

FUSIONfacts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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

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NEXT ISSUE'S SPECIAL REPORT

The July 10, 1992 announcement by MITI should have an effect on the view of cold fusion by both media and the officials of various government agencies. *Fusion Facts* will have a special report on this subject.

DON'T MISS AN ISSUE

A. SPECIAL NEWS RELEASE!

JAPAN'S MITI LAUNCHES MAJOR COLD FUSION PROGRAM

Jed Rothwell and Dr. Eugene F. Mallove, Cold Fusion Research Advocates, Chamblee, Georgia, sent us the following information just in time for this issue:

July 13, 1992

TOKYO, Japan -- The powerful Japanese Ministry of International Trade and Industry (MITI) last Friday [July 10, 1992] announced its full economic support for cold fusion research and development in Japan. Sources in Japan say that the government plan will serve as a "springboard for similar research by the private sector."

Front page banner headlines in the major daily *Yomiuri* newspaper (7/10/92) read: "Cold Fusion: Clean Energy Source to be Developed into Practical Use." A bold header follows: "Nation Begins Full Scale Research."

The Energy Resources Department of MITI will appropriate several hundred million yen for primary research from the fiscal 1993 budget. The agency intends to spend several billion yen (several tens of millions of U.S. dollars; 125 yen = \$1) on the five-year project beginning in fiscal 1993. The agency has established a study group together with researchers, power companies, and large electric machinery producers. The group recently concluded that excessive heat was, indeed, generated in cold fusion experiments, although it is not sure exactly how the process works. The research is aimed at finding this out.

The first part of the July 11, 1992 *Yomiuri* article reads:
"The Energy Resources Department of the Ministry of International Trade and Industry on July 10 revealed plans

that it will launch a full-scale program to develop a new form of fusion. Fusion is considered the ideal form of energy for the 21st century. This form, cold fusion, was said to have an 'unknown mechanism,' and the prospects for practical use have not been clear. Agreement was reached during informal meetings with experts that starting in fiscal '93, several hundred million yen per year will be devoted to full scale basic research in the field in order to discover the exact mechanism of the phenomenon. This full scale research is in contrast to the limited work that has gone on up to now, mostly in university laboratories. Cold fusion is considered an ultra-clean form of energy, in contrast to fission power, because it does not create radioactive waste, so it is increasingly hoped that it will replace fossil fuel."

Dr. A. Takahashi of Osaka University's Department of Nuclear Engineering is quoted in the article; "The cause of the effect is still unknown, but there is no doubt that the effect is occurring. The problem is how to sustain the reaction. The amount of heat our experiment yielded makes it certain that this [cold fusion excess heat] can only be some sort of nuclear reaction. It is not such a miracle that deuterons closely packed into the palladium lattice should undergo some sort of nuclear reaction. I am very pleased to see a national effort to crack this problem. I rate the new program very highly. It is solid recognition of this [new science] as a potentially unlimited energy source."

Other Yomiuri excerpts (July 10, 1992): "Cold fusion received global attention after U.S. and European [sic] scientists announced experimental success in 1989. However, the Japan Atomic Energy Research Institute and several other institutions discontinued research in April 1991 because of limited success in the laboratory.

"In February this year, however, atomic engineering expert Professor Akito Takahashi of Osaka University announced he produced twice the amount of consumed energy for two consecutive months, by electrolyzing heavy water. Reviewing the experimental results, the agency [MITI] concluded there was no doubt that a reaction did occur."

Excerpts from the Nikkei Shimbun, June 27, 1992.
"Science Eye" feature section by J. Takaki:

Headlines: "A new step for 'cold fusion' development" -
- "Osaka University Excess Heat Data" -- "Replication Experiments underway worldwide, as industry takes interest."

Excerpt: "If nuclear fusion can be developed, it would give mankind a nearly inexhaustible source of energy. That dream may now be realized in a simple laboratory test tube..."

EPRI MEETS 20 CORPORATE EXPERTS

The article relates that Dr. Thomas Passell of the U.S. utility industry Electric Power Research Institute [Palo Alto, CA] visited Japan recently and held a meeting in a "certain location" in Tokyo with top experts from MITI and from 20 corporations. Six other corporations are said to be at work on cold fusion already. Dr. Passell reveals that the EPRI budget for the next three years is \$12 million. He says that representatives from the U.S. National Science Foundation are visiting [EPRI-funded] SRI International [Menlo Park, CA] right now.

Quote from Dr. Hideo Ikegami, Director of the National Institute for Fusion Science in Nagoya: "There are still a few stuck-in-the-mud 'fossils' who do not believe the effect is real, but they have not examined the data since 1989. Overall, the acceptance has grown tremendously."

Quote from Dr. T. Mizuno of Hokaido National University: "We sensed the change [in attitude toward cold fusion] in the middle of the year. ... Recent experiments have vastly improved, more accurate instrumentation, so we are 100% certain the neutron measurements are real." [Measuring neutrons is a solid confirmation of nuclear reactions.]

Quote from Tokyo Institute of Technology's Dr. M. Okamoto: "It may not be nuclear fusion per se, but there is no question that some sort of nuclear reaction is taking place."

Some of the news sources in Japan that have reported the MITI announcement are: *Yomiuri Shimbun*, July 10, 1992, lead article on page 1; *The Daily Yomiuri* (English Edition), July 11, 1992; *Nikkei Shimbun*, July 11, 1992; and the NHK National Television afternoon news broadcast, July 11, 1992.

Meanwhile, the U.S. Department of Energy Ignores Cold Fusion!

B. THE BEST OF COLD FUSION AWARDS

By Hal Fox & Readers

INTRODUCTION

The new enhanced energy science of cold fusion has progressed from its birth announcement (March 23, 1989) through astonishment, denial, and grudging acceptance (by some), to its present imminent acceptance for planned commercialization. This issue of *Fusion Facts* begins its fourth year of publication. It is appropriate to recognize the best and some of the worst of those people and institutions who have advanced and retarded the

development of cold fusion. This list of awards also includes some recognition of other enhanced energy developments.

PIONEERING AWARDS

FATHER OF COLD FUSION AWARD

To Professor Steven Jones (BYU) for his article in the July 1987 *Scientific American*, goes the award for the premier paper on cold fusion and for his leadership in demonstrating neutron production. [Johann Rafelski & Steven E. Jones, "Cold Nuclear Fusion", *Scientific American*, Vol 257, pp 84-89.]

USEFUL COLD FUSION DISCOVERY AWARD

To Professors Stanley Pons (U/Utah) and Martin Fleischmann (The Univ., Southampton) for their discovery that excess heat could be produced from cold fusion in a palladium-lithium-heavy water system. [M. Fleischmann, S. Pons, and M. Hawkins, "Electrochemically induced nuclear fusion of deuterium." *J. Electroanal. Chem.*, 261, pp 301-308, and erratum, 263, p 187 (1989).]

PUBLICATIONS AWARDS

BEST PEER-REVIEWED JOURNAL AWARD

To Editor George Miley goes the INTEGRITY MEDAL for his excellent series of professional papers on cold fusion published in *Fusion Technology*, A Journal of the American Nuclear Society. Despite continued criticism, Miley has provided a vehicle for the exchange of technical information on cold fusion since the September 1989 issue.

BEST BOOK AWARD

To Dr. Eugene F. Mallove for Fire From Ice, Searching for the Truth Behind the Cold Fusion Furor. The best balanced (both pro and con) discussion of the discovery of cold fusion. Here's to "a seeker of truth." [Wiley science editions, 334 pages, illus. Available from the author at **Starbound**, 171 Woodhill-Hooksett Rd., Bow, New Hampshire 03304, phone (603) 228-4516.]

BEST SCIENCE MAGAZINE AWARD

Without a doubt the award goes to *21st Century Science and Technology* and to its editorial staff including Carol White and Marjorie Hecht with whom we have exchanged much information. [Published quarterly, \$20 for 4 issues, write P.O. Box 16285, Washington, D.C. 20041.]

BEST NEWSLETTER AWARD

To *Fusion Facts* for three years of rapid communication among the cold fusion community. [Each letter from readers nominated *Fusion Facts* for its timely compilations of information.]

BEST REVIEW ARTICLE AWARD (TIE)

To Drs. M. Srinivasan (BARC, India) and Edmund Storms (Los Alamos Nat'l Lab, U.S.) [M. Srinivasan (Neutron Phys Div, BARC, India), "Nuclear Fusion in an Atomic Lattice: An Update on the International Status of Cold Fusion Research", *Current Science*, April 25, 1991, 174 refs. and Edmund Storms, "Review of Experimental Observations About the Cold Fusion Effect", *Fusion Technology*, Vol 20, Dec 1991, pp 433-477, 363 refs. Reviewed in the May 1991 issue of *Fusion Facts*.]

BEST ORGANIZED ADVOCATES AWARD

This award goes to Cold Fusion Research Advocates, 2060 Peachtree Industrial Court, Suite 312-F, Chamblee, Georgia 30341, phone (404) 451-9890, fax (404) 458-2404. Our congratulations to both Jed Rothwell and Eugene Mallove. A great effort was made to influence government with over 300 signed supporters of a petition to encourage government recognition of a new science. We also commend Jed Rothwell for his skill in speaking, writing, and translating Japanese. His skill has built bridges among U.S. and Japanese cold fusion scientists.

WORST COLD FUSION COVERAGE AWARD

This award is a three-way tie for distributed misinformation. The award includes a prescription for glasses with which to read the extensive cold-fusion literature. The award goes to *Scientific American*, U.S. Edition (Japanese edition excepted); to *Science* (published by American Association for Advancement of Science); and to *Nature*, all of whom ought to know better.

BEST U.S. CORRESPONDENT AWARD

The award goes to Dr. Samuel P. Faile of Cincinnati, Ohio as the best U.S. correspondent. Readers will note that Dr. Faile provides us with new information for every issue of *Fusion Facts*. Thanks Sam!

BEST FOREIGN CORRESPONDENT AWARD

This award goes to Dr. Peter Gluck in Romania. Peter is intelligent, witty, and a great friend of cold fusion. *Fusion Facts* is strongly dependent on world-wide volunteers to bring you the latest information on cold fusion and enhanced energy developments. Thanks Peter!

* * * * *

WORST NEWSPAPER COVERAGE AWARD

By a good margin, the award goes to *The New York Times*. This newspaper has earned other similar awards for articles on the electric light -- "impractical" (1880); airplanes -- "waste his [Langley] time, and the money involved, in further airship experiments" (1903); and space travel -- "Goddard...does not know the relation of action to reaction" (1920). [See "Famous Men & Technological Forecasting", *Fusion Facts*, Sept 1991, page 3.]

WORST EXCUSE FOR MALIGNING COLD FUSION AWARD

This coveted award goes to Dr. Douglas R. O. Morrison (CERN, Geneva, Switzerland), who at times had an office at Oakridge National Laboratory where two teams measured excess heat in cold fusion experiments. In spite of such evidence, Morrison has chosen to be the perennial purveyor of pathological cold fusion. He has fought cold fusion with pathological conviction. ["Review of Cold Fusion", presented at a Plenary Session of the World Hydrogen Energy Conference, 24 July 1990, Honolulu, and repeated elsewhere.]

