circuit including the anode and the cathode.

EDITOR'S COMMENTS

Fusion Facts is pleased to present Dr. Aspden's insight into the anomalies of both cold fusion and the U.S. Patent Office. Since the time of the first conference on cold fusion (May, 1989 in Los Alamos) there has been considerable discussion on whether the cold fusion nuclear

reactions occurred within or on the surface of the palladium cathode. Experimental evidence since that conference has seemed to confirm both. However, in the case of both light- and heavy-water experiments using alkali-metal carbonates and nickel cathodes, the fusion reactions appear to be catalyzed on the surface of the nickel. As the cycle of experiments and theory development continues, it is predicted that there will be found more than one method to produce nuclear reactions in an electrochemical cell. Some Nobel-prize deserving theorist is probably now exploring ways of explaining the diverse experimental observations reported by scientists in over 30 countries that are working on the new science of cold fusion. The goal of *Fusion Facts* is to reduce the time to bring new ideas and new evidence to the cold-fusion community. Dr. Aspden's sharing of some new information related to cold fusion is, therefore, greatly appreciated.

C. NEWS FROM THE U.S.

CALIFORNIA - INERTIAL CONFINEMENT FUSION

Courtesy of Dr. Samuel P. Faile

John D. Lindl, Robert L. McCrory & E. Michael Campbell (Lawrence Livermore Nat'l Lab except McCrory who is from Univ of Rochester, NY), "Progress Toward Ignition and Burn Propagation in Inertial Confinement Fusion," *Physics Today*, Vol 45, No. 9, September 1992, pp 32-40, 8 Figs, 24 Refs.

ARTICLE LEAD-IN

To achieve efficient inertial confinement fusion (ICF) one must produce a small hot spot within the imploding target from which thermonuclear burn can ignite.

EDITOR'S COMMENTS

Attendees at this month's Third Annual Conference on Cold Fusion will probably learn how to construct and operate an electrochemical cell that produces two-to-four times as much energy as input. The cost, including electronic monitoring equipment, is estimated at less than $10,000. Alternatively, one can invest a minimum of $25,000,000 in the equipment of the inertial confinement fusion described in this paper. However, no excess heat can be expected in the near future. The authors note: "The next few years promise to be a very exciting time for ICF research. With the continued success of the technical program on Nova, the construction and subsequent experimental program at the Omega Upgrade and other facilities, and the proposed construction of the Nova Upgrade, it should be possible to achieve ignition and fusion burn propagation soon after the turn of the century." Long before this time, many of us will be driving automobiles powered by enhanced-energy systems, such as may be developed around cold fusion heat-producing cells. The days of the energy-research dinosaurs may be waning.

INDIANA - CLUSTER-IMPACT FUSION

Chemical Abstracts, September 7, 1992

Yeong E. Kim, Jin Hee Yoon, Robert A. Rice, & Mario Rabinowitz (Dept. Physics, Purdue Univ., West Lafayette), "One Dimensionality of Deuteron Velocity Distribution for Cluster-Impact Fusion," *Modern Phys Letters B*, **1992**, Vol 6, No 10, pp 573-579.

AUTHORS' ABSTRACT

In cluster-impact fusion, the width of the proton energy spectrum gives information about the temperature of the fusing deuteron, and its shape reflects the dimensionality of their velocity distribution. The observed symmetric spectrum implies a 1-dimensional distribution, whereas a 3-dimensional distribution would result in a skewed spectrum. One-dimensionality implies either extremely rapid thermalization in the beam direction, or the possibility of beam ion fusion.

MASSACHUSETTS - McKUBRE AT MIT

From several friends/correspondents

CORRESPONDENTS' COMMENTS

The following report is from Dr. Mitchell Swartz:

Dr. Michael McKubre of EPRI presented a summary of his laboratory's experimental work to the MIT community on September 24, 1992 in another talk sponsored by Professors Smullin and Hagelstein of the Department of Electrical Engineering. Their laboratory, in a meticulous series of experiments using alkaline LiOD solutions with palladium cathodes, have had further corroboratory evidence supporting excess enthalpy of two types - baseline and burst.

Dr. McKubre discussed the roles of aluminum (and silicon), as an in-situ gelatinous (possibly amphoteric) layer upon the cathode. Although the method by which this chemical layer increases the likelihood of successful generation of baseline excess heat remains less than clear, the aluminum-modified cathode in their hands is reported to create a "relatively causal, reproducible" system. His laboratory reports generating this baseline excess thirty-eight times. These were in the range of 1 to 30% above input power. The irregular anomalous heat "bursts," generating >300% excess power, were found to initiate spontaneously, but much more rarely, three times.

The energy generated during the prolonged experiments was >45 MJ/mole of Pd. The excess power density was about 200 watts/cc of palladium. No excess heat was observed for light water.

The skeptics again advanced the concept of systematic errors and Dr. McKubre responded that all of his laboratory's measurements which demonstrated significant deviations from the control were characterized by **positive** excess heats. This is to be considered because if systematic errors are the cause of excess heat, then, given the large number of experiments showing a significant effect, one of them ought to have created a result with a **negative** excess heat.

In summary, it was an excellent presentation, and was well received. More than a score of experiments demonstrating baseline excess heat using a much more reproducible system than originally reported by FP were presented by McKubre. Aspects of loading, and other factors, appear to continue to control the attainment of these phenomena.

The following comments are from Dr. Samuel P. Faile:

Dr. Mallove said that the McKubre talk was attended by 50 people and was a rousing success. It was a tell-all success. The secret is now public that necessary ingredients are about 200 ppm aluminum with some silicon dissolved in the electrolyte. Many experiments have been conducted and high reliability has been obtained for a baseline of 10-20% excess heat. Also there occurs bursts lasting as much as 8 days during which as much as 300% excess heat is produced. Many experiments have yielded 200 Megajoules/mole of palladium. A couple of critics who were at the talk walked out before McKubre finished his presentation. ... McKubre's group has done a thorough search for byproducts and have found none. ... Dr. Mallove reported that McKubre spoke highly of Dr. Takahashi's technique as an example of a successful approach. ... McKubre believes that the unknown nuclear process of cold fusion has commercial potential.

[Thanks to Dr. Swartz and Dr. Faile for these reports. Ed.]

REPORT IN *WALL STREET JOURNAL*

Jerry Bishop, "Predictable Heat Source Reported From 'Heavy' Water Electrolysis," *Wall Street Journal*, Sept 28, 1992, pg B12.

EDITOR'S COMMENTS

Jerry Bishop attended the presentation by Dr. Michael C.H. McKubre of his cold fusion experimental work at SRI International funded by EPRI. In his article of September 28, 1992, he also mentions the work by Dr. Edmund Storms of Los Alamos National Laboratory (New Mexico). Storms replicated Prof. Takahashi's work which helped the Japanese Ministry of International Trade and Industry to budget 2.7 billion yen (about $22 million) to the funding of cold fusion research efforts in Japan. Bishop states that EPRI is the only source of funding for cold fusion research in the United States. He would have been more correct to say, "the only publicly-admitted source of funding." The article cites Dr. McKubre as reporting excess heat from 38 experiments conducted since 1989. One of the more interesting facts in the article is the information from McKubre that aluminum and/or silicon added to the electrolyte increases the probabilities for success. This is the "Pixie Dust" that has been rumored to be a part of the McKubre work. We congratulate Jerry Bishop and his editors. This is one of the few newspaper articles that has been published within the past three years that did not include an interview with some opinionated skeptic eager to negate any ideas that cold fusion could possibly work. Thank you, Jerry. In the words of Dr. Martin Fleischmann, "My work was hard enough to accept, wait until the skeptics hear about light-water cold fusion."

NEW JERSEY - NO EXCESS HEAT
Chemical Abstracts, September 7, 1992

T.R. Jow, S. Slane, E.J. Plichta, C.W. Walker, S. Gilman (Electronic Technologies Devices Lab, Fort Monmouth), "Calorimetric investigation of deuterated palladium electrodes," *Report* **1991**, slcet-tr-91-17, 22 pages.

AUTHORS' ABSTRACT

Calorimetric experiments were conducted to verify the caloric claims by Fleischmann and Pons. A twin-cell heat conduction calorimeter was used, rather than the quasi-adiabatic instrumentation of the original investigation. Under similar electrochemical conditions, the output of heat powers from experimental cells of Pd in 0.1M $LiOD/D_2O$ and that from control cells of Pd in 0.1M $LiOH/H_2O$ and Pt in 0.1M $LiOD/D_2O$ were all in close agreement with input heat powers using simple theory. These results show no anomalous 'excess' heat, as claimed.

[If they had been receiving *Fusion Facts*, they probably would have been successful. Ed.]

JUST FOR FUN:
"He died at 70. He just postponed his burial until he was 85." Robert L. Backman, LDS General Conference speaker, Oct. 3, 1992.

NEW JERSEY - EXCESS ENERGY PATENT
Courtesy of Dr. Samuel P. Faile

Francisco Pacheco, Inventor, "Bi-Polar Auto Electrolytic Hydrogen Generator," U.S. Patent No. 5,089,107, February 18, 1992, 2 Figures, 7 claims.

PATENT ABSTRACT

An autoelectrolytic hydrogen generator system constituted by one or a plurality of similar cells wherein a galvanic arrangement of magnesium and aluminum plates of sacrificial elements as anode; stainless steel as cathode and sea water as electrolyte, by its very nature is made to develop a voltage when connected in short circuit causing a current to flow within the system and hydrogen production of hydrogen in situ and on demand by the electrolytic action at one pole, the cathode, and additional hydrogen by the electrochemical reaction at the other pole, the anode. **Surplus electric energy of the system applied to a optional electrolyzer will also be made to produce additional hydrogen at its two sacrificial aluminum electrodes.** [Bold added. Ed.]

EDITOR'S COMMENTS

The inventor states the following: "It is not well understood, other than by speculative theory (time element?), the action of the permeable separator between the metals magnesium and aluminum, however, and being incontrovertible the fact that it causes to be produced an excess of hydrogen above the predictable quantities produced by electrochemical reactions, this fact is disclosed and incorporated as principal and very important part of the invention." In addition to producing hydrogen (for industrial or vehicle propulsion use) the invention also produced electricity which can also be used to electrolyze water to produce additional hydrogen. It will be interesting to have a careful evaluation made of this invention to determine if it is an "over-unity device" (meaning that it produces more energy out than is accounted for by normal scientific calculations of energy in).

NEW YORK - A NEGATIVE & ANSWER
Courtesy of Dr. Samuel P. Faile

A General Electric Research Report and Some Comments by Pons and Fleischmann.

R.H. Wilson, J.W. Bray, P.G. Kosky, H.B. Vakil (GE Corp. R & D, Schenectady), and F.G. Will (currently at U/U), "Analysis of experiments on the calorimetry of LiOD-D_2O electrochemical cells," *J. Electroanal. Chem.*, Vol 332, (1992), pp 1-31, 7 Figs, 4 Tables, 11 references, paper received 24 June 1991.

AUTHORS' ABSTRACT

In this paper we present a detailed analysis of calorimetry with heavy-water electrolytic cells, especially of the type described by Pons, Fleischmann and co-workers in recent publications. We also summarize our own experiments, which involve calorimetry of electrolytic cells of various designs. None of our experiments has yielded any excess heat or radiation products within the detection limits. We evaluate the data and methods of Pons, Fleischmann and co-workers and, where sufficient data are available, conclude that they overestimate significantly the excess heat. This is in part because in their calibration they did not include calculation of the change in input electrochemical power to the cell resulting from the calibration heater power. An additional significant overestimate of excess energy occurs when the calibration is made at cell temperatures above about 60 C, owing to the increased evaporation of heavy water during the calibration. Furthermore, we find unexplainable inconsistencies in the data on light-water controls, as reported by Pons and Fleischmann. While our analysis shows their claims of continuous excess heat generation to be overstated significantly, we cannot prove that no excess heat has been generated in any experiments.

M. Fleischmann (Univ of Southampton) & S. Pons (Univ of Utah), "Some comments on the paper Analysis of Experiments on Calorimetry of LiOD/D_2O Electrochemical Cells, R.H. Wilson et al., *J. Electronal. Chem.*, 332 (1992) 1," *J. Electroanal. Chem.*, Vol 332, (1992), pp 33-53, 4 Figs, 3 Tables, 13 references, paper received 26 March 1992.

AUTHORS' ABSTRACT

We comment here on the title paper and find that it is a series of misconceptions and misrepresentations of previous reports by Fleischmann, Pons, and co-workers. It is shown that the conclusions reached by the authors lead to gross errors in the prediction of the observed responses of the electrochemical calorimeters described in the original work and that the correct methods of analyses are indeed those we originally described as well as those which have been outline in subsequent publications. We find that the authors have not validated their own methods and have not provided sufficient information to allow assessment of their work.

EDITOR'S COMMENTS

At this late date in the rapid development of cold fusion, this presentation by G.E. researchers and the scholarly critique by the masters of cold fusion has little value except to help put an end to some of the rumors about the G.E. work helping to destroy cold fusion. With due

respect to F.G. Will, he did find highly significant evidence for cold fusion during his final weeks at the National Cold Fusion Institute at the University of Utah Research Park. Some of the comments made by Pons and Fleischmann are of interest: "We observe that the results of the independent investigation using Kalman filtering were presented to the group at GE during 1991: their omission of reference to this work shows that they also reject this method..."(page 40). "That the analysis of Wilson et. al. is incorrect, quite apart from its lack of accuracy (it leads to double subtracting errors, see below), can be seen by comparing their calculation of k'_R ..." (page 48). "...not the negative enthalpies derived by Wilson et al. (which contravene the laws of thermodynamics)." page 48. "The scheme of calculation adopted by Wilson et al. therefore leads to a double correction..." (page 50). "...the authors also conclude that the cells are markedly endothermic ... a condition which evidently contravenes the laws of thermodynamics" (page 50). "That the conclusions reached by Wilson et al. are untenable is shown by ..." (page 50). "Instead of exploring the causes of their conclusions, Wilson et al. discuss the validity of our **blank** experiments and their discussion is again largely based on their misinterpretation of our Method 1." (page 50).

Fleischmann and Pons also criticized Wilson et al. for selecting data from a cell that showed little excess heat and suggested it would have been better had they chosen a better performing cell. Unless you are a history buff, or want to read about the complexities of open-cell calorimetry, the papers may not be worth your time investment. Fleischmann and Pons must get tired of using their valuable time on dismantling their critics. It is of interest to note that G.E. could have invested in cold fusion work at the NCFI and failed, in this editor's opinion, to take advantage of an unusual opportunity. Perhaps some decision maker decided that more money would be forthcoming from riding the hot fusion band wagon. G.E., there is still time to change band wagons.

NEW YORK - STRANGE EXAMPLE

Raymond A. Moody, Jr., M.D. with Paul Perry, COMING BACK, A Psychiatrist Explores Past-Life Journeys, c 1990, page 189, Bantam Books, New York.

EDITOR'S COMMENTS

In a most unlikely place for reading about cold fusion this book discusses some of the explanations for patients who may report "past life experiences." Self delusion is suggested. One of the authors uses cold fusion as an example. "It was reported by a Utah physicist that he could produce energy through a process that is much cleaner and safer than the nuclear fusion found in reactors. As of this writing, however, the preponderance of expert opinion seems to be that his observations were mistaken." The author concludes, "No doubt an example, in part, of wishful thinking." Except for the fact that it was two chemists, that there were initially no experts on cold fusion except for Pons and Fleischmann, that expert opinions about new science are generally not worth much, and that the discoveries of Pons and Fleischmann have been fully validated, the comments have some merit. As a matter of religious interest, some highly-regarded cold fusion scientists **believe** in past lives. Many others, as scientists, **know** the reality of cold fusion phenomena.

NEW YORK - CORPORATIONS JOIN FORCES

The Associated Press, "Corporations Join Forces to Study Communications of Future," *The Salt Lake Tribune*, page C10, October 1, 1992.

EDITOR'S COMMENTS

The article reports that more than a dozen companies have joined forces to study and be involved in the communication systems of the future. We look forward to a similar consortium of corporations who will join forces to provide the world with clean, inexpensive, safe enhanced energy systems. Interested parties, please contact Hal Fox c/o *Fusion Facts*, P.O. Box 58639, Salt Lake City, UT 84158.

PENNSYLVANIA - NEW FORCE
Courtesy of Dr. Samuel P. Faile

Robert Koontz (Applied Science & Technology, Inc., Huntington), "Evidence for a Previously Unobserved Force," *Bulletin of the American Physical Society*, Vol 37, No. 5, October 1992, Paper ED9.

AUTHOR'S ABSTRACT

The mean free path (MFP) anomaly has been observed at very high statistical levels in relatively recent experiments. There is therefore no longer a question as to the veracity of the phenomena. The question remains therefore as to the origin of the effect. It turns out that all of the MFP experiments can be explained if and perhaps only if anomalons are interacting via a previously unobserved and long-range hadronic force. The interactions of such particles can be observed, however, only if an experiment is done which is sensitive to low momentum transfer reactions [glancing collisions]. Emulsion and bubble-chamber experiments represent such experiments because they contain hydrogen which is unbound and thus visibly scatterable for significant distances at low momentum transfer. This is why other

experiments which were not sensitive to low momentum transfer did not observe the MFP effect. Those experiments have been referred to as the "electronic experiments." Detailed descriptions will be presented.

[Dr. Faile has communicated with Dr. Koontz and will be receiving a copy of his paper within a couple of months. Dr. Faile will provide a copy of the paper to *Fusion Facts*.]