SCIENCE AWARDS

ELEGANT EXPERIMENT AWARD

To Dr. Melvin Miles (Naval Weapons Center, China Lake, California) and to his collaborators (Univ. of Texas - Austin) for measuring helium-4 as the by-product of nuclear reactions in a Pons-Fleischmann type cell. [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", *Proc. of the Second Annual Conference on Cold Fusion*, June 30-July 4, 1991, Como, Italy. See also *J. Electroanal Chem.* 304, p 271, 1991.]

BEST MODEL AWARD

To Dr. Robert Bush (Cal Poly, California) for his improving Transmission Resonant Model (TRM). This model has been the most predictive of any models or theories over the past three years. [Dr. R.T. Bush (Cal State Polytech, Pomona), "A Transmission Resonance Model for Cold Fusion.", Presented at COLD FUSION - A STATUS REPORT session in conjunction with the ASME Winter Annual Meeting held in San Francisco, CA December 12, 1989; "Isotopic Mass Shifts in Cathodically-Driven Palladium via Neutron Transfer suggested by a Transmission Resonance Model to explicate enhanced Fusion Phenomena (Hot and Cold) within a Deuterated Matrix", *Proceedings of The First Annual Conference on Cold Fusion*, March 28-31, 1990, University of Utah Research Park, Salt Lake City, Utah; "Production of Tritium, Neutrons, and Heat Based Upon the Transmission Resonance Model (TRM) for Cold Fusion", *Proceedings of Anomalous Nuclear Effects in Deuterium/Solid Systems*, Brigham Young University, October 22-24, 1990; Robert D. Eagleton & Robert T. Bush, "Calorimetric Experiments Supporting the Transmission Resonance Model for Cold Fusion", *Fusion Technology*, Vol 20, No 2, pp 239-245, 8 figs, 3 refs, September 1991; "Cold Fusion: The Transmission Resonance Model Fits Data on Excess Heat, Predicts Optimal Trigger Points, and Suggests Nuclear Reaction Scenarios.", *Fusion Technology*, Vol 19, No 2, pp 313-356

84 ref, 25 fig.; and "A Light Water Excess Heat Reaction Suggests that 'Cold Fusion' is 'Alkali-Hydrogen Fusion'," *Fusion Technology*, accepted for publication planned for fall 1992. (Paper reviewed in *Fusion Facts*, Dec 1991.)]

BEST INTERNATIONAL ORGANIZERS AWARD

This was a hard one because there are so many unpaid and dedicated supporters of cold fusion who have made a great success out of the conferences held. However, M. Srinivasan (BARC, India); Giuliano Preparata??? (U/Milano, Italy); V.A. Tsarev (Moscow, Russia); Hideo Ikegami (Nat'l Inst for Fusion Science, Nagoya, Japan); Steve Jones (BYU, Utah); and Fritz G. Will (U/Utah) have all directed some of the best conferences on cold fusion and/or represented their national efforts to the world community of scientists.

BEST LIGHT WATER EXCESS HEAT AWARD (TIE)

The nominees are Dr. Randell Mills, Dr. Takaaki Matsumoto, Dr. Noninski, Dr. M. Srinivasan and his BARC friends, and the team of Bush and Eagleton. The award goes to Dr. Randell Mills for showing the way and to Drs. Bush and Eagleton (Cal Poly, California) for demonstrating that the hydrogen-alkali metal (nickel cathode) cell can change Rubidium to Strontium, and to Dr. Srinivasan and his friends for promoting the value of frequency control. [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; Robert T. Bush, "A Light Water Excess Heat Reaction Suggests that 'Cold Fusion' is 'Alkali-Hydrogen Fusion'", *Fusion Technology*, accepted for publication planned for fall 1992. (Paper reviewed in *Fusion Facts*, Dec 1991.) The report on the latest BARC work, instigated by Srinivasan is being prepared.]

POOR-BOY EXPERIMENTERS AWARD

This award goes to Dr. Dennis Cravens (Vernon College, Texas) for his many "how-to" descriptions using equipment that can be obtained at a minimum investment. [Craven's latest was "Notes for Garage Researchers", *Fusion Facts*, April 1992, pg 28.]

THE BRANCHING RATIO AWARD

This award goes to the scientists at BARC, Trombay, Bombay, India for showing with a series of experiments that the "equal branching ratio" of nuclear reactions to produce tritium or neutrons may be valid for hot fusion but was invalid for cold fusion. [P.K. Iyengar and M. Srinivasan (Editors), *BARC Studies in Cold Fusion (April - September 1989)*, Report BARC 1500, Bhabha Atomic Research Centre, Trombay, India, December 1989. (A collection of twenty papers.)]

THE EXCESS HEAT AWARD

This award goes to Dr. Michael McKubre (SRI, International, California) for his group's work to achieve over 250% excess heat on a reasonably steady-state basis. This work was funded by the Electrical Power Research Institute. [C.H. McKubre, R. Tocha-Filho, S.I. Smedley, F.L. Tanzella (SRI International), S. Crouch-Baker, T.O. Passell, J. Santucci (EPRI), "Isothermal Flow Calorimetric Investigations of the D/Pd System," The Science of Cold Fusion, Proceedings of the II Annual Conference on Cold Fusion, June 29 to July 4, 1991, p. 419, Italian Physical Society, c1991.]

HIGH TEMPERATURE COLD FUSION AWARD

This award goes to Drs. Bor Yann Liaw and Bruce E. Liebert for their invention of the molten salt approach to cold fusion. Although difficult to replicate, this work is expected to show the way to higher temperature cold fusion. [Bor Yann Liaw, Peng-long Tao, Patrick Turner, Bruce E. Liebert (U. of Hawaii), "Elevated Temperature Excess Heat Production Using Molten Salt Electrochemical Techniques", *Special Symposium Proceedings - Cold Fusion*, World Hydrogen Energy Conference #8, p 49-60, July 23-24, 1990, Honolulu, Hawaii. (See also *Fusion Facts*, Vol 2 No 4, Oct 1990, pages 1-14 for a reprint and an extensive review of all references.)]

ENHANCED ENERGY AWARD

This award goes to a pair of scientists: To Kenneth Shoulders for showing that an EV (an electron cluster) not only demonstrates that the Coulomb barrier is no barrier, but that an electron cluster can produce more energy than consumed to produce the cluster. To Kiril Chukanov for showing that ball lightning produces excess heat (20% usually and 200% occasionally.) [For Shoulders work see "New Energy Source Patented", *Fusion Facts*, July 1991, page 30. For Chukanov's work see *Fusion Facts*, Sept 1991, page 2 & 13; November 1991, pp 24-25; May 1992, pp 3-5, June 1992, pg 22.]

WILLING TO SHARE AWARD

This award goes to Professor Akito Takahashi (Osaka Univ, Japan) for his willingness to share information, data, and experimental procedures concerning his recent successes with pulsed electrolysis experiments. Dr. Takahashi presented his information at personal visits to MIT and to Texas A&M. He also provided detailed information about his work to help others replicate his important results. [*Fusion Facts*, May 1992, pp 8-11 and also Jed Rothwell & Gene Mallove, "Replicating the Takahashi Experiment", March 1992, pp 19-20.]

BEST EXPERIMENTAL MANUSCRIPT AWARD

This award goes to Dr. Andrew M. Riley (then with College of Engineering, U/Utah & with Nat'l Cold Fusion Institute) for his seven papers in the Investigation of Cold

Fusion Phenomena in Deuterated Metals, Final Report, Vol II, Engineering, published by National Cold Fusion Institute, University of Utah, SLC, Utah, June 1991. Dr. Riley was killed January 2, 1992 while working with a cold fusion experiment at SRI International, Menlo Park, California. (Dr. Mitchell R. Swartz suggested this award.)

STILL NOT WITH IT AWARD

This award is given to the U.S. Patent Office for the best continuous unsubstantiated denigration of cold fusion for refusing any invention involving, or in the environment of cold fusion. (Suggested by Dr. Swartz.)

PARADOXICAL BEHAVIOR AWARD

MIT is the winner of this award for seeking U.S. patents on cold fusion while publishing a negative paper and officially maintaining that cold fusion does not exist. It seems that hot fusioners have problems seeing through their plasmas. (Suggested by Dr. Swartz)

THE SCIENTIST'S AWARD**INTELLIGENT PERSEVERANCE AWARD**

To the hundreds of cold fusion scientists, theoreticians, experimenters, inventors, and writers who have persevered in spite of strong criticism from some of their peers and most of the media. These men and women have won through the perils described as follows: "On the Plains of Desolation, bleach the bones of countless thousands, who at the Dawn of Victory sat down to rest and resting died." (author unknown to me). This award goes to those who refuse to rest at the Dawn of Victory. You are about to present to the world the greatest scientific gift of the century - clean, inexhaustible energy. The victory is yours, the work has just begun.

C. DRAMATIC DEVELOPMENTS IN COLD FUSION & M. SRINIVASAN VISITS UTAH

This past month has brought several remarkable developments in the continuing history of cold fusion:

1. After three years of experiments, Dr. Nelson Ying of Orlando, FL (says the news article) produced up to 100,000 times more energy that applied to a Pons-Fleischmann type electrochemical cell.
2. Several U.S. scientists were provided with the same or similar Palladium foil that Takahashi used for his remarkable results. Apparently, the palladium comes from two different batches of Pd from the same supplier. One batch proves to produce substantial amounts of excess heat and the other batch apparently does not.
3. Srinivasan visited Randall Mills; Robert T. Bush and Robert D. Eagleton; and scientists at BYU and the Univ. of Utah. Srinivasan called BARC from Utah to get the latest results with BARC experiments in light water.

Srinivasan reports that about seven teams of scientists have now replicated the light water, nickel cathode, alkali-metal carbonates experiments with several reports of 300% excess heat.

4. The Encyclopaedia Britannica discovered cold fusion with a somewhat reasonable article in its 1993 Year Book of Science and the Future.

5. The SRI, International report on Dr. Andrew Riley's death was finally completed.

6. Discovery Channel on U.S. cable TV presents a reasonably positive report on cold fusion.

Details follow in this and other sections of this newsletter.

1. DR. NELSON YING

See the report under NEWS FROM THE U.S. under FLORIDA, page 8.

2. TAKAHASHI'S EXPERIMENT REPLICATED

Dr. H. Ikegami of Japan's National Institute for Fusion Science has been most kind in helping several U.S. scientists (seven known to *Fusion Facts*) with sample Pd from the same batch or a similar batch that was used by Takahashi in his recent remarkable experiments. Dr. Eugene Mallove publicly (speech at the University of Utah) claimed successful results. One scientist had favorable results at a National Laboratory and is preparing a written report. Scientists at two universities received the second batch material and reported no success. (Some pre-treatment of the Pd by annealing was recommended.) Scientists at two other facilities had not started their planned work at press time. A report from Japan was that five cells were successfully producing excess heat. Reports are being planned. *Fusion Facts* will publish further information as it is released by the researchers concerned.

3. SRINIVASAN VISITED UTAH

While in the U.S. and Canada to visit his two daughters, Dr. Mahadeva Srinivasan, head of the Neutron Physics Division of the Bhabha Atomic Research Center (BARC) near Bombay, India, took time to visit with fellow cold fusion scientists. Srinivasan met with Dr. Randall Mills in Lancaster, Pennsylvania; with Drs. Bush and Eagleton at Cal Poly in Pomona, California; and with friends at BYU and the University of Utah.