WASHINGTON, DC - CHEMICAL HEAT
From Chem Abstracts, Sept. 21, 1992

Edmund S. Rittner, Andrew Meulenberg, Jr., "A chemical interpretation of heat generated in 'cold fusion'," *J. Fusion Energy*, **1990**, Vol. 9, No. 4, pp 377-382.

AUTHORS' ABSTRACT

A thermochemical analysis showed that the steady-state "excess heating" observed in calorimetric experimental recombination catalysts, electrochemistry [result] is attributable to the heat of formation of liquid D_2O and O_2 gases generated in the electrolytic cell. The recombination is catalyzed by both electrodes and the extent of the reaction increases on stirring, especially when D_2 gas sparging is used for this purpose. Thermal effects of stored chemical energy, which include thermal power output exceeding electrical input in the shorter term and cathode meltdown from total sudden release, arise from storage of Deuterium atoms in supersaturated solid solution within the cathode volume. Their recombination to form D_2 builds up high internal pressures, causing multiple fracture. Excess heat is liberated as D atoms and D_2 molecules fall into deep traps created on fresh Pd surface, supplemented by deuterium recombination heat. Postulation of unknown nuclear processes to account for the heat is not necessary.

WASHINGTON D.C. - USING BUCKYBALLS
Courtesy of Dr. Samuel P. Faile

Peter Aldous, "Making Buckyballs Go Ballistic", *Science*, Vol 257, 11 Sept 1992, page 1481.

EDITOR'S COMMENTS

Researchers at the Institute of nuclear physics, Orsay, France have accelerated C_{60} buckyball ions to about 50 million electron volts. This is a new heavy-ion approach to the study of ion-solid collisions. Dr. Robert Vandenbosch of the University of Washington is looking at the possibility of using C_{60} as projectiles. He says that if his group can make a beam of C_{60} ions, he will "soon be battering it against a deuterated target in search of fusion."

[Surely makes electrochemical cells sound simple to work with. Ed.]

WASHINGTON, D.C. - EDUCATION GOALS

Gannett News Service, "Danger, Lack Of Skills Stall U.S. Students," *The Salt Lake Tribune*, page A3, October 1, 1992.

EDITOR'S SUMMARY

The lead-in paragragh states, "Deadly schools and unprepared pre-schoolers are hampering the nation's efforts to radically improve the U.S. education system by 2000, government officials said Wednesday." The article lists by percentages some of the failures of the U.S. educational system and speaks of the **massive inertia** that stands in the way of achieving the following six goals:

1. All children will start school ready to learn.
2. 90% high school graduation rate.
3. Improved academic achievement and citizenship.
4. The United States will be number 1 in science and mathematics achievement.
5. Adult literacy and lifelong learning.
6. Safe, disciplined and drug-free schools.

To this list *Fusion Facts* would like to add one more:
7. The education of the scientific community (especially those funded by DOE funds) so that they improve their capability of recognizing new science.

D. NEWS FROM ABROAD

CANADA - SORPTION TIME SCALES

B.E. Conway & J. Wojtowicz (Univ of Ottawa), "Time-scales of electrochemical desorption and sorption of hydrogen in relation to dimensions and geometries of host metal hydride electrodes," *J. Electroanal. Chem.*, 1992, vol 326, no 1-2, pp 277-97.

AUTHOR'S ABSTRACT

The time-scales of electrochemical hydrogen sorption and desorption processes at H-storing metals are of current interest in the development of rechargeable metal hydride anode materials for new secondary battery systems and in relation to the use of Pd and other metals as hosts for D in the supposed cold fusion process. The sorption process is related to the cathodic H2 evolution mechanism at the surface of the host metal through the H coverage delta-H

prevailing at a given overpotential at that surface. The delta-H is detected by the electrosorption isotherm for H, and the sorption rate is determined by the gradient of the chemical potential of hydrogen in the near-surface region. The efficiency of sorption of hydrogen is examined in terms of the kinetics of H2 evolution in relation to delta-H and the sorption rate. It is shown, by means of quantized numerical calculations, how host metals or alloys depend on (1) their physical dimensions and (2) their geometries. An important aspect of the present work is the quantified comparison of hydrogen desorption rates from thin plates and spherulites of comparable volumes and surface areas, as well as from cylinders, and normalization parameters for this purpose are derived. The time-scales for hydrogen desorption are sensitive to electrode dimensions and geometries, and are evaluated quantitatively. Corresponding effects arise in the diffusion-controlled current density values that can be realized in hydrogen oxidation at metal hydride anodes and which determine power densities attainable in metal hydride batteries.

CHINA - NO NEUTRONS
From Chem Abstracts, Sept. 21, 1992

Rongbao Zhu, Xiaozhong Wang, Feng Lu, Longjun Luo, Jianyu He, Dazhao Ding, H.O. Menlove (China Inst. Atomic Energy, Beijing), "Measurement of anomalous neutron from deuterium/solid system," *Yuanzineng Kexue Jishu*, **1991**, Vol 25, No 6, pp 84-92, in Chinese.

AUTHORS' ABSTRACT

A series of experiments on both D_2O electrolysis and the thermal cycle of D_2 absorbed by Ti turnings was designed to examine the anomalous phenomena in the D_2/solid system. A neutron detector containing 16 BF_3 tubes with a detection limit of 0.38 neutrons per second for 2-hour counting is used for electrolysis experiments. No neutron counting rate statistically higher than the detection limit was observed from Fleischmann-Pons-type experiments. An HLNCC-II neutron detector equipped with 18 ^3He tubes and a JSR-11 shift register unit with a detection limit of 0.20 neutrons per second for a 2-hour run are employed to study the neutron signals in D_2 gas experiments.

ENGLAND, PENN., & FINLAND - K ON Ni(111)
Courtesy of Dr. Samuel P. Faile

D. Fisher, S. Chandavarkar, & I.R. Collins (U of Liverpool), R. Diehy (Penn State U.), P. Kaukasoina & M. Lindroos (Tampere Inst. of Tech.), "Top-Site Adsorption for Potassium on Ni(111)," *Phys Review Letters*, Vol 68, No. 18, 4 May 1992, pp 2786-2789, 2 Figs, 2 Tables, 30 Refs.

AUTHORS' ABSTRACT

We have used dynamical low-energy electron diffraction (LEED) to determine the adsorption site and the geometry of the surface region for the p(2x2) overlayer of potassium adsorbed on Ni(111). The structure consists of the potassium atoms adsorbed on **top** of the Ni atoms with vertical reconstructions of Ni atoms in the first and second substrate layers combined with a slight horizontal reconstruction of the first substrate layer. The potassium-nickel bond length is found to be 2.82 $\pm$ 0.04 Angstrom corresponding to a rather short effective potassium "radius" of about 1.57 Angstrom.

AUTHORS' CONCLUSIONS

There have been no extensive calculations that we know of for simple alkali-metal adsorption systems which consider in detail the possibility of on-top adsorption sites and so our attempts to account for it can only be speculative. A likely reason for the occurrence of top sites only on close-packed surfaces is that the potential-energy corrugation due to the repulsive part of the adatom-substrate potential in these systems must be very small or it will dominate the site preference. It is intriguing that a recent calculation showed that the attractive interaction between a point charge outside an Al(111) surface and its image is significantly stronger when the point charge is located on top of the surface atoms. However, a cluster calculation of K/Pt(111) indicates that for one atom the hollow site is preferred to the top site by an energy exceeding 0.2 eV. This raises the interesting question of whether the adsorption site of the first atom is different from that in a commensurate layer. In order to resolve the exact nature of the bonding of alkali metals to metal substrates it will ultimately be necessary to carry out some extensive and systematic electronic structure calculations for these systems as a function of overlayer density.

EDITOR'S COMMENTS

Fusion Facts has previously noted this publication as an abstract only. We now have read the paper and believe that it is of **significant importance to the understanding of Ni-cathode cold-fusion cells.** The introduction to this paper notes that no explanation has been proposed for the low-coordination site of Cs/Cu(111) and that the findings are unexpected and uncorroborated. The authors note that it has been usual to assume that the adsorption site for alkali metals would be the high-coordination site on Ni because of the nondirectional bonding expected of the alkali s orbital. The authors then state, "The results presented in this paper show that this is not a good

assumption in all cases and that our current understanding of the alkali-metal chemisorption bond is not complete."

ENGLAND - CF IN EXILE
Courtesy of Marge Hecht and Dr. Faile

Andy Coghian, "Test-tube fusion lives on in exile", *New Scientist*, Sept 5, 1992, pg 8.

New Scientist EDITOR'S COMMENTS

The lead-in states: "The British Association's Science Festival heated up in the second half with more confusion over cold fusion, queries over aquariums and a carp about cod," *New Scientist*, 5 Sept 1992, page 8.