In Utah Dr. Srinivasan was interviewed by a reporter from the *Deseret News* in the offices of *Fusion Facts*. Srinivasan reported, "In the last few months we have been looking for heat in the so-called nickel light-water cells. Three different groups (at BARC) have set up some experiments . . . Preliminary results clearly indicate excess heat -- Output heat which is roughly three times input heat." In

presenting some details of light-water experiments to the faculty/student sessions at BYU and the U/U, Srinivasan reported the use of porous nickel cathodes to achieve improved results as compared with Ni foil or Ni rods. He also reported on successes using low frequency (0 to a few kHz) current. The best results were shown to be at a few hundred cycles per second. Magnitudes and waveforms were not disclosed because papers by the experimenters are in preparation.

Srinivasan presented some remarkable results of Dr. Robert T. Bush's Transmission Resonance Model (TRM) with his recent model improvements. The TRM is certainly one of the most productive models of cold fusion in terms of predicting experimental results that were later measured. The prediction and measurement of a sawtooth (or fractal) type of curve to be obtained when excess heat achieved is plotted against the electrolyte (or cathode) temperature is an excellent example of the model prediction and results, Srinivasan noted.

Srinivasan also covered some of the features of two papers by Tadahiko Mizuno, et al., a Japanese scientist at the Hokkaido University in Sapporo, Japan. [See under NEWS FROM ABROAD, under JAPAN heading.] The most interesting feature is the experimental evidence for loading a Pd cathode at relatively low temperatures. "COOL IS BETTER", noted Srinivasan on one of his transparencies.

The results of a visit to Japan were also reported to the Utah groups by Srinivasan. He noted that many universities in Japan are involved in cold fusion. In addition, he learned that Japan's MITI (Ministry of International Trade and Industry) plans to provide \$50 million for cold fusion research with the goal of commercialization by the year 2000. In addition, ten Japanese companies have formed a consortium to further cold fusion research. **It is unfortunate that in the United States there is no equivalent of MITI and that our well-funded Department of Energy has been seriously misinformed by their scientific advisors about the many successes in cold fusion.**

Fusion Facts wishes to thank FEAT, Inc. (a private Utah corporation involved in enhanced energy system development) for helping to arrange a visit to Utah by Dr. Srinivasan. Thanks are also extended to Prof. E.P. Palmer for making arrangements for the visit to BYU and for showing us the underground neutron-measuring facility. At the University of Utah, Robert Miller of the U/U Science and Medical Archives at the Marriott Library and Dr. James McIntyre were most helpful to provide the arrangements to meet faculty and students. Srinivasan's visit was most timely and his broad knowledge of the world's work in cold fusion was greatly appreciated at both campuses and by the staff of *Fusion Facts*, and

FEAT. Both Dr's Takahashi and Srinivasan are to be highly commended for their visits to the United States and their willingness to freely exchange information with scientific colleagues. This action depicts the nature of good science and is much more desirable than the emotional attacks made against cold fusion by a few scientists.

4. BRITANNICA FINDS COLD FUSION

See the first report under NEWS FROM THE U.S. on this page.

5. SRI, INTERNATIONAL REPORT ON ACCIDENT

See Dr. Craven's summary on page 19.

6. DISCOVERY CHANNEL DISCOVERS C.F.

On the Discovery Channel (a U.S. cable Television channel) was recently aired a somewhat balanced discussion of cold fusion. Under its Beyond 2000 series, the Discovery Channel presented "The Cold Fusion Question." The presentation discussed the sun's source of energy and stated that if harnessed there is enough energy in 1.5 cubic kilometers of sea water to surpass all known oil reserves. After dismissing the \$100 billion spent on hot fusion attempts, the video showed cold fusion cells in a Stanford Univ laboratory. The video presented statements from the following: Dr. Robert Huggins (for) & Walter Meyerhof (against), both of Stanford; Fleischmann (for), Drs. Bart Czirr & Steven Jones of BYU (for neutrons not heat); Dr. Brophy of U/U now deceased ("let the science community decide"); and Maddox of *Nature* who spoke of the initial frenzy, leaked copies (of F-P initial paper) and the suggestion of self-delusion by not sharing information with peers. Fleischmann states, "You just have to take a long view. People will come around to our view of it [cold fusion] in the end. This video presentation was much better than the mostly negative NOVA production that was presented about a year ago on U.S. public television channels. Progress is being made."

D. NEWS FROM THE U.S.

ENCYCLOPAEDIA BRITANNICA DISCOVERS C.F.

George B. Kauffman (Prof of Chem, Calif State Univ, Fresno), "Applied Chemistry - Cold Fusion," 1993 Yearbook of Science and the Future, Encyclopaedia Britannica, pp 305-306.

EDITOR'S SUMMARY

Fusion Facts was delighted to receive the annual science yearbook for 1993 (events of 1991) and find that cold fusion had been discovered by the staff of the Encyclopaedia Britannica. Prof. Kauffman's article relates that during 1991, "...many scientists began to lose interest in a case that showed no signs of being settled. ...and the scientific community remained sharply polarized between the skeptical majority and a minority of cold fusion supporters." Kauffman might have reported that the controversy was between the **unreading majority and the successful experimenters**. "While most scientists dismissed Pons and Fleischmann's work...", continues Kauffman and reports that the work of Steven Jones (BYU) was more readily acceptable. The article reports on Melvin H. Miles work in measuring helium-4 as a byproduct of cold fusion and quotes John R. Huizenga as saying, "it just violates all that we know about nuclear physics." Of course, Huizenga is wrong again, because he fails to recognize that the helium-4 may be a byproduct of a deuterium - lithium-6 reaction (as proposed by Robert T. Bush and others.) The article cites the contrast between Gene Mallove's book and Frank Close's "highly critical" book. The final paragraph quotes Carol White, Editor-in-Chief of *21st Century Science and Technology*, "...an international team of top scientists unequivocally confirmed their 1989 results, and their conclusions that what was occurring was a nuclear event--not merely electrochemical." Finally, Dr. Robert T. Bush (Cal Poly Univ) is quoted as saying, "The general message conveyed by the conference was that far from fading away, cold fusion research appears here to stay and is getting stronger."

Since the events covered by Kauffman's report, Drs. Bush and Eagleton have had excellent successes with light water electrochemical cells; Takahashi (and now several others) have succeeded in getting excess heat from a postage-stamp size one mil thick palladium foil; three teams at BARC have obtained up to 300 percent excess heat from light water cells; and Ying (Orlando, Florida) reports astonishingly high excess heat measurements using fractional watt inputs. [See elsewhere in this issue for summaries of these recent events.]

CALIFORNIA - HIGH TEMP Ti-Pd ALLOY

Courtesy of Dr. Samuel Faile

A.F. Jankowski (Lawrence Livermore Nat'l Lab., Chem & Materials Science), "A15 structure formation in Ti-Pd," *J. of Alloys & Compounds*, vol 182, no. 1, April 9, 1992, pp 35-42, 7 refs, 7 figs.

AUTHOR'S ABSTRACT

Vapor phase formation of thin films in the Ti-Pd alloy system is investigated using magnetron sputter deposition. Crystalline as-deposited structures are produced with nominal compositions of 20, 25 and 30 atomic percent Pd. The high temperature b.c.c. phase is produced on room temperature substrates via quenching from the vapor phase. An A15 structure of Ti_3Pd is rigorously identified for the first time, in agreement with predictions from electronic structure calculations.

[Cold Fusion scientists may want to consider this Ti_3Pd alloy for cold fusion work at 400 to 500 C operation. Ed.]

CALIFORNIA - REPLICATION OF CLUSTER IMPACT FUSION

From Chemical Abstracts, June 1, 1992

Y.K. Bae, D.C. Lorents, S.E. Young (Mol. Phys. Lab., SRI International, Menlo Park), "Experimental confirmation of cluster-impact fusion," *AIP Conf. Proc.*, 1992, 250 (Towards Unified Pict. Nucl. Dyn.), pp. 310-320, in English.

AUTHORS' ABSTRACT

We have investigated d-d fusion induced by impact of $(D_2O)_N^+$ and $(H_2O)_N^+$ clusters with $N = 1-50$ on deuterated polyethylene targets at energies of 135-225 keV. Both the energy dependence and magnitude of the fusion yield measured confirm the results of Beuhler et al. (1989). The size dependence of the $(D_2O)_N^+$ fusion yields measured at the impact energy of 225 keV for small ($N < 10$) clusters follow the thermonuclear model. However, for $n > 10$ the size dependence rapidly deviates to higher yields from the model as N increases. For $(H_2O)^+$ and $(H_2O)_2^+$ at 225 keV, the yields roughly agree with the knock-on model. No fusion event was observed for $(H_2O)_N^+$ clusters with $N = 4$ to 50, however, $n + 115$ clusters produced an observable fusion rate. The ratio between fusion rates of $(H_2O)_{115}^+$ and $(D_2O)_{115}^+$ is $5 \pm 2\%$, in close agreement with the result, approx 5%, measured by Beuhler et al. at 300 keV.

[For negative results see Fallavier et al. under NEWS FROM ABROAD under France.]

FLORIDA - HIGH EXCESS HEAT CF

AP staff writer, "Florida scientist hopes to heat up world with cold-fusion process," *Deseret News*, Saturday, June 27, 1992. Also from *Orlando Sentinel* staff writer, "Floridian Says Fusion's No Illusion," *Salt Lake Tribune*, pg A-3, June 28, 1992.

EDITOR'S COMMENTS

The news reports stated only that the experimental work uses platinum and palladium electrodes in heavy water. The *Deseret News* article states, "Using subatomic particles called bosons, a 15-microwatt current separates the deuterium and produces up to half a watt of electrical power according to Ying." In a call to Dr. Ying, he promised to send us information as soon as possible. He did mention that his patent attorney was not pleased with the announcement. A non-disclosure agreement has been signed by a cold-fusion experimental team and replication is being attempted. *Fusion Facts* will have more information as soon as it is available.

HAWAII - MOLTEN SALTS

Courtesy of the authors

Bor Yann Liaw, Peng-long Tao, & Bruce Liebert (Univ of Hawaii), "On Charging Palladium in an $AlLiCl-KCl$ Eutectic, Excess $LiH(D)Pd$ Cell," *Proc of Eight International Symposium on Molten Salts*, 181st Electrochemical Society Meeting, St. Louis, Missouri, May 17-22, 1992, 2 tables, 8 figs, 9 refs.

AUTHORS' ABSTRACT

An anomalous heat effect was found during high-current-density charging of an $AlLiCl-KCl$ eutectic with excess $LiDPd$ cell at elevated temperatures. The electrochemical and calorimetric behavior of this molten salt approach will be discussed. The thermochemical aspects of possible reactions at each charging stage will be interpreted by cell potential to seek a possible explanation for the anomalous heat. We were unable to identify any conclusive chemical nature of the anomalous phenomenon. The phenomenon is quite irreproducible because of several material-related problems and the lack of understanding of the control of predominant electrochemical reactions during the excess power excursion.

AUTHORS' CONCLUSION

A molten salt technique was used to charge a palladium anode with deuteride at elevated temperatures. Under high charging current densities and potentials, we occasionally measured excess power and heat. This phenomenon cannot be explained thermochemically. From thermodynamic considerations of the cell potential, we concluded that DCl formation in the D^- -containing melt was responsible for the sustainable loading of deuterium into Pd, which may lead to the generation of excess power and heat. The presence of Fe, and its oxidation into $FeCl_2$, played an important role in stabilizing the cell potential that facilitated the DCl

formation. If this scenario is true, the control of the relative concentration of Li^+ , Fe^{+2} , D^+ , D^- and Cl^- in the melt should be crucial for the reproducibility of the excess heat phenomenon.

[The authors acknowledge financial support from Fusion Resources, Inc. and from the Univ. of Hawaii. It is our understanding that some modest support is forthcoming from the U.S. Navy. Thanks Hawaii. Ed.]

INDIANA - CLUSTER IMPACT THEORY

From Chemical Abstracts, June 1, 1992

Y.E. Kim, M. Rabinowitz, Y.K. Bae, G.S. Chulick, R.A. Rice (Dept Phys, Purdue Univ, West Lafayette), "Hot plasma shock-wave theory of cluster-impact fusion," *AIP Conf. Proc.*, 1992, 250 (Towards Unified Pict. Nucl. Dyn.), pp 321-343, in English.

AUTHOR'S ABSTRACT

Cluster-impact fusion can be understood as hot fusion on a microscopically small atomic scale. It is improbable to account for the data as an artifact of contamination. By means of theoretical analysis based on a universal scaling equation, our high temperature model is consistent with the known data of recent d-d fusion experiments in which clusters of D_2O , H_2O , and D are accelerated onto deuterated targets. Furthermore, we show that the line broadening of the experimentally obtained proton spectrum supports our prediction of the high temperature in the impact region. Although we have focused on a temperature enhancing shock-wave model, our methodology and scaling equation are sufficiently general to encompass additional processes such as pinch instability heating. We estimate the present efficiency of this process, and predict higher efficiencies for various experimental conditions.

MASSACHUSETTS -- IMPACT FUSION

Courtesy of Dr. Samuel Faile

Peter Graneau (Center for Electromagnetics Research, Northeastern Univ, Boston), "Heavy-Water-Arc Gun for Impact Fusion," *Galilean Electrodynamics*, July/Aug 1992, vol. 3, no. 4, pp 63-65, 2 figs, 11 refs.

AUTHOR'S ABSTRACT

The paper considers the prospect of generating nuclear fusion energy with D-D reactions by direct impact and collision of heavy water droplets fired from water-arc guns. D_2O -cluster impact fusion has already been demonstrated to occur at relative velocities of the order of 100 km/s. With the help of experiments and the

momentum equation of electrodynamic launchers it is argued that the water-arc gun is capable of accelerating a 0.1 g heavy water mass to 100 km/s. This depends on the water-arc explosion being driven by electrodynamic forces and not by steam pressure. An experiment is outlined which proved conclusively that steam was not a factor in the operation of the water-arc gun.

NEW YORK - D-D CLUSTER IMPACT FUSION

Courtesy of Dr. Samuel Faile

From Chemical Abstracts, June 1, 1992

R.J. Beuhler, Y.Y. Chu, G. Friedlander, L. Friedman (Chem. Dep. Brookhaven Natl. Lab., Upton, NY), "Experimental demonstration of deuterium-deuterium fusion by cluster ion impact," *AIP Conf. Proc.*, 1992, 250 (Towards Unified Pict. Nucl. Dyn.), pp. 283-93, 6 ref., in English.

AUTHORS' ABSTRACT

The recently discovered phenomenon of D-D fusion induced by cluster ion impact on deuterated surfaces is reviewed, along with experimental investigations designed to prove that the phenomenon is not caused by artifacts. Particular emphasis is given to time-of-flight experiments which unambiguously establish that the observed fusion events are caused by the slow-moving cluster ions rather than by faster small-ion impurities.

NEW YORK - ENERGY ENTREPRENEURS

Courtesy of Dr. Samuel Faile

Barrett Seaman (staff writer), "Chasing the American Dream," *TIME*, July 6, 1992, pp 46-51.

EDITOR'S COMMENTS

This is a story of two American inventors who developed a liquid fuel based on the removal of sulfur and nitrogen pollutants from coal. The fuel is a success and the business on the verge of failure after 20 years. The information in this article shows the difficulties of establishing a new energy business in America. The combination of federal and state laws, rules, and regulations make it difficult for a small business to compete in an entrenched energy market. As cold fusion entrepreneurs, we should beware. We will need more than good products. We will need excellent science, engineering, marketing, financial, and business expertise. The article states that 9 of 10 inventors never receive a dime for their inventions. Sounds like we cold fusioners may need to form a mutual-aid cooperative and involve the marketing, financial, and business managers. That will be a real FEAT.

E. NEWS FROM ABROAD

ENGLAND - NATURE ON SHAKY GROUND

Courtesy of Dr. Samuel Faile

David Lindley (staff), "Out, out brief candle ...", *Nature*, Vol 357, 25 June 1992, pg 635, no ref.

EDITOR'S COMMENTS

Nature's foremost staff member in the U.S., Dr. David Lindley, must not have a long-distance telephone budget that would pay for a call to Texas A&M. Lindley claims that Professor John Bockris, TAM, was [sic] "the most active proselytizer" for cold fusion. Lindley writes that tritium generation at TAM has a history of being sporadic; that tritium-production claims "subsided" in 1990 at TAM; that there were unproved charges of "deliberate contamination;" that some traces of tritium were found in some samples of Pd that was present before the experiments; and that "neither heat nor tritium has lately been found at [TAM]...except in accord with the usual strictures of physics and chemistry." Unless Lindley has adopted cold fusion as part of the "usual strictures [sic]", then Lindley is blowing out Hamlet's candle too quickly. As Shakespeare would say, "O! while you live, tell truth, and shame the devil!" (King Henry IV, Part I).

Fusion Facts knows better, so we called Dr. John Bockris' office and confirmed the fact that the latest TAM paper (Chun-ching Chien, D. Hodko, Z. Minevski, & J.O'M. Bockris, "On an electrode producing massive quantities of tritium and helium") has been accepted for publication by the *J. of Electrochem Chemistry* and will be published in either volume 240 or 241. This paper describes the results achieved and the manner in which Bockris et al. have helped to resolve the problem of replication of the F-P Effect in producing tritium and/or other nuclear reactions in electrochemical cell experiments. We also recommend the following paper: J.O'M. Bockris, D. Hodko & Z. Minevski, "The Mechanism of Deuterium Evolution on Palladium: Relation to Heat Bursts Provoked by Fluxing Deuterium Across the Interface," published in The Science of Cold Fusion, Proceedings of the II Annual Conference on Cold Fusion, Edited by Bressani, Del Guidice, & Preparata, Italian Physical Society, 1991, pp 337-362, 8 figs, 8 ref.

However, Dr. Lindley, we still have great respect for *Nature*, at least for its pre-cold fusion scholarly work. Now David, please relight your candle else you and your vaunted publication will remain in intellectual darkness. Remember that famous poet, Wordsworth, who said, "Let Nature be your teacher." Or how about moving to solid ground: "To the solid ground of Nature trusts the mind that builds for aye." (W. Wordsworth) This is *Nature's* motto which used to be on *Nature's* front cover.

FRANCE - CLUSTER-ION FUSION

Courtesy of Dr. Samuel Faile

From Chemical Abstracts, June 1, 1992

M. Fallavier, J. Kemmler, R. Kirsch, J.C. Poizat, J. Remillieux, J.P. Thomas (Inst. Phys. Nucl. Lyon, Univ. Claude Bernard Lyon I, France), "Search for nuclear fusion induced by D_N^+ and N_N^+ cluster ions in deuterated targets," *AIP Conf. Proc.*, 1992, 250 (Towards Unified Pict. Nucl. Dyn.), pp. 294-302, in English.

AUTHORS' ABSTRACT

According to the results of the Brookhaven group, d-d fusion can be achieved in deuterated targets when using water clusters, deuterated or not, for energies per unit mass even much below 1 keV. We have investigated the extreme situation of pure D cluster bombardment, choosing a similar range of energy per d in order to make a significant comparison. With such projectiles, magnetically mass selected after acceleration, no fusion event has been detected and our experimental upper limit for the fusion rate was >2 orders of magnitude below the typical values reported with deuterated water clusters. This result supports the picture reported in most of the theoretical models that any favorable energy transfer to the d requires the presence of a heavier collision partner in the projectile. In the course of these experiments, the only possibility for assessing the effect was to use N instead of D. Unfortunately, only the deflection of the low mass projectiles off the target direction was experimentally feasible. Since fusion was observed both with the pulsed cluster beam and with the continuous leak beam of atomic and molecular species, a contamination by residual d is most likely responsible for the effect.

[In contrast see Bae, et al. above in NEWS FROM THE U.S. under California heading. Ed.]

FRANCE - H ON CRYSTALS

Courtesy of Dr. Samuel Faile

From Chemical Abstracts, June 1, 1992

M. Fallavier, B. Hjorvarsson, M. Benmansour, J.P. Thomas, (Inst. Phys. Nucl. Lyon, Univ. Claude Bernard Lyon, France), "Determination of hydrogen surface coverage of platinum-nickel ($Pt_{0.5}Ni_{0.5}$ single crystals by NRA," *Nucl. Instrum. Methods Phys. Res., Sect. B*, 1992, B64 (1-4), pp 83-87, in English.

AUTHORS' ABSTRACT

The $^1H(^{15}N, \alpha, \gamma)^{12}C$ resonant nuclear reaction was used to measure the H coverage on the (110) and (111) faces of $Pt_{0.5}Ni_{0.5}$ single crystals. Surface treatments prior to adsorption experiments as well as beam-induced

defects were studied ensuring a correct determination of H concentration. Hydrogen coverage was measured from 115 to 4000 K in the 10^{-8} to 10^{-4} mbar HL2 pressure range. The maximum coverage is 1 monolayer on the (110) face and 0.2 monolayer on the (111). An interpretation for these low values, compared with the coverage of Ni(110), and Pt(111), is proposed. The computation variation of the first 3 atomic layers of the crystals accounts for this difference.

INDIA - BRANCHING RATIOS

Courtesy of Samuel Faile

Lali Chatterjee, Amal Chakraborty & Goutam Das (Physics Dept, Jadavpur Univ, Calcutta), "Non-radiative exit channels in low energy d-d fusion," *Indian J. of Pure & Applied Physics*, vol. 29, Dec 1991, pp 781-786, 3 figs, 19 refs, in English.

AUTHORS' ABSTRACT

The exit channel kinematics for low energy d-d fusion (muonic and amuonic) have been studied in the sub-barrier region, and the branching ratio of the two non-radiative channels compared with experiment. Screening and Coulomb effects have been discussed.

EDITOR'S COMMENTS

Muon catalyzed fusion experiment favors the neutron channel. Kinematic analysis favors the tritium channel as does the Oppenheimer Philips suggested process. Electrochemical cell experiments highly favor the tritium channel. Dr. Chatterjee, what is the probability of a $\text{Li-6} + \text{D-2} \rightarrow 2 \text{He-4}$ channel which favors neither?

ITALY - GAS-LOADING EXPERIMENTS

Courtesy of Dr. Samuel Faile

From Chemical Abstracts, June 1, 1992

F. Lanza, G. Bertolini, V. Vocino, E. Parnisari, C. Ronsecco (Jt. Res. Cent., Comm. Eur. Communities, Ispra, Italy), "Investigation on cold fusion phenomena using gas-metal loading experiments," *Comm. Eur. Communities Report EUR 13908*, 1992, 31 pages, In English.