FF EDITOR'S COMMENTS

This article reports on Fleischmann's recent presentation to the Science Festival at The University, Southampton. The article cites Fleischmann comments about several laboratories that have produced excess heat and measured neutrons of the order of 5 to 50 neutrons per second for each watt of power produced and that the neutrons appears to have energy levels of 2.45 megaelectronvolts. Fleischmann counters skeptics who point out that the number of neutrons is too small by stating that the process of fusion happens in the lattice and is different from gas-plasma fusion. While Frank Close, who has never run a successful experiment, tells Fleischmann that all you get out in a burst is what you put in, Fleischmann point out that the excess energy measured is far more than the small amount of electro-chemical energy provided to the cell. If Frank Close has trouble with Pd/LiOD/Heavy Water experiments, wait until he is asked to accept a light-water/Ni/potassium carbonate cell that produces continuous 300% excess heat!

FRANCE - DETECTING GAMMAS
From Chem Abstracts, Sept. 21, 1992

S. Pons, M. Fleischmann (listed as U/U but working in France), "Concerning the detection of neutrons and gamma-rays from cells containing palladium cathodes polarized in heavy water," *Nuovo Cimento Soc. Ital. Fis.A*, **1992**, Vol 105A, No. 6, pp 763-772, in English.

AUTHORS' ABSTRACT

The neutrons generated in "cold fusion" cells can be detected following thermalization by means of high-resolution spectroscopy of the gamma-rays generated by the (n, gamma) reaction in light water. To achieve this characterization, it is essential to use analytical procedures which do not discriminate against the stat-state or quasi-steady-state generation of the neutrons in the cell.

HUNGARY - DEUTERON-NEUTRON SCATTERING
From Chem Abstracts, Sept. 21, 1992

L. Borbely & P. Doleschall (KFKI Res Inst, Budapest), "Nucleon exchange effects at low bombarding energies for deuteron-neutron scattering, *Phys. Lett. B*, **1992**, Vol 283, No. 1-2, pp 10-21.

AUTHORS' ABSTRACT

For the quartet n-d scattering at low bombarding energies the nucleon exchange mechanism plays an important role and we propose a new type of effective-range formula which incorporates this structural effect. Our approach can be generalized for many channel processes too.

INDIA - H NEAR METAL SURFACE
Courtesy of Dr. Samuel P. Faile

B. Singla, V.K. Jinday, & K.N. Pathak (Punjab Univ.), & V.V. Paranjape (Lakehead Univ. Thunder Bay, Ontario, Canada), "Self-energy of a hydrogenic atom near a metal surface," *Phys. Rev. B*, Vol. 46, No. 11, Sept 15, 1992, pp 7088-7095, 3 Figs, 11 Refs.

AUTHORS' ABSTRACT

General expressions for the self-energy of hydrogenic atoms near a metal surface have been derived. It is found that the self-energy at the metal surface saturates to a finite value with the inclusion of multipolar excitations of the hydrogenic atoms. Numerical results have been presented for hydrogenic atoms moving normal to the metal surface at two speeds. It is also found that dispersion effects of surface-plasmon excitation further reduce the magnitude of the self-energy.

AUTHORS' CONCLUSIONS

We conclude that our work provides a complete description of the self-energy of the hydrogenic atoms near a metal surface. The metal surface is treated within the hydrodynamical model and dispersion effects of the surface plasmon in this model are completely taken into account. The theory takes care of the multipolar excitation of the atom and dispersion effects of surface plasmons provides a finite value of the self-energy at the metal surface.

EDITOR'S COMMENTS

In the introduction the authors discuss previous findings that the interaction energy varies as $1/Z^3$ when the distance between atom and metal surface is large and varies as $1/Z$ when the distance Z between the atom and metal surface is small. This change is attributed to

quantum dynamics effects near the surface. The authors state, "In this paper we formulate a general theory for the calculation of the self-energy of hydrogenic atoms near a metal surface, using a hydrodynamical model of metallic electrons." The authors incorporate the dispersion effects of surface plasmons in their calculations. Their expressions handle the self-energy of the atom moving normal to the metal surface. This paper may have some bearing on some of the theories or models that handle the hydrogen/metal surface interaction in explaining the source of energy in cold fusion cells.

ITALY - INCREASING TUNNELING
Courtesy of Dr. Samuel P. Faile

D. Mugnai & A. Ranfagni (Istituto di Riceria sulle Onde Elettromagnetiche del CNR), "Complex Classical Trajectories in Tunnelling: How Instanton Bounces Can Become Real Processes," *Il Nuovo Cimento*, Vol 14 D, No. 5, May 1992, pp 541-551, 7 Figs, 22 Refs, In English.

AUTHORS' SUMMARY

Instanton bounces in complex-time and high temporal density can be related to complex classical trajectories when the potential barrier is slightly perturbed. The bounce duration in real and imaginary times is found to be in good agreement with the one evaluated by the phase-time method. On this basis, a plausible interpretational model of the tunnelling processes is suggested.

AUTHORS' CONCLUSIONS

It seems therefore that the potential model here considered is able to give adequate answers to the questions above presented [e.g. probability of tunneling]. In particular we can obtain bounce processes of relatively small amplitude such that their probability is sufficiently high ... More important, during processes of this kind the system spends a real time suitable to produce the loss of correlation between relaxation trajectories with or without bounce processes. This real time is weakly dependent on the position of the perturbation in the potential analogously to the **time delay in the reflection of wave packets which is practically independent of the width of an opaque barrier.** ... The analysis here performed has been developed considering, for simplicity, a perturbation which causes a static modification of the potential. A more realistic picture should consider time-dependent perturbations randomly distributed in the coordinate space. On this basis **we could imagine tunnelling processes as due to multiple bounces, occurring at different scattering centers (the complex turning points) induced by the perturbation.** The resulting motion would consist of successive steps, forth and back in the space, rather than a uniform motion. [Emphasis mine. Ed.]

EDITOR'S COMMENTS

In the body of the paper, the authors point out that a perturbation can cause a particle in a potential well to "bounce" and penetrate into a [Coulomb] barrier with a surprisingly high probability. The rationale is that a high frequency perturbation, such that there may be a bounce with every 1,000 oscillations, could result in one decay event per nanosecond. Or, in other words, the sum of many attempts to tunnel can effectively increase the successful penetrations (or tunneling). This insight may be helpful in cold fusion theories where the probability of penetration of the Coulomb barrier is currently taken to be very low. Scientists such as Julian Schwinger, Robert Bass, Robert Bush, Peter Hagelstein, and others will want to examine this work to see how it may affect their theories or models.

ITALY - IMPACT OF IONS ONTO LiD
Courtesy of Dr. Samuel P. Faile

G.F. Cerofolini (Univ of Modena), F. Corni, G. Ottaviani & R. Tonini (Univ of Modena), "Search for Nuclear Reactions Produced by the Impact of Heavy Molecular Ions onto LiD," *Il Nuovo Cimento*, Vol 105A, May 1992, No 5, pp 741-750, 12 refs, 3 Figs, 2 Tables, in English.

AUTHORS' SUMMARY

Preliminary evidence for light element fusions induced by the impact of heavy molecular ions, with mass around 430 a.m.u. (obtained by fragmentation of $Re_2(CO)_{10}$) and energy of 140 keV onto LiD target is presented. The experimental arrangement excludes the impact of fast light particles due to fragmentation inside the acceleration column and supports the idea of a new underlying physics.

AUTHORS' CONCLUSIONS

Let us neglect for the moment the candidate Li-D fusions. The D-D fusion yield observed in our experiments, is of the order 10^{-11} fusions per impinging molecule, is of the same order as that observed by the Brookhaven collaboration despite the energy used in our experiment, 140 keV, is lower by approximately a factor 2 than those at which Brookhaven experiment was carried out (250 to 350 keV). Assuming that the D-D fusion yield increases with projectile energy as found by Brookhaven collaboration (ref 7 reports that an energy increase by 50 keV produces a yield increase by one order of magnitude in three different targets), the yield at 300 keV is expected to be much higher, thus suggesting that our combined choice of target-projectile is a serious improvement toward

a possible future exploitation of warm fusion. The possibility that lithium participates and exalts the net fusion rate makes this conclusion stronger.

EDITOR'S COMMENTS

In discussing the difference between the computed reaction rates and putative rates deduced from experimental measurements the authors stated: "Since even in the most optimistic case the conventional model predicts a D-D fusion rate lower than the observed one by more than 6 orders of magnitude, we disregard this mechanism and accept the *ansatz* that the observed fusions are associated with a **new physical phenomenon** occurring in the dense collisional cascade."

JAPAN - LIGHT-WATER COLD FUSION
Courtesy of Jed Rothwell, Clustron Sciences Corp.

Staff, "Large Amount of Excess Heat Verified With Light Water," *Hokkaido Shimbun*, also copied to *Chunichi Shimbun*, October 2, 1992, front page. Also: S. Nagayama, "Expanded Potential of Cold Fusion With Light Water," page 2, in Japanese. Translated by Jed Rothwell.