AUTHORS' ABSTRACT

Previous experiments showed that tritium is produced in deuterated Ti. The data obtained are highly scattered and nonreproducible. To better define the phenomenon, a series of tests was performed using various metals and alloys and different deuterating conditions. Sheets and shavings of Ti, Zr, Hf, Ta, Zircaloy 2, and Ti-Zr (50 at.% alloy) were tested. The tritium production was obtained

as the difference of the tritium content in the deuterated metal and the initial content of tritium in the D_2 gas. The amount of T produced is low, and reproducibility is rather poor. A statistical analysis shows that significant differences are obtained by varying the type of metal used. In general, the tritium production increases with an increase in the atomic number of the metal. Moreover, significantly higher productions of tritium were obtained using the materials of tech-grade such as Ta, Zircaloy 2, and Ti-Zr alloy.

JAPAN - HYDROGEN DIFFUSION

Two important papers by Mizuno

Courtesy of Dr. M. Srinivasan

FIRST PAPER

Tadahiko Mizuno (Hokkaido Univ, Sapporo, Japan), "Diffusion of Hydrogen and Deuterium in Zirconium under Cathodic Polarization," *J. Japan Inst. Metals*, Vol 5, 1991, pp 553-5571, 10 Figs, 9 refs, in Japanese, translated by BARC. [Translation available from *Fusion Facts*.]

AUTHOR'S ABSTRACT

[English Abstract in Journal.] The diffusion behavior of hydrogen and deuterium in Zr during cathodic discharge was studied by direct measurement of their concentrations. These were estimated by a volumetric measurement of the chemical dissolution of the metal hydride layer and a d-d fusion method of deuteron bombardment to the metal layer including deuterium. The diffusion behavior was analyzed with a simple push model that the diffusing hydrogen or deuterium atom interact directly with another hydrogen or deuterium atom composed [with] hydride or deuteride.

The activation energy of diffusion for hydrogen and deuterium in their hydride layer showed the same value of 49.0 kJ/mol and they were almost the same as in other papers. But the diffusion coefficients of hydrogen (D_{DH}) and deuterium (D_{HD}) showed a big difference; the ratio of $D_{\text{DH}}/D_{\text{HD}} = 14.4$ is extremely large compared with another value of nearly 3 obtained using a conventional diffusion model. The reason for the big difference is considered as follows. The diffusion process can be divided into several stages of the fundamental process. They are the discharge of the hydrogen ion from the solution to metal surface adsorption, the dissolution to metal from the surface, the diffusion through the hydride layer and the combination with the metal atom. The ratio of $D_{\text{DH}}/D_{\text{HD}}$ for this model has a value of less than 4. But in the case of the push model in which the hydrogen atoms interact with each other, the ratio becomes 11.3.

AUTHOR'S CONCLUSIONS

[BARC translation of paper.] Diffusion of hydrogen in metals in the above discussion occurs due to jump mechanism between the hydrides. It will not be a continuous diffusion, rather an interaction between hydrogen bonding with metal atoms and hydrogen entering later. This method of viewing that hydrogen diffusion will continue while hydrogen atoms collide with each other will make the task of explaining experimental facts much easier. In Wagner-Jost model hydrogen first advances into metals due to absorption of electrolyzed hydrogen. Further, after its diffusion in hydride layer, it shifts to hydride-metal boundary and then new hydrides are formed with metal atoms. . . . In this model hydride forming hydrogen will be distinguished from hydrogen diffused in hydrides. However, in order to explain continuous shifting of hydrogen absorbed earlier by thrust of hydrogen entering later, we must take into consideration thrust effect due to collision of hydrogen atoms.

SECOND PAPER

Tadahiko Mizuno, T. Akimoto, K. Azumi & M. Enyo (Hokkaido University, Sapporo, Japan), "Diffusion Rate of Deuterium in Pd During Cathodic Charging," *Denki Kagaku zasshi*, Feb-Mar 1992, pp 1-7, 9 Figs, 28 refs, in Japanese, translated by BARC. [Translation available from *Fusion Facts*.]

AUTHORS' ABSTRACT

[English abstract as published.] The absorption and release rates of deuterium into or from Pd were measured during electrolysis in a closed cell. At least two states of deuterium in Pd are deduced from the behavior of the diffusion. The difference in the diffusion constants is by two orders of magnitude, being of the order of 10^{-6} and 10^{-8} sq cm per sec respectively, at room temperature. The alpha, beta, and a new phase contribute to the diffusion processes in these two fast and slow steps [of adsorption and desorption] respectively.

AUTHORS' INTRODUCTION

[From BARC translation.] Low-temperature fusion phenomenon was successively reported by Fleischmann and Pons, and Jones et al., in March 1989. Pouring deuterium solution in a simple glass cell, they carried out electrolysis using Pd, Ti etc. as electrodes and observed the occurrence of gamma rays, beta rays, neutrons as well as heat. We had also reported about detection of neutrons of 2.45 MeV supposed to be caused by d-d reactions and detection of tritium [Mizuno, et al., *Denki Kagaku*, Vol 59, No. 9, p 798, (1991).] We came to view [the conclusion] that for making further progress in such investigations it will be important to obtain information relating to diffusion behavior of hydrogen and deuterium

in Pd. Numerous studies have been carried out in the past on diffusion behavior in Pd. Many of them mainly related to diffusion behavior in dilute gas at high temperature and hydrogen at relatively low current density which is mainly used as transparent film. In fact, few studies were done emphasizing electrochemical measurements. It is difficult to come across any work in the previous literature investigating diffusion behavior during the whole process of absorption and desorption at greater current density using large-size Pd rod, especially near room temperature. The present study aims at continuous measurement of deuterium amount in Pd during electrolysis in LiOD deuterium solution and study of the diffusion behavior of deuterium using a metal electrolysis cell.

AUTHORS' CONCLUSIONS

[BARC translation.] The effect of current density and temperature on the absorption and desorption characteristics of deuterium during electrochemical charging of large Pd electrodes has been studied. The following observations have been made:

- (1) Deuterium is absorbed and desorbed according to the rule of speed in the second stage. Considering diffusion in alpha and beta phases in the first stage of absorption, its activation energy will be -24.0 KJ per mol and 2.17 KJ per mol in the slow stage.
- (2) Absorption in the slow second stage is a protective film type having a speed nearly 2 orders of magnitude less than in the first stage and the type of formation of its film is parabolic. At this time, beyond the limit of solid solution, a new phase will be formed without the movement of deuterium.
- (3) Critical current density is present in the formation of the new phase. The speed of its formation is determined by current density and temperature.
- (4) The discharging of deuterium proceeds apparently in the second stage. Fast discharging in the first stage is from alpha and beta phases and slow discharging in the second stage is due to decomposition from the new phase.

EDITOR'S COMMENTS

There are some important concepts in this paper. Perhaps the most important is the experimental evidence that the rate of loading (of deuterium into Pd) is greater at low temperatures than at higher temperatures. The experiments were run at 80, 110, and 135 C. The data shows that the function is a linear when plotted as linear temperature (x-axis) and log of atomic ratio (D/Pd) (y-axis). Therefore, as pointed out by Srinivasan in his presentations to BYU and Univ/Utah colloquiums (early July 1992), "COOL is BETTER" when loading a Pd lattice. The paper also presented data to show that the plot of loading versus current density is a linear plot when the Atomic ratio (D/Pd) is linear (y-axis) and current

density is logarithmic (x-axis). In summary, the temperature at which the Pd is loaded is more important than the current density (within reason.) However, we have learned elsewhere that there are other factors to consider, such as there may be less disruption of the metal lattice by slow loading (low current.)

The paper shows that a high rate of loading can be expected while loading the Pd in its alpha phase (Stage I). The loading rate becomes parabolic as the beta phase develops (Stage II). During desorption, the fast phase occurs when the hydrogen is leaving the beta phase and the slower desorption occurs during the alpha phase. The paper presents evidence to indicate that a third phase may be involved which slows down the desorption. The important concept is that only a proper combination of temperature, current density, and charging time (several days) will load the Pd to near a D/Pd ratio of 1.0. The paper does not explore the many factors involved in Pd preparation that may restrict loading. The 99.99% purity Pd is melted by high frequency, cast, and then machined to a diameter of 10 mm and cut to a length of 10 cm. Before using in the cell, the Pd is degassed for 6×10^5 seconds (one week) at 200 deg C in an electric furnace under 10^{-6} mm Hg vacuum.

This is an important paper and should be carefully studied by anyone who is experimenting with cold fusion electrochemical cells using Pd. It is important to note that a Pd-Ag alloy allows loading without phase change and the use of such alloys may improve the experimental processes. See *Fusion Facts*, Aug. 1991, page 17 for Dr. James B. Hunter's information on "Cold Fusion and Palladium Silver Alloys."

JAPAN - EXTRAORDINARY RESULTS

Courtesy of Dr. Samuel Faile

From Chemical Abstracts, June 1, 1992

Osamu Shirai, Sorin Kihara, Yoshiki Sohrin, Masakazu Matsui (Inst. Chem. Res., Kyoto Univ., Japan), "Some experimental results relating to cold nuclear fusion," *Bull. Inst. Chem. Res., Kyoto Univ.*, 1992, vol 69(5-6), pp. 550-9, in English.

AUTHORS' ABSTRACT

The extraordinary evolution of heat or gamma rays during the electrolysis of the following procedure are introduced: after the constant-current electrolysis with an applied current of 500 mA at a Pd rod cathode (10 mm diameter rod x 15 mm) for 3 days in D₂O solution containing 0.1M DCI and 0.01M PdCl₂, the electrolyte solution was replaced by 0.1M LiOH (H₂O) solution, and then the electrolysis with 500 mA was continued. Whole through [read, throughout] this experiment a constant current of

5 A which was indifferent to the electrolysis was passed through the Pd rod electrode. The extraordinary phenomena were observed immediately or 30 minutes after from the replacement of electrolyte solution. The phenomena were difficult to reproduce even by the repeating experiments of the entirely same procedure. Current-potential relations in the electrolysis of D₂O or H₂O at Pd electrodes and permeation behaviors of D or H atom through Pd are discussed connecting with the extraordinary phenomena.

[This is the first experiment that *Fusion Facts* has encountered that could help explain some of the experimental evidence using light water after loading with heavy water. Obviously, there is a greatly increased density of electrons within the metal lattice. It is suggested that pulsed current be used in further experiments. Pulsed current could be used through both the electrolysis circuit and/or through the palladium rod circuit. Ed.]

JAPAN - RELIGION TO SCIENCE

Courtesy of Jed Rothwell

Atsuko Tsuji (Assistant Editor, winner of 1989-1990 Knight Fellowship, Science Journalism, MIT), "Cold Fusion: from a religion to a science," *Aera*, weekly news magazine published by *Asahi Newspaper*, June 16, 1992, pp 39-42, 9 illustrations, in Japanese. Translated by Jed Rothwell.

EXCERPTS FROM SCIENCE ARTICLE FOR LAYMEN

We have excerpted some of the headlines, in bold to give you the sense of the article:

"Three years after the discovery of the century."

"A letter from a friend warning, 'you will be eaten alive'"
Advice given to Takahashi prior to his visit to MIT.