EDITOR'S COMMENTS

Subheadlines include: "Hokkaido Univ. Cold Fusion Experiment", "Will report at next month's conference", "Expectations grow that this will help explain the mechanism of the phenomenon", "Worth Investigating", "Fully Confident of the Results", "At MITI A 4-Year Development Program", and "300 million yen requested." These articles cite the work of Dr. Reiko Notoya of the Catalysis Center, Hokkaido University. Apparently she obtained a copy of Dr. Bush's paper which he sent to Professor Tadahiko Mizuno (same university) and decided to try to replicate the Bush-Eagleton work. The article states, "this is the first time a light water reaction has been reported in Japan." The article also mentions in two places that "...two groups in England and America in March, 1989." They are apparently crediting the Fleischmann, Pons, Hawkins article as relating to two groups. All of the three did the work and made the announcement from the University of Utah on March 23, 1989.

The article states that Dr. Notoya's light-water, nickel-cathode experiment used potassium carbonate and produced "three to four times more heat" than was input to the device. A control cell had a temperature rise of eight degrees while the operating cell temperature raised from 20 to 50 degrees. The article states, "Furthermore, there is evidence of a nuclear fusion transformation; some of the potassium in the electrolyte solution appears to have been converted into calcium. Before the experiment there was 22 ppm of calcium in the electrolyte, but after inputing 2.2 watts, increases as large as 4.4 ppm of calcium were detected. The increase in calcium was roughly proportional to the amount of excess heat."

Nagayama states, "**Anomalous heat**, that is, excess heat, in light water electrolysis experiments was first reported in the U.S. in 1991. [By Dr. Randell L. Mills of Lancaster, Pennsylvania.] However, there were no widespread reports of replication, so the mainstream experimentalists continued to assume that cold fusion could only be achieved with heavy water." He states that this cold fusion is made with **plain-old** nickel and continues, "Of course, you do have to have a certain amount of **know how** to perform the experiment properly; to handle the materials very carefully, and prepare the cathode surface correctly. There are more steps in the preparation than with the palladium - heavy water systems. However, the raw materials, nickel and water, are much more familiar and generally available than palladium." And he could have added, these cells always work.

A bit of misinformation was included in the main article on the magnitude of excess heat produced. The paper says, "There have been previous reports from American researchers of excess heat from light water, but these results [of Dr. Reiko Notoya] are an order of magnitude greater." Both Dr. Randell Mills and Drs. Bush & Eagleton have had results of excess heat (using small cells) that exceeded 10 times the input power. Of the several groups that have been working with light-water, nickel-cathode cells, most have achieved similar results to those of Dr. Notoya as reported in this article.

This Japanese article reported the MITI (Ministry of International Trade and Industry) Energy Resources Department announced on September 18, 1992 a four-year program to develop cold fusion reaction into a practical form of energy. The program will be named, **New Hydrogen Energy**. This department formed a **New Hydrogen Energy Research Panel** in March, 1992 with members selected from major industrial manufacturers, electric power companies, and others. The department issued a statement, "while it is not clear exactly what is occurring, the existence of the heat is beyond question." The panel concluded, "We cannot ignore this potential alternative source of energy." The development work will concentrate on the practical aspects of cold fusion and leave the theoretical aspects to the university researchers. [Obviously, there was not the Japanese equivalent of Dr. John R. Huizenga (Chairman of the DOE panel on cold fusion & author of Cold Fusion, The Scientific Fiasco of the Century.) on the panel.] The areas selected for development are: 1. Scaling to larger sizes and sustained reactions; and 2. to monitor trends and research both domestic and international. Three hundred million yen

(about $2.5 million) has been requested for the forthcoming fiscal year.

JAPAN - EVIDENCE POURS IN
Courtesy of Jed Rothwell, Clustron Sciences Corp.

Staff writer, "Evidence Supporting Cold Fusion Pours In," *Nikkei Shimbun*, September 26, 1992, page 12, in Japanese. Translated by Jed Rothwell.

EDITOR'S REVIEW

This article cites the results reported at the Electrochemical Society Meeting. "One researcher after another reports **excess heat**." The society meeting was held in Sapporo on September 25, 1992. The largest amount reported was 35% from a cell using a palladium cathode with a gas membrane similar to that used in a fuel cell. Heavy water and lithium deuteroxide were used. The report was from the R&D lab of Aishin Seiki Corp., Imra, Japan. The research showed that as the ratio of deuterons to Pd atoms exceeds 0.85, the excess heat generating reaction begins. The amount of excess heat is a function of the D/Pd ratio above 0.85. Dr. Takahashi reported on his replication of his earlier work. Although this replication produced less excess heat (about 20%) there was an increased emission of neutrons. A team from Yokohama National University reported 15% excess heat. A team from Tokyo Agriculture and Engineering University added a trace of aluminum and reported 3% excess heat. A team from NTT (Japan Telegraph & Telephone) Basic Research Lab reported on the use of thin films of Pd loaded with deuterium gas. When subjected to vacuum and increased temperature, they measured bursts of heat and the emission of tritium.

The article makes the following comment [emphasis added, Ed.]: In commenting on the history of the Fleischmann-Pons announcement the article states: "However, 1. When third parties did the experiment, they found that the replicability was poor, they did not get the same results; 2. Many questioned whether the heat and neutrons had been decisively verified or not. Because of this, in Europe and the United States, a skeptical view of these experiments prevails. **However, in Japan, research to verify the effects has continued.** And in the United States, the Department of Energy still hasn't discovered cold fusion.

The article states that the correlation between heat and high loading was first reported in 1991 by a researcher from SRI, International. The facts are that the importance of loading was first reported in the May, 1989 meeting in Santa Fe, New Mexico. I believe that scientists from Texas A&M, both Dr. Bockris and Appleby, stressed the loading factor. Japanese scientists were in attendance at that first cold fusion workshop. The article ends with the following comment: "Assuming that cold fusion really is occurring in these devices, they constitute a virtually inexhaustible source of energy, and they are incomparably simpler and cheaper than the **hot** fusion machines. Not only have universities and industry shown interest in this field, but the government has also begun research. MITI is requesting a 300-million yen investigative budget for 1993. [And the U.S. Department of Energy still hasn't discovered cold fusion is a reality.]

RUSSIA - UNIFIED FIELD THEORY
Courtesy of Dr. Samuel P. Faile

I.L. Gerlovin, R.Kh. Baranova, & P.S. Baranov, & P.S. Baranov (affiliation not shown), "New Approach to Cold Fusion (Low-Temperature Nuclear Fusion)," translated from *Zhurnal Obshchei Khimii*, in *J. of General Chemistry of the USSR*, Vol 62, No. 1, part 2, Jan 1992 (July 10, 1992 translation), pp 193-194, 5 Refs., English translation.

AUTHORS' ABSTRACT

This is the first communication giving the results of a fundamentally new approach to low-temperature nuclear fusion, based on a new unified fundamental field theory, together with experimental corroboration of predictions of the theory and illustrations of possible practical uses of the results.

EDITOR'S COMMENTS

The authors state, "From studies of fundamental field theory and correlated work with this theory it is known that the solar system moves relative to the physical vacuum with an extremely high velocity of hundreds of kilometers per second. Therefore, all processes involving the physical vacuum have daily, yearly, and secular temporal variations." These variations are deemed to have a major role in cold fusion processes. The authors cite data taken from a variety of CF experiments to show that their theory has merit. The authors state that they have confirmed that first, CF neutron emission occurs even if distilled water is used with electrodes not saturated with deuterium, and second, that the energy of the process depends on the orientation of nuclei both in the electrolyte and in the electrode material. The new unified fundamental field theory described briefly by the authors works with more than one space (in the mathematical sense) and certain measurements in the laboratory space are the results of events in a space complementary to the laboratory space. The authors plan to publish a larger paper discussing their theory and experimental results.

RUSSIA - NO NEUTRONS
From Chem Abstracts, Sept. 21, 1992

V.N. Soifer, V.A. Goryachev, A.N. Salyuk, A.F. Sergeev (Far East. Sci. Cent, Vladivostok), "Neutron emission during heavy water electrolysis," *Appl. Radiat. Isot.*, **1992**, Vol 43, No. 8, pp 1041-4, in English.

AUTHORS' ABSTRACT

The emission of fast neutrons by recoil protons (0.02-3 MeV energies) during the electrolysis of heavy water was studied experimentally using iron, stainless steel, titanium, titanium-vanadium, platinum and palladium cathodes. Normal low-background measuring equipment was used (sensitivity up to 3 x 10^{-4} Bq/mL) with a proportional methane counter, Vol 4 L, pressure 2 x 10^5 N/m^2 which was calibrated with a californium source of 2 x 10^7 n/s; the registration efficiency was 7%. Statistical processing of the results using the Student criterion failed to detect any neutron flux of > 0.04 n/s from our various conditions of electrolysis with a reliability of 99.9%.

SWITZERLAND - MUON-CATALYZED FUSION
Chemical Abstracts, September 7, 1992

C. Petitjean (Paul Scherrer Inst., Villigen), "Progress in muon catalyzed fusion", *Nuclear Physics A*, **1992**, Vol A543, No. 1-2, pp 79c-98c, 110 refs, in English.

AUTHOR'S ABSTRACT

The state of the art and the recent progress made in muon-catalyzed fusion is reviewed. Resonant d-muon-d formation is now quantitatively understood, but the d-muon-tritium kinetics is more complicated and full interpretation still difficult. Experiments demonstrated 100 to 150 d-t fusion per muon. The most reliable value for d-t sticking is about 0.6 %. New theoretical results extending over the full energy range, describe now most kinetic processes with high precision and yield ultra large rates for d-muon-t formation at collision energies of about 0.2 - 2 eV. For future exploration the use of H/D/T triple mixtures is discussed. There are prospects for using muon-catalyzed fusion for intense neutron sources.

E. SHORT ARTICLES FROM READERS

NOTES FOR EXPERIMENTERS
From various sources.
By Hal Fox

CLEANING PALLADIUM

Dr. Dennis Cravens reports that Dr. Edmund Storms has found that a pre-loading treatment of palladium with aqua regia appears to promote deuterium loading and the later development of excess heat. This treatment may involve the action of surface chlorine and its ability to change the rate of deuteron adsorption.

"LOADING" TIME FOR NICKEL
Drawing from a combination of ideas: Dr. Peter Glück's SURFDYN (Surface Dynamics) concept of nuclear catalysis [1]; Nielsen's work on showing the development of Ni-H-Ni-H- rows on a nickel surface [2]; and the Fisher et al. [3] report on how alkali-metal ions adsorb on top of the Ni atoms in a Ni lattice; the process of "loading" of the nickel cathode in a light-water cell is proposed:

When porous nickel is used as the cathode in a light-water cold-fusion cell, it takes several hours of "loading" time before the cell produces excess heat. Thereafter, the cell can be turned **OFF** and later turned **ON** with the almost immediate production of excess heat. It is proposed that in this electrochemical environment in the cell, there is a surface rearrangement of Ni atoms alternating with H ions to produce rows of Ni-H-Ni-H-Ni-H- as reported in reference [2]. Fisher, et al., [3] have shown that in a vacuum the potassium (or other alkali-metal ions) become attached to the top of the Ni atoms to provide rows of lollipop-like structures of surface Ni-K combinations. Dr. James McIntyre [U/Utah, personal communication] points out that the potassium in an electrolyte is surrounded by a thin water layer and would not be expected to provide the lolly-pop linkages. Whatever the precise arrangement between the nickel surface, the protons, and the potassium ions, this structure, after a short (few hours) loading time allows for the itinerant H ions to interact with the K ions to produce nickel-catalyzed nuclear reactions. This type of reaction has been detailed in Dr. Robert Bush's new Transmission Resonance Model [4].

One may ask if it is necessary for the Ni-H-Ni-H- rows to be established or would the Ni-K linkage be adequate to support nuclear reactions? An experiment may be performed in which the Ni-H-Ni-H- rows are established before the potassium (or other alkali metal) is introduced into the cell. One could then compare "turn-on" time using this pre-hydriding approach with cells that are not pre-hydrided.

REFERENCES FOR THIS SECTION:

[1] Peter Glück, "Understanding Reproducibility: Topology is the Key," *Fusion Facts*, May 1992, pp 19-23, 25 refs.; Also, "Nuclear Catalysis and Cold Fusion," *Fusion Facts*, June 1992, pp 1-3.

[2] L.P. Nielsen, F. Besenvbacher, E. Laegsgaard, & I. Stensgaard (Institute of Physics, Univ of Aarhus, Denmark), "Nucleation and growth of a H-induced reconstruction of Ni(110)," Physical Review B, Vol 44, No. 23, Dec 15, 1991, pp 13156-59, 3 figs, 20 refs, in English.

[3] D. Fisher et al., "Top-Site Adsorption for Potassium on Ni(111)", *Phys Review Letters*, Vol 68, No. 18, 4 May 1992, pp 2786-2789, 2 Figs, 2 Tables, 30 Refs. See page 11, this issue for comments on this paper.

[4] Robert T. Bush (Physics Dept, Cal State Polytechnic U.), "A Light Water Excess Heat Reaction Suggests that 'Cold Fusion' may be 'Alkali-Hydrogen Fusion'", *Fusion Technology*, Vol. 22, No. 2, September, 1992, pp 301-322, 2 Figs, 61 Refs. [Abstract in *Fusion Facts*, Dec 1991., paper reviewed in September, 1992, pp 6-8.]

PARAMETER TESTING

As will be shown by papers presented at the Nagoya conference, the alkali-metal, porous-nickel, electrochemical cells "always work". This consistency contrasts with the unpredictable "bursts" of excess heat found in the use of palladium cathodes. Obviously, this greatly improved degree of repeatability of the light-water Ni-cathode cells provides the necessary conditions for the study of many cell parameters. The rapid development of light-water cold fusion reactors is expected to be the result. Here are some of the factors that now can be explored in some detail:

1. What are the types of containers that can be used for light-water reactors. It is known that Teflon and Pyrex glass have been successfully used. What types of stainless steel will be suitable?

2. The use of pulsating d.c. has proved beneficial in light-water reactors. What are the optimum frequencies? What are the optimum wave-shapes? Does the cell geometry affect the optimum frequency?

3. Assuming that the light-water reactors transmute the alkali metals, where are these nuclear byproducts to be found? What percent is lodged in the cathode and what percent appears in the electrolyte?

4. Does the amount of transmuted element produced explain the amount of excess heat observed over the time period the cell is operated?

5. Assuming that some of the energy from nuclear reactions in the light-water cells is emitted as X-rays, what is the spectrum of such X-rays? Does the spectrum change as a function of reactor internal pressure?

6. What is the amount of excess heat produced as a function of both reactor pressure and electrolyte temperature? It is suggested that holding the temperature constant and raising the pressure will reduce the size of the gas bubbles formed on the nickel cathode and thereby increase the amount of excess heat produced. Smaller bubbles will leave more of the nickel exposed and thereby increase reaction surfaces.

7. By operating a reactor for long periods of time, it is expected that some contamination will build up and modify the efficiency of the cell. What are the rates of reactor degradation as a function of time and/or total excess heat produced?

It is expected that papers delivered at the Nagoya Conference will provide answers and/or clues to many of the above questions.

REACTOR SAFETY

One of the primary desires for commercialization of cold fusion is to produce excess heat without producing harmful nuclear byproducts such as tritium and/or neutrons. This can be achieved if one can select and promote nuclear reactions that produce only stable transmuted elements and energy. For example, the **D + D --> He-4 + energy** is one such reaction. However, this reaction has a probability of occurring about 1 in a million deuteron fusion events (as observed in plasma reactions).

Assuming the correctness of the Bush new alkali-metal/hydrogen fusion model, it is appropriate to examine the various known nuclear reactions involving hydrogen or deuterium and alkali metals. Following is a list of the predominant isotopes of alkali metals and some of the possible hydrogen or deuterium nuclear reactions. See reference [4].

Lithium:

$^{6}Li + D \rightarrow {}^{4}He + {}^{3}He + n + 1.79$ MeV
$^{6}Li + D \rightarrow {}^{4}He + T + p + 2.56$ MeV
$^{6}Li + D \rightarrow {}^{8}Be^{*} \rightarrow {}^{4}He + {}^{4}He + 22.4$ MeV
$^{7}Li + D \rightarrow {}^{4}He + {}^{4}He + n + 15.1$ MeV

Sodium:

$^{23}Na + H \rightarrow {}^{24}Mg + 11.7$ MeV
$^{23}Na + D \rightarrow {}^{24}Mg + n + 15.9$ MeV
$^{23}Na + T \rightarrow {}^{26}Mg + 21.6$ MeV

Potassium:

$^{39}K + H \rightarrow {}^{40}Ca + 8.3$ MeV
$^{41}K + H \rightarrow {}^{42}Ca + 10.3$ MeV
$^{39}K + D \rightarrow {}^{40}Ca + n + 6.0$ MeV
$^{39}K + D \rightarrow {}^{41}Ca^{*} + 14.35$ MeV
$^{41}K + D \rightarrow {}^{43}Ca + 15.85$ MeV
$^{39}K + T \rightarrow {}^{40}Ca + n + n + 1.45$ MeV

Rubidium:

$^{85}Rb + H \rightarrow {}^{86}Sr + 9.6$ MeV

$^{85}Rb + T \rightarrow {}^{88}Sr + 20.7$ MeV

$^{85}Rb + D \rightarrow {}^{86}Sr + n + 7.4$ MeV

Obviously, it would be desirable to select from the above list those reactions that produce only energy plus a transmuted stable isotope. It will be noted that with the use of light-water (proton reactions) stable isotopes are most frequent. Therefore, for ultimate safety it would appear prudent to use deuterium-free water for commercial light-water reactors.