"In the 1960's they would be treated as heroes; now it is almost as if they were criminals." Comment is made about cold fusion researchers, in general, especially in the U.S. In this section the article describes work by Mallove and the intellectual and financial support of Jed Rothwell. "He says that, 'it is thanks to Japan that the **resistance** in the U.S. is able to continue.'" Rothwell, who learned Japanese as an exchange student, is constantly busy translating and exchanging information between Japan and U.S."

"Researchers who would be the next Copernicus - working like the hidden Christians of the early Edo era." The author says, "It appears that Japan has somehow or other taken the lead in cold fusion research." ...

Quoting Dr. Hideo Ikegami of the National Institute for Fusion Science, "The research might not pan out; we might fail. But to fail for lack of trying would be far worse." Again, "Science originated from heresy, and that is what science should be. New ideas are born from heresy" he says with the enthusiasm of a modern-day Copernicus.

"A 'sun' in a test tube."

"A host of new phenomena have appeared that defy conventional scientific wisdom." The author states, "If we could bring Sir Isaac Newton into the present day with a time machine, he might smile bitterly and say, 'people haven't changed, have they?'"

"Atomic nuclei collide and energy is produced."

"Even if it is fruitless, science is science."

The author ends the article with the following, "Dr. Takahashi's experiment attracted attention because it demonstrated continuous heat. As shown in the diagram, it used a palladium plate. He devised a new method of varying the electric power input between high and low phases, which increased the number of deuterons absorbed by the palladium. Excess heat and neutrons have been detected in other experiments as well." ...

"The existing theories of nuclear fusion cannot explain these things. An unknown, anomalous reaction like this excites the curiosity of the researchers. 'We will track it down, and find out what is happening. There might be nothing to it after all, but that is how you do science' (Dr. Okamoto)"

JAPAN - SUB-BARRIER FUSION

From Chemical Abstracts, June 1, 1992

N. Takigawa (Dep. Phys., Tohoku Univ., Sendai, Japan), "Present and future of the sub-barrier fusion reactions," *AIP Conf. Proc.*, 1992, 250, (Towards Unified Pict. Nucl. Dyn.), pp. 26-51, 54 ref., in English.

AUTHOR'S ABSTRACT

The large enhancement of the fusion cross section of heavy ion collisions at energies below the Coulomb barrier has stimulated many experimental as well as theoretical studies in the past decade. An overview is given of the present status of the theoretical research of this subject and some prospects for the future are discussed. [The Coulomb barrier is no longer the barrier it once was, thanks to Ken Shoulders' discoveries. Ed.]

PAKISTAN - ROOM TEMPERATURE SUPERCONDUCTIVITY

Courtesy of Dr. Samuel Faile

Shahnaz Malik, M. Mohammad, & A.Y. Khan (Electrochemistry Group, Dept. of Chem, Quaid-I-Azam, Islamabad), "Superconducting Ceramics with Zero Resistance at and Near Room Temperature," submitted to *Nature*, and reported in *High T_c Update*, vol. 6, no. 11, June 1, 1992, published by Ames Laboratory, Iowa State University.

EDITOR'S COMMENTS

The authors reported that a Na-substituted Y-Ba-Cu-O ceramic is superconducting at and near room temperature. Resistance measurements of zero were obtained using currents in the range of 2 to 5 mA. The authors prepared samples by solid-state reactions of BaCO₃, CuO, Y₂O₃ and Na₂C₂O₄. Finely ground material for each sample was heated (six 24-hour cycles between 800 - 900 C). Pellets measuring 13 mm in diameter and with a thickness of 1-2 mm were made using a pressure of about 6,000 kg/sq cm. The pellets were sintered for 24 hours at 880 C in an oxygen atmosphere and then furnace cooled to ambient temperature. Superconductivity was found with critical temperatures of 90 K, 300 K, and 230 K for various chemical combinations. 0.1 Na atomic percentage appears to provide the highest critical temperature. This material now joins bismuth filaments as room-temperature superconductors. *Fusion Facts* has speculated that the understanding of superconductivity and cold fusion will be found to be related as our understanding of matter increases.

RUSSIA - CATALYST-MEMBRANE SYSTEMS

Courtesy of Drs. Peter Glück and Samuel Faile

V.M. Gryaznov (A.V. Topchiev Inst. of Petrochemical Synthesis, Russian Academy of Sciences, Moscow), "Platinum Metals as Components of Catalyst-Membrane Systems," *Platinum Metals Rev.*, 1992, vol. 36, no. 2, pp 70-79, 6 figs, 47 refs, in English.

AUTHOR'S INTRODUCTION

Platinum group metals are extensively used as catalysts both in dispersed form and as solids. During recent years we have been witnessing the rapid and successful development of a new branch of catalysis, namely the creation of catalyst-membrane systems. The systems combines a catalyst and a membrane which has selective permeability for one of the reagents. Platinum group metal catalysts ensure higher target product yields and durability than other catalysts. In general, catalyst-membrane systems enhance both reaction rate and

selectivity, due to directed transfer of energy and reagents. Three functional variations of catalyst-membrane systems have been investigated:

- a) One of the initial reactants, for example hydrogen, reaches the catalyst through the membrane, which is permeable for this substance only. The second reactant comes from a gaseous or liquid phase.
- b) One of the reaction products is selectively removed through the membrane.
- c) The substance penetrating through the membrane is being formed on the catalyst adjacent to one surface of the membrane, this then diffuses through the membrane and reacts at its other surface on the second catalyst with the substance being introduced from the gaseous or liquid phase.

AUTHOR'S CONCLUSIONS

Combining catalysts and membranes has become a most promising method for improving existing technologies. It seems likely that the suggested classification of catalyst-membrane systems will be helpful in further investigations.

Several types of catalytic membrane reactor have now been studied both theoretically and experimentally. The results have proved to be very encouraging, especially for thermodynamically complicated reactions. Palladium alloys which maintain their hydrogen permeability when in contact with dehydrogenation products have been found. Such membranes are good for use in combination with hydrocarbon-dehydrogenation catalysts and can be used as catalysts for the oxidation of the removed hydrogen, thus compensating for the endothermicity of dehydrogenation.

EDITOR'S COMMENTS

In the June issue of *Fusion Facts*, Dr. Peter Glück provided us with information about possible nuclear catalysis. Dr. Glück highly recommended to us the work of Professor Gryaznov. We commend this paper to you. While there is no good theory (known to us) about nuclear catalysis, the same can also be said for a complete theory of chemical catalysis. However, if nuclear-reaction catalysts exist, we can probably find them and use them for the benefit of mankind.

RUSSIA - GLOW DISCHARGE REPORT

Courtesy of Dr. Ed Palmer

A.B. Karabut, Ya. R. Kucherov, I.B. Savvatimova (Scientific Industrial Association "Lutch", Podolsk, Moscow), "The investigation of Deuterium Nuclei Fusion at Glow Discharge Cathode," author's manuscript, publication unknown, 12 manuscript pages, 9 refs, 4 fig., in English.

AUTHORS' ABSTRACT

After the first publications on cold nuclear fusion with neutrons and excessive heat registration with heavy water electrolytic cell experiments [Fleischmann, Pons, Hawkins & Jones et al.] numerous attempts were made to reproduce these results. Earlier we reported results achieved at gas discharge device cathode bombardment with deuterium ions from glow discharge plasma [cites 2 previous papers] (Current = 10-100 mA, Voltage = 100-300 volts.) In those publications we showed neutron emission with up to 10^7 neutrons per sec intensity, and excessive heat release for about 10 to 20 minutes with a palladium cathode (0.1 mm thick and 1 cm² [sic].) A correlation of neutron intensity and heat release was found. In this paper we present the results of the experiments mostly obtained after the previous publications. These results are obtained using specially-prepared cathode materials and giving reproducible results.

AUTHORS' CONCLUSIONS

1. In glow discharge in deuterium, neutron flux with intensity of 10^3 to 10^7 per second per cm² is measured by three independent methods.
2. The energy spectrum of neutrons from the discharge chamber is measured. The comparison of neutron energy groups (2.5 to 4.5) MeV and (14 to 17) MeV intensity shows the anomalous type of nuclear reaction, 5 orders different from "hot" fusion.
3. The measurements of gamma-radiation energy spectrum and half-life period enables us to identify the presence of rhodium radioactive isotopes on a palladium cathode and Mo isotopes forming on molybdenum-made parts of electrodes.
4. The deviation from radioactive decay law at discharge switch-off allows us to tell that nuclear reaction lasts at least 30 minutes after discharge switch-off.
5. Braking gamma-radiation is observed with edges 1350 KeV and more than 4.5 MeV.
6. Possible types of nuclear reactions explaining "cold" fusion and other "cold" nuclear reaction experimental results are discussed.

EDITOR'S COMMENTS

This paper reports the results using a 0.3 mm silver cathode with .15 to .20 sq meter area as an activated material. A Pd cathode was used. After 150 to 300 seconds bombardment in a deuterium gas partial vacuum the foil beta-emission was measured and showed a maximum of about 6×10^6 neutrons per second which decreased rapidly over time. The neutron spectrum showed peaks at 2.5, 4.5, and 13.8 MeV. The paper discusses the possible nuclear reactions that would give these energies. Gammas were also measured. The authors cite a 4-stage experiment: 1. some gamma-lines

appear; 2. some neutrons appear; 3. stable neutron signals and gammas rapidly increasing; 4. transition at termination occurs with occasional neutron bursts. Additional experiments were made using a Nb-based cathode. The authors discuss the possible nuclear reactions that occur and the rate of decrease of these reactions after the power is switched off.

RUSSIA - SYNTHESIS OF HEAVY ELEMENTS

Courtesy of Dr. Samuel Faile

From Chemical Abstracts, June 1, 1992

Yu. Ts. Oganessian (Lab. Nucl. React., Jt. Inst Nucl. Res., Moscow), "Reactions leading to the synthesis of heavy elements," *AIP Conf. Proc. 1992*, 250 (Towards Unified Pict. Nucl. Dyn.), pp. 465-87, 36 ref., in English.

AUTHOR'S ABSTRACT

The review includes the results of recent experiments carried out at the Laboratory of Nuclear Reactions, JINR and discusses some possibilities of carrying out experiments investigating the dynamics of complex nuclei interaction processes.

SWEDEN - HYDROGEN DIFFUSION

Courtesy Dr. Samuel Faile

Yinggang Li & Goran Wahnstrom (Inst of Theoretical Physics, Chalmers Univ of Technology, Goteborg), "Nonadiabatic Effects in Hydrogen Diffusion in Metals," *Phys Rev Letters*, vol 68, no 23, pp 3444-47, 1 fig, 26 ref, in English.

AUTHORS' ABSTRACT

Molecular dynamic simulations for hydrogen diffusion in Pd are performed, using a potential based on the embedded-atom method. It is found that a single adiabatic Born-Oppenheimer potential energy surface cannot reproduce the wave-vector dependence of the quasidelectric peak obtained in neutron scattering studies. By incorporating coupling to low-lying electron-hole-pair excitations among the conduction electrons close agreement with the experimental result is obtained. This shows that in some cases one has to go beyond the Born-Oppenheimer approximation in order to characterize correctly the diffusive motion of hydrogen in metals.

E. SHORT ARTICLES FROM READERS

COLD FUSION AT DEBRECEN - HUNGARY

A report on a cold fusion conference by Dr. Peter Glück

During 1-4 June 1992, I enjoyed the kind hospitality of my friends from the Kazzuth Lajos Scientific University, Debrecen. This beautiful town in the eastern part of Hungary (200,000 inhabitants) is known in the history of cold fusion for the first replication of the neutron emission, a week after the Fleischmann-Pons conference. There is a Hungarian saying, "He who loves the flowers cannot be a bad man." Change "flowers" to "neutrons" and the saying describes Prof. Dr. Julius Csikai: he loves the neutrons, has over 120 publications in this field and is the author of the well known book, Handbook of Fast Neutron Generators, CRC Press, 1987.

Csikai, together with his colleague Adj. Prof. Tibor Sztaricskai and his wife Adj. Prof. Margaret Buczko Csikai (Chair of Experimental Physics) had an electrolytic cell working as a generator of deuterium and so it was quite handy to replace one electrode with a Pd tube. What is not well known is that they were using a malfunctioning rectifier which was rectifying only the positive part of the sinusoidal current, **therefore, they worked with a pulsed current! This is the probable explanation of the prompt startup of the nuclear phenomena.**

Later they obtained further positive results working with different electrodes: Pd tube, plane spiral, descending and inverted spiral, rod type, hook, in $D_2O + NaOH$ and $D_2O + D_2SO_4$, 3.3 M [sic] systems, obtaining neutron emissions in the 1.33 to 2.33 times background range. After the first experiment they changed the "bad" rectifier and the results seemed to slow up. Due to lack of funding and psychological pressure, they were forced to give up this research. The origins of this pressure are remote from Hungary (CERN, DOE, etc.) but as Mrs. Buczko Csikai explained to me, the Csikai's are now teaching a new generation of students that cold fusion is real, is challenging, and that it was a pity to interrupt their study. They follow with great interest the development in the field and are convinced that the situation will change.

Prof. Sandor Daroczy from the Isotope Department is another expert in cold fusion. The cells constructed by his group are made of acrylic plastic and have base plates of palladium working as cathodes, deuterium being constantly diffusing through this plate during electrolysis. This research comprises many thousand hours of work, great efforts have been made for improved electronics. The group has used thin (0.125 mm) and thick (1 mm) cathodes in order to see if a bulk effect is present. The result was negative and surprisingly the thin plates have shown neutrons in excess during electrolysis, the thick ones only during post-electrolysis discharge. This team has used (part of the time) a periodic multi-current mode; i.e. the current was increased in four steps to a maximum and then decreased again. Unfortunately, at the time of my visit only background measurements were being

performed. The researchers are waiting for adequate funding and for new palladium parts.

This type of cell has unique possibilities due to the possibility of having free access to one face of the cathode. I have suggested coating one side and making it impermeable to deuterium and then to puncture this coating by aid of a laser but this approach is not possible under the given circumstances. The paper of the Daroczy team will be published soon. I consider both their results and ideas as very interesting.

On the 3rd of June I gave a lecture on cold fusion at the House of Academy in Debrecen. The chief organizer was Prof. Mihaly Beck (Chair of Physical Chemistry) a world-known expert in chemical kinetics (especially oscillatory reactions) and a famous author on the problems of science-pseudoscience. His IQ is over 140, I guess, but he is a skeptic regarding cold fusion. During my visit I have tried to present him all the reliable data confirming cold fusion (*Fusion Facts* was very useful) and tried to explain the complexities of this phenomenon. From Budapest, Central Research Institute of Physics came Dr. Gyuula Bercze, my opponent, an internationally known theorist. I did not know him before but we had some quite vehement polemics, triggered by his paper, "The cold Fusion circus" published in the popular scientific press.

[Note: The following gives an insight into the way in which Dr. Glück handles controversy with humor. Ed.]

I began my conference presentation with a famous quotation: "Ladies and Gentlemen, I believe it was President Lyndon Johnson who advised, 'If you enter a room and you cannot see immediately who is with you and who is against you -- then you are not good for politics.' This advice is valid for me, too. If a lecturer cannot establish immediately that the majority of his audience is for or against the subject of his conference, then it is better to not hold conferences. But I am prepared. I have here two variants of my conference talk: The first is entitled, 'The future of cold fusion in energetics' and second, 'Cold fusion is laying in the silent graveyard' (Note that this title is similar to the first verse of a well-known Hungarian folk-song.) But even if am forced to adopt the second variant this is the unique and last concession I admit to make for the sake of the enemies of cold fusion. By the way, only the titles differ - the texts of both variants are identical . . ."

I presented the evolution and the present situation of cold fusion, and explained in detail the SURFDYN concept. The acceptance of both positive and negative results and the whole philosophy behind this idea proved to be a good point. The experimental facts also are very hard to deny. The weakness of the whole story is that nobody exactly knows what is and what isn't possible on or in a

lattice of Pd hydride; the quantum effects, mobility of deuterium mechanism, screening, acceleration, etc.

Dr. Bercze replied with a really excellent presentation of the epistemological problems of the physicists who cannot accept the replacement of a well-verified paradigm with a new one, theoretically inconclusive, not well defined. Later we all discussed many experimental details and even if the skeptics remained skeptics and the believers also didn't change, I had a certain feeling that a mutual empathy is, and will, slowly develop. I was always convinced that "differences in opinion attract clever people and repel only those who are not clever," and at Debrecen I had the privilege to meet high-class scientists and exceptionally clever and cultured people.

/s/ Peter Glück, Romanian Correspondent

STRUCTURE OF SCIENTIFIC REVOLUTION

"The Development of Cold Fusion as a Test Case for Thomas Kuhn's Hypotheses in The Structure of Scientific Revolutions" by Dr. Robert T. Bush [1], Department of Physics, California State Polytechnic University, 3801 West Temple Ave., Pomona, CA 91768.

For those of us struggling to fit together the various pieces in the cold fusion jigsaw puzzle, clearly to us a genuine scientific puzzle, the resistance to cold fusion by other scientists and the great negativity from much of the scientific press is disconcerting at the least and often infuriating and project-threatening. Thus, it may hardly appear to ameliorate things to suggest the sort of "warfare" that cold fusion appears presently mired in has happened over and over throughout the history of science. Nevertheless, this is certainly true, and it may make it easier for us to accept mentally if the cold fusion episode, now involving a crusade for objectivity for those of us who have seen the positive evidence mount up in our own labs and those of other scientists around the world, can be placed in this historical context.

I suggest, therefore, that we avoid the trap of "villainizing" our critics (even though some critics may heartily deserve it!). This type of rebuttal will, after all, stand in the way of our attempts to convert critics to our way of thinking. After all, the support of an erstwhile critic who reverses his position in our favor because he has finally seen the light may be incalculable for winning the "war." In this connection then, and pursuant to that goal, it may be helpful in attempting to establish some empathy with the critics of cold fusion by striving to understand the genuine perceptual difficulties that can arise with regard to attempting to understand a familiar context into which an aspect of novelty, such as cold fusion certainly contains, has been injected.

In his celebrated book, The Structure of Scientific Revolutions (Univ of Chicago Press, 1962), that incomparable historian of science, Thomas Kuhn, emphasizes the pitfalls lying in wait for any individual, and the scientist in particular, when faced with such elements of novelty in otherwise familiar contexts. Thus, on page 62 of the first edition, he refers to three characteristics associated with the emergence of new phenomena, "the previous awareness of anomaly, the gradual and simultaneous emergence of both observational and conceptual recognition, and the consequent change of paradigm categories and procedures often accompanied by resistance. **There is some evidence that these same characteristics are built into the nature of the perceptual process itself** [2].

In a psychological experiment that deserves to be far better known outside the trade, Bruner and Postman [3] asked experimental subjects to identify on short and controlled exposure a series of playing cards. Many of the cards were normal cards, but some cards were made anomalous, e.g., a red six of spades and black four of hearts. Each experimental run was constituted by the display of a single card to a single subject in a series of gradually increased exposures. After each exposure the subject was asked what he had seen, and the run was terminated by two successive correct identifications.

Even on the shortest exposures many subjects identified most of the cards, and after a small increase in exposure time all subjects identified all of the cards. For the normal cards these identifications were usually correct, but the anomalous cards were almost always identified without apparent hesitation or puzzlement as being normal cards. The black four of hearts might, for example, be identified as the four of either spades or hearts. Without any awareness of trouble it was immediately fitted to one of the conceptual categories prepared by prior experience. **One would not even like to say that the subjects had seen something different from what they identified.** With a further increase in exposure to the anomalous cards, subjects did begin to hesitate and to display **awareness of anomaly**. Exposed, for example, to the red six of spades, some would say: That's the six of spades, but there's something wrong with it - the black has a red border. Further increase of exposure resulted in still more hesitation and confusion until finally, and sometimes quite suddenly, most subjects would produce the correct identification without hesitation. **Moreover, after doing this with two or three of the anomalous cards, they would have little further difficulty with the other cards.** A few subjects, however, were never able to make the requisite adjustment of their categories. Even at forty times the average exposure required to recognize normal cards for what they were, more than 10 per cent of the anomalous cards were not correctly identified. **And the subjects who**

then failed often expressed acute personal distress. One of them exclaimed: "I can't make the suit out, whatever it is. It didn't even look like a card that time. I don't know what color it is now or whether it's a spade or a heart. I'm not even sure now what a spade looks like. My God!" [4]

Further on, as a concrete example of such perceptual difficulties associated with novelty in science, Kuhn writes (pp 114-115), **"Sir William Herschel's discovery of Uranus provides a first example and one that closely parallels the anomalous card experiment.** On at least seventeen different occasions between 1690 and 1781, a number of astronomers, including several of Europe's most eminent observers, had seen a star in positions that we now suppose must have been occupied at that time by Uranus. One of the best observers in this group had actually seen the star on four successive nights in 1769 without noting the motion that could have suggested another identification. Herschel, when he first observed the same object twelve years later, did so with a much improved telescope of his own manufacture. As a result, he was able to notice an apparent disk-size that was at least unusual for stars. Something was awry, and he therefore postponed identification pending further scrutiny. That scrutiny disclosed Uranus' motion among the stars and Herschel therefore announced that he had seen a new comet! Only several months later, after fruitless attempts to fit the observed notion to a cometary orbit, did Lexell suggest that the orbit was probably planetary. When that suggestion was accepted, there were several fewer stars and one more planet in the world of the professional astronomer. **A celestial body that has been observed off and on for almost a century was seen differently after 1781 because, like an anomalous playing card, it could no longer be fitted to the perceptual categories (star or comet) provided by the paradigm that had previously prevailed."**

Clearly, "cold fusion," like an anomalous playing card (e.g. "anomalous" branching ratios as a "red spade"), or entire deck of anomalous cards, thus presents a perceptual morass for the scientific community. However, if Kuhn's thesis is correct, we can at least take heart (maybe "black", pun intended) that the situation is essentially normal, in that this perceptual morass characterizes how new science emerges to confound the defenders of the institutionalized status quo. These defenders are reacting as anticipated on the basis of Kuhn's thesis. And, importantly for us, they are, for the most part, honest and conscientious citizens of the scientific community and hardly participators in any sort of conscious conspiracy to deny scientific truth for whatever reason. [Dr. Bush, you are most kind. Ed.] There could, of course, always be some exceptions to this assumption of innocence. I would like to suggest that those readers who have accepted the meaningfulness of the heavy water work but are presently looking askance at

the light-water experiments, which in my opinion presently constitutes a revolution within a revolution, are themselves beginning to provide evidence for the operation of this Kuhnian dynamic in the historical unfolding of science. Finally, it is my opinion that "cold fusion," which I take to mean cold nuclear reactions associated with a lattice (regardless of actual temperature, since pressure could be a factor), will win the fight for general acceptance by the scientific community and that, moreover, the cold fusion episode will come to be viewed as a highly-supportive test case for the Kuhnian view of how science develops. Hopefully, and optimistically, a major perceptual shift in our favor is not far off.