FLOW-THROUGH CALORIMETRY

Because the light-water reactors turn-on relatively quickly and because the amount of excess heat observed is of the order of 20% to 70% under most operating conditions, the sensitivity of the calorimeter is not as important as with cells that produce only a few percent excess heat. Therefore, it is strongly suggested that closed cells be used (with a recombiner to recover the water and the heat from evolved hydrogen and oxygen). It is further suggested that flow-through calorimetry be used. In most cases, except where very accurate measurements are required, heat loss through radiation or conduction from the top and bottom of the reactor can be ignored (meaning that excess heat computations will be conservative). The flow-through calorimetry allows for easy measurement of the temperatures of the cooling fluid entering and leaving the heat exchanger used with the reactor. A positive-displacement pump can be effectively used for moving the cooling liquid through the heat exchanger. By varying the flow rates and/or the temperature of the cooling liquid, the temperature of the electrolyte can be modified. According to data gathered by Bush and Eagleton, it has been shown that the amount of excess heat from a reactor can be a strong function of the electrolyte temperature.

AN OFFER TO EXPERIMENTERS

Fusion Energy Applied Technology, Inc. (FEAT), a Utah cold-fusion development company has made arrangements with a U.S. Corporation to supply samples of porous nickel for research and development of cold fusion reactors. If the experimenters will abide by three requests, FEAT will supply porous nickel metal that has been successfully used by several researchers to fabricate light-water cold fusion reactors. The three requests are: 1. That an acknowledgement be given to the supplier for their support in supplying the material, 2. That the data be shared with FEAT, and 3. That any patent applications evaluate the invention as to whether it is an improvement on the Bush-Eagleton patents pending. FEAT will respect any requests for withholding publication of the data but does suggest that summary information be provided to *Fusion Facts* for early dissemination to the rest of the cold fusion researchers and developers. FEAT is the owner of rights to several cold fusion patents pending and will furnish specific information to experimenters who sign appropriate non-disclosure agreements. FEAT can provide license-rights to cold fusion developers under its licensing program. FEAT is owned primarily by American cold fusion scientists who are dedicated to the rapid commercialization of cold fusion. Address any correspondence to FEAT, P.O. Box 58639, Salt Lake City, Utah 84158.

DISCUSSIONS ON MICROEXPLOSIONS WITH DR. PETER GRANEAU

By Dr. Samuel P. Faile

In a late August discussion with Dr. Graneau he expressed the view that cold fusion is actually capillary fusion where a large current conducts down a path surrounded by insulating material. The large current results in immense pressures caused by longitudinal or ampere forces. Dr. Graneau plans to talk to Dr. Edmund Storms (Los Alamos National Laboratory) and others about this concept. Dr. Graneau believes the capillary fusion effects produce micro-explosions.

We discussed the research on acoustic emissions, including information in the article by Dr. P.I. Golubnichii, et al., "Correlated neutron and acoustic emission from a deuterium-saturated palladium target," *JETT Lett.*, Vol 53, No. 2, 25 June 1991, pp 122-125, that was originally submitted in December 1990 to *Psi'ma Zh. Eksp. Teor. Fiz.*, and published in Russian in Vol. 53, No. 2, pp 115-118 (25 Jan 1991). Dr. Petek (Oak Ridge National Lab) told Dr. Graneau there was a clamp on cold fusion work, including acoustic effects, at ORNL and that the work previously done using deuterium-palladium and the control hydrogen-palladium would not be published. The policy is apparently being set by the USA tokamak personnel. Apparently some previous work at ORNL did confirm the Russian results on acoustic effects with heavy-water but not with the light-water control CF cells. These results could imply that there is not enough energy to produce a significant acoustic emission by mechanical stress effects in the absence of fusion. An implication is that cold fusion is the cause of the acoustic emission and not just a tiny by-product of cracking (particles attributed to fracto-fusion). When deuterium is used in the cell, a process could be producing a nuclear micro-explosion rather than mechanically-induced cracking with the result that an acoustic emission occurs.

I asked Dr. Graneau about another topic: How does the water-arc-gun projectile dissipate its energy upon impact without heating. He said that the effect is purely inertial. The salt water acts like a rigid body and can be used to

produce holes in many layers of fabric or cloth without heating even though the process is more efficient when metals are impacted. He says at high speeds the water does not have enough time to undergo internal friction which would produce heat.

CONFIRMATION OF LIGHT-WATER NICKEL-CATHODE COLD FUSION

From Dr. Robert T. Bush, Cal Poly, Pomona

Dr. Reiko Notoya of the Catalysis Research Center of Hokkaido University has corroborated part of the theoretical and experimental work by Dr. Bush at the California State Polytechnic University, Pomona (Cal Poly, Pomona). This work was first reported in Bush's paper [1].

The experiments by Bush and Eagleton employed electrolytic cells that are a variation of the Fleischmann-Pons cells and the Randell Mills type cell. (Dr. Eagleton is Dr. Bush's colleague in the Cal Poly Cold Fusion Project.) According to Bush's paper, the light-water excess-heat reaction, which was originally discovered by Dr. Randell Mills [2], is the light-water equivalent of the heavy water excess heat reaction discovered by Fleischmann and Pons. This "alkali-hydrogen fusion" takes place at, or very near, the surface of a metal lattice (typically nickel for the light water case and palladium for the heavy water case). Three forms of alkali-hydrogen fusion are envisioned, alkali-hydrogen fusion, alkali-deuterium fusion, and alkali-tritium fusion, corresponding, respectively, to the addition of a proton, deuteron, or triton to a nucleus of an alkali atom such as lithium, potassium, sodium, cesium, and including hydrogen. These nuclear reactions produce a more stable nucleus with a lower rest mass than the sum of the rest masses of the original nucleus and the proton (in the case of alkali-hydrogen fusion). This difference in the rest masses before and after, or "mass defect", is associated with an energy E, where $E = m \times c^2$; where m is the mass defect in Einstein's famous formula. The energy (as excess heat) somehow ends up primarily in the metal lattice by virtue of a process that we are still trying to understand. The result is a transmutation from a reactant element to a product element having one more proton in its nucleus. Implicit, also, in the model is the idea that lower, or higher, mass numbers could result if a product nucleus is unstable and exhibits radioactive decay. As stated in the conclusion of Bush's paper: "It can be concluded that, should this general picture ... hold up under objective examination, it would be another step en route to the creation of an essentially new branch of science, namely, the physics of low-energy nuclear transmutations. Thus, one has a modern "alchemy" that is potentially staggering. We can expect many pleasant surprises, e.g., perhaps the replacement of fossil fuels and fission fuels by a cheaper and safer heat process based upon low-energy nuclear transmutation with, perhaps, byproducts that further enhance the value of the process. Hopefully there will not be too many unpleasant surprises."

ADVANTAGES OF LIGHT-WATER CELLS

The light-water excess-heat process may have distinct advantages over the heavy-water case. For example, Bush and Eagleton find in the Cal Poly laboratory that reproducibility of the light-water effect is essentially 100%, whereas it is only about 50% or less for the heavy-water cells. There is the additional economic advantage of the light-water process since nickel is cheaper than palladium and light water cheaper than heavy water. As Bush wrote: "If the light-water work constitutes a subrevolution within cold fusion ... the economic ramifications could be immense in view of the relative expense of heavy water (approximately $1,000.00/gal.) to that of deionized, or distilled, water (one tenth of a penny per gallon)."

REPLICATION

Dr. Notoya has employed a light-water based potassium-carbonate electrolyte with an electrolytic cell and calorimeter and has shown that an excess-heat effect occurs and that calcium increases in the electrolyte. Notoya is an associate of Dr. Mizuno at Hokkaido University, who was one of the first Japanese scientists to duplicate the excess heat effect of F/P. A preprint of Dr. Bush's paper was sent to Mizuno's group in the winter of 1992 and this preprint probably stimulated the work of Dr. Notoya. Included in this preprint was a report of the potassium-calcium work done at Cal Poly, which provided the initial confirmation of Dr. Bush's hypothesis.

Also reported in Bush's paper (before publication) is work in which, according to his model, rubidium should be converted to strontium by the addition of a proton. This result is even more interesting than calcium from the standpoint of a confirmation of the prototype of alkali-hydrogen fusion because of the fact that strontium is so much less contaminative in the general environment than is calcium. Subsequent mass spectrographic examinations of before and after sections of a Cal Poly cathode has shown that the strontium-to-rubidium ratio is what it should be to give the amount of excess heat detected. This is the best evidence that we yet have of the so-called "smoking gun" in cold fusion in which a nuclear byproduct is detected that correlates well with the amount of excess heat produced. An earlier "smoking gun" was the semi-quantitative study of helium-4 correlation with excess heat in the heavy-water case performed by Miles and Ben Bush (no relation) at China Lake [3].

Mills [2] and Bush [1] disagree with regard to the source of the excess heat in the potassium reaction, with Mills

claiming an exotic chemical effect produced by the metal and potassium environment in which hydrogen atoms collapse to a lower size than is ordinarily possible. According to Mills [2], his model precludes obtaining an excess heat effect if sodium replaces the potassium in the carbonate. However, Bush and Eagleton have obtained excellent excess heat results with sodium. In fact, Bush's model predicts that, for otherwise equal input parameters, sodium should give about double the excess power of potassium, and this is indeed what Bush and Eagleton have found experimentally. Bush does not think that there could be two separate processes; viz. his own and that of Mills, so the latter's failure to obtain results with sodium is a bit of a mystery. Of course, the cold fusion world recognizes the debt that they owe to Randell Mills [2] for his experimental discovery of the light-water excess-heat effect in potassium.

THE DETECTION OF X-RAYS

Most recently Bush and Eagleton have obtained indisputable experimental evidence for another "smoking gun" to support the excess heat effect as a nuclear process: They have detected X-rays at the surfaces of electrolytic cells built by Dr. Eagleton, and correlated the X-ray intensity with the excess power production of the cell for both the light-water and heavy-water cases. The intensity is too low outside the cell to fog a dental film, so that there is no exposure danger of working with such cells. The X-rays are detected with a setup in which a sodium iodide crystal backed by a photomultiplier tube has its signal put through an amplifier, and then into a multichannel pulse-height analyzer. Bush and Eagleton's work was directly stimulated by that of Srinivasan (BARC), who reported seeing evidence of electron fluxes associated with heavy- and light-water work and by that of Miles and Ben Bush (no relation) at China Lake, California, who have reported seeing a fogging of dental film for film exposed inside the cell in the case of cells exhibiting the excess-heat effect. Bush and Eagleton succeeded in X-ray studies (where others, such as physicists at the University of Utah, claimed no success) because Bush & Eagleton believed in the possibility of low level X-rays and thus were notably more painstaking in experimental procedures. These studies have low signal-to-noise ratios, but excellent statistics and high correlation. Correlation of X-rays with excess power provides us with another convincing "smoking gun". Also, the fact that X-rays were observed for both the heavy-water and light-water cases is strong evidence that both processes are nuclear, and further supports Bush's new Transmission Resonance Model. Whereas in the palladium case people might argue that fields due to microcracks might be providing high electric fields resulting in particle acceleration and subsequent X-rays, the case of nickel as the metal would not seem to lend itself to this interpretation. The presence of X-rays thus strongly suggests processes of energy much higher than chemical; viz. nuclear reactions.

REFERENCES:

[1] Robert T. Bush (Physics Dept., Cal State Polytechnic U.), "A Light Water Excess Heat Reaction Suggests That 'Cold Fusion' is 'Alkali-Hydrogen Fusion'," *Fusion Technology*, Vol. 22, Sept. 1992, pp 301-321. [Abstract reviewed in *Fusion Facts*, Dec. 1991.]

[2] Randell L. Mills, Steven P. Kneizys, "Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion'," *Fusion Technology*, **Aug 1991**, Vol 20, No 1, pp 65-81, 10 refs.

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

F. LETTERS TO THE EDITOR

LETTER FROM ENGLAND

Dear Hal,

... I have cold fusion on my mind at this time owing to my own struggle with the U.S. Patent Office on the subject and the fact that Martin Fleischmann has aroused some interest here [The University, Southampton, England] on the occasion of the meeting of the British Association for the Advancement of Science.

... For your records please note that I am now no longer a staff-listed member of the University of Southampton and my address henceforth should be my home address from which I am intending to do business as **Thermodynamics Limited.**

Yours sincerely, /s/ Harold
H. Aspden, Acres High, Hadrian Way, Chilworth, Southampton, SO1 7HZ, ENGLAND.

EDITOR'S COMMENTS: We are grateful to Dr. Aspden for his excellent article printed in this issue [beginning on page 3]. Dr. Aspden is one of those scientific workers who are pushing the frontiers of science into new areas to make better science and a better world. Thank you Harold.

LETTER FROM PROF. STEVEN JONES
August 21, 1992

Dear Hal,

[Dr. Jones cites a student-written article in which Jones seemed to disparage Dr. Storms' work where Jones was misquoted as saying, "If you don't have ash commensurating, then it isn't energy."]

This is non-sensical, of course, not to mention the strange term "commensurating." I am particularly sensitive that this university-paper article could have given offense to Dr. Storms, which I certainly never intended. I have long had a good relationship with Ed which I hope will continue despite this aberration.

You asked about the reaction:

$$d + {}^{6}Li \rightarrow 2\ {}^{4}He + 22.4\ MeV$$

The nuclear ash in this case is clearly helium. It is instructive to calculate the amount of helium formed for, say 100 MJ of energy released:

1 watt requires 2.8×10^{11} (d + ^{6}Li) reactions per second;

so 100 MJ = $10^{8} \times 2.8 \times 10^{11}$ reactions

= 5.6×10^{19} helium atoms

= abut 10^{-4} moles.

At STP, this helium would occupy about 2 ml, an easily measurable quantity of ash.

Finally, may I advise your readership that there is now a laboratory dedicated to "cold fusion" studies in a tunnel in the Wasatch mountains 10 km from the BYU campus. The facility has come about primarily due to the foresight and support of David Worledge of EPRI. We welcome those with devices that show evidence of unusual heat or nuclear product generation. We have instruments to look for such products. We seek to work cooperatively with the community to determine whether there is a connection between heat and nuclear reactions by direct measurements.

With My Best Regards, /s/ Steven E. Jones

[The editor apologizes that this letter was not promptly printed in the September issue. We thank Dr. Jones, one of the real pioneers in cold fusion, for his comments.]

LETTER FROM OHIO
Dr. Sam Faile & Super Capacitors

September 22, 1992

Deuterium Gas in Porous Supercapacitor Metal Alloy Containing Lithium Stimulated by Non-Hertzian Waves, A Candidate for Energetic Cold Fusion?

The next best environment to EV entities [high-charge electron clusters] may be the screening offered by supercapacitors (See *Science*, p 787, Feb 14, 1992 on Pinnacle Research Institute work on supercapacitors, telephone 408/379-1900) [also see review in *Fusion Facts*, March 1992, pg 6.] that exhibit storage capacity several orders of magnitude greater than ordinary capacitors. The porous metal sponge could be an alloy with some lithium or some other alkali metal. The porous structure with 100,000 times the surface area of a 2-dimensional surface could be loaded with deuterium gas. The cold fusion process might be activated by charging up the capacitor with an electrical charge for a big increase in screening effects while subjecting the unit to non-Hertzian waves to change the quantum potential. The dynamics in the high surface density material at the large surface area in the sponge could favor cold fusion. Although this environment may be second best to the activity of an electron bead (EV entity) when viewed from the perspective of a few locally-active zones a few microns across, the effect overall throughout the metal sponge supercapacitor may be far greater than an ordinary cold fusion cell. Activity added up for the whole supercapacitor may be far greater than an ordinary cold fusion cell. Activity summed over the whole supercapacitor may greatly exceed what a few EV entities can accomplish. That something unusual is occurring in condenser, the kind of viewpoint that is needed for cold fusion, relates to Dr. Inomata of MITI who reported data on small changes or antigravitational effects in condensers.

Editor's Comments: Dr. Faile is one of the most productive correspondents and has some good insights into a large spectrum of scientific possibilities. We thank him for sharing this idea with us. Dr. Faile has filed for patent protection on an expanded version of this idea. Dr. Faile is one of the owners of FEAT.

FAX FROM ROMANIA

Dr. Peter Glück sent the following fax:

Dear Hal,

I couldn't send any cold fusion report in September due to lack of papers here. Will send an essay on CF technology based on 2 papers by Bockris - *J. Int. Hydrogen Energy*, June, 1992 and my ideas.

/s/ Peter

FAX FROM ENGLAND
Courtesy of Tom Beazley

Dr. Martin Fleischmann, Fellow of the Royal Society, will present a discourse under the auspices of The Royal Institution of Great Britain, 21 Albemarle St., London W1X 4BS, Telephone 071-409 2992. This presentation is a part of the Royal Institution Discussion Evenings. Dr. Fleischmann will present his discourse on Friday, December 4, 1992. The notice states: "In this discourse, the lecturer will give an account of the underlying notion, the experiments and an informal prognosis of the cold fusion story."

G. MEETINGS AND MISCELLANEOUS

FUSION BRIEFINGS -- HIGHLIGHTS NEWS

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

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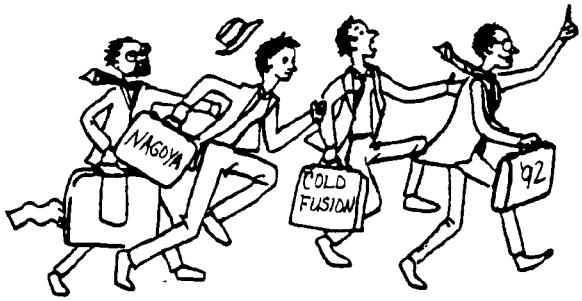

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