[1] Dr. Robert T. Bush is a physicist teaching physics and conducting both theoretical and experimental research into "cold fusion." Dr. Bush collaborates with his colleague, Dr. Robert D. Eagleton. Dr. Bush's name is most prominently associated with the old TRM (Transmission Resonance Model) for cold fusion. Hopefully soon, Bush will be recognized for his new three-dimensional TRM. Bush's new paper, "A Light Water Excess Heat Reaction Suggests that 'Cold Fusion' May be 'Alkali-Hydrogen Fusion'." This paper will appear in the September 1992 issue of *Fusion Technology*. This paper deals with both heavy- and light-water excess heat effects. See *Fusion Facts*, December 1991 for a copy of the abstract of Dr. Bush's paper.

[2] Emboldened words are Bush's and not Kuhn's.

[3] J.S. Bruner & Leo Postman, "On the Perception of Incongruity: A Paradigm," *Jrnl. of Personality*, XVIII (1949), pp 206-223.

[4] On page 64 Kuhn points out that on p. 218 of that article [3] Bruner writes, "My colleague Postman tells me that, though knowing all about the apparatus and display in advance, he nevertheless found looking at the incongruous cards acutely uncomfortable."

[5] Dr. Bush relates, "Although my Ph.D. is in Physics, I consider myself fortunate to have once been a student of Thomas Kuhn's at U.C. (Berkeley). During the academic year 1960-61 I was formally enrolled in History of Science at Berkeley and was awarded a Woodrow Wilson Fellowship to continue in this field before returning formally to physics. During that year I worked on Kuhn's History of Quantum Mechanics Project."

EDITOR'S COMMENTS

Scientists trained to be looking for the unexpected, in contrast to those who are looking only for data to augment a hypothesis or a model, would be expected to be the most ready to accept the replication of anomalies. Pons and Fleischmann not only found a strong anomaly

but it was not easy to replicate. Fortunately, the light-water/Ni/alkali carbonate experiments are much easier to replicate. Therefore, the light-water work, Bush's "revolution within a revolution", may be the evidence that wins more critics to cold fusion. *Fusion Facts* agrees to be kind to your critics, they may become your friends. Perhaps the measure between an honest critic (or skeptic) and an "enemy of progress" is the level of emotion. Alternatively, it may be the manner in which he/she sorts experimental data (peer-reviewed papers) into "accept" and "reject" piles. The most outspoken critics seem to come from large institutions (especially in U.S. and Europe) funded by hot fusion monies. *Fusion Facts* forecasts that as cold fusion becomes more readily acceptable, this same group of scientists and institution will be the major recipients of government funds.

CALIFORNIA - REPORT ON FATALITY

Dr. Cravens wrote for *Fusion Facts* the following summary of the reports released by SRI and EPRI on the tragic accident that killed Dr. Andrew Riley.

SRI International Announces findings in the Probe of Fatal Laboratory Explosion.

By Dr. Dennis Cravens, Vernon College, Texas

ABSTRACT

SRI has released their findings on the Jan. 2, 1992 accident [that fatally injured Dr. Andrew Riley]. It appears that a Teflon plate shielding the recombiner became displaced and blocked the tube leading to the pressure gauge. The gas pressure then built up due to the partial failure of the catalyst. The gases exploded after the system was moved from the calorimeter.

SRI, International assembled a most impressive group of experts in the areas of explosives, electrochemistry, physics, and other disciplines. They recently released their analysis of the accident in a series of reports [1-5]. The following information was condensed from these reports with most of the information coming from [1].

The explosion occurred in a cell designed to operate at low pressures and temperatures and had been running for more than 800 hours before the explosion. The Committee concluded that the most plausible explanation of the accident, based on the evidence of the distorted stainless steel cell, the injury to Dr. Riley, and the distribution of pieces in the laboratory, is that an explosion occurred in the upper part of the cell container where the evolved oxygen/deuterium gas mixture was located.

The Committee attributed the unanticipated and undetected accumulation of gas to the failure of the recombiner (5% atomic weight percent Pt on the 4 mm diameter low density alumina balls from Aesar-Johnson-Matthey.) In addition, a gas outlet tube that could have alerted scientists to a high-pressure condition in the cell, became blocked by an internal Teflon part near the cell top. When researchers moved the cell for examination, it may have restarted the catalysis, overheating some platinum catalytic spheres, which then detonated the gas mixture.

The SRI International laboratory experiment used a closed, stainless-steel cell with a mass of about 1.5 kg. The cell had a screw-on top and a welded-on steel bottom section. An external heater and brass radiating fins are on the outside of the cylinder. The electrolyte fills approximately the lower bottom half of the volume of the cell. The electrodes are both palladium and are held in the electrolyte by pieces of the Teflon (PTFE) and palladium wires.

The catalyst recombines the D_2 and O_2 to water which falls down on a cone-shaped piece of PTFE and then down the walls to the electrolyte. A gas pipe connected at the top of the cell leads to a pressure transducer for measuring the pressure in the cell.

The entire cell is mounted in a glass Dewar. This combination is placed into a bath and monitored by temperature differences to assure constant temperature of the cell. To maintain the electrochemical cell in a near-isothermal condition, the amount of power into the cell is maintained constant by an extra heater wound coaxially with the electrochemical cell itself and controlled by a computer. The total power to the cell, that is, the sum of the power going into the electrolysis and the power to the heat is held constant throughout the experiment.

On January 1, 1992, gas was leaking from the bottom bend of the gooseneck of the gas tube into the calorimeters. The calorimeter was stopped and the remaining cell assembly was removed from the bath and placed on the bath's ledge. The water was allowed to drain to below the level of the leak. The gas tube was cut nearer to the cell than the leaky part and a Swagelok union and end cap previously used to attach the pressure transducer assembly was fitted loosely to the remainder of the gas line using PTFE ferrules. The lab personnel waited until the next day to repair the leak.

The next day, January 2, 1992, the researchers came in and saw another leak of bubbles coming from the top bend of the tube. Dr. Riley, first removed the clear acrylic top coming from the top of the calorimeter and then lifted the cell out of the bath, set it on the edge of the bath, and was waiting for the water level to go below

the leak level before turning off the cell current. The cell current was left on because, with gas coming out of the cell, there was no chance of light water getting into the cell through the hole and ruining the cell. When the water level got below the leak but not yet to the top of the cell, Dr. McKubre turned toward the computer to turn off the current. He had not reached the computer, had not touched the keyboard, when the explosion occurred.

Dr. Riley was standing on a stool adjacent to the cell at the time of the explosion. He was struck in the head and fatally injured. The other three researchers in the room all received minor injuries from flying glass and other parts.

The steel cell was obviously distorted (a detailed stress analysis appears in report [2]) and indicated that the pressure reached was approximately 300 bars or 4350 psi. The top of the cell is bulged upward and the sides of the cell in the upper half are bulged outward in a radial manner. The bottom half of the cell, where the electrolyte and the electrodes were, has much less distortion than the top half, the bottom plate is separated from the top cell and bulged downward. These facts indicated that the explosion occurred in the upper half of the cell from the evolved gases.

The Committee concluded that the cell was not operating at atmospheric pressure at the time of the explosion and then an oxygen-deuterium explosion was the most likely cause of the accident. Further analysis indicated that the piece of PTFE was probably pressed against the top of the cell hard enough to restrict gas flow into the gas pipe, in effect blocking the gas pipe. The seal was strengthened by the increased pressure in the cell and rendered the investigator "blind" to the real pressure condition of the cell. The ignition of the gas was likely from 1) the movement of the cell exposed clean areas, 2) an electrical short, 3) exposure of the cathode, or 4) pressure ignition.

Notes: The cell had been run at high current (7.0 Amps) for over 700 hours and the catalyst had reached temperatures as high as 700 C. The cell was being run 20 hours at 2.0 Amps (ramped from 0 over one day) when the leak was detected. The D_2 and O_2 reached pressures of 30 atmospheres just before the explosion which caused pressures of about 300 atmospheres.

[1] SRI Scientific Investigative Committee, "The January 2, 1992, Explosion in a Deuterium/Palladium Electrolytic System at SRI International," an SRI report, May 14, 1992.

[2] James B. Colton & Robin L. Jones, "Metallurgical/Mechanical Aspects of Accident Investigation," an SRI report, May, 1992.

[3] Edited by David M. Golden, prepared by Crouch-Baker, McCarthy, McKubre, Smedley, and Tanzella, "Chemical Thermodynamic and Electrochemical Aspects of Accident Investigation," an SRI report, May, 1992.

[4] Adelman, Chairman; prepared by Independent Review Committee, "Review of Fatal Accident at SRI International on January 2, 1992 in Course of Deuterium/Palladium Power Generation Equipment," an SRI report, June 12, 1992.

[5] James Kloss, "SRI International Announces Findings in Probe of Fatal Laboratory Explosion," an SRI news release, June 18, 1992. Report cites undetected buildup of gases and pressure in electrochemical cell.

EDITOR'S COMMENTS

All accidents are met with distress and with anguish, especially where there is a loss of life. This detailed report is welcomed for its careful insight to explain the accident. The lessons to be learned are perhaps these: Batteries and other electrochemical cells can evolve explosive gases. None of these should be operated without special safety precautions. Explosion-proof safety masks should be worn when handling cells. Every closed cell container should be equipped with pressure gauges and at least one pressure blow-out fail-safe feature. Recombiners are not to be trusted, especially after long use. Handle any closed-cell as though it might explode.

We again extend our sympathy to the family and friends of Dr. Andrew Riley, a noted and brilliant cold fusion scientist. He will be remembered by his friends. He was one of the early pioneers involved in the great trek toward achieving clean, inexpensive, and non-polluting energy systems. **That the rest of the cold fusion pioneers should succeed would be his urgent wish.**

G. LETTERS TO THE EDITOR

HISTORIC THEORY MILESTONES

An important history from Dr. Robert W. Bass

Dear Hal,

In my opinion, the following (admittedly rather subjective) list of 8 items represents significant milestones in the history of theoretical understanding of Cold Fusion:

A. On 19 April 1989, Dr. Steven E. Koonin of Caltech submits to *Phys. Rev. Letters* (but later withdraws) a prophetic paper pointing out that, "any conditions in the [Pd-D] system which enhance fluctuations will also enhance fusion rates. ... Fluctuations of the environment

... within a solid can significantly enhance the rate ... because of its **extreme sensitivity** to the **effective potential barrier**. [Emphasis added.] Dr. Eugene Mallove (*Fire From Ice*, Wiley, 1991) summarizes Koonin's work as a suggestion of "looking for 'dynamic' effects that might augment the tunneling -- vibration mechanisms that would perhaps cause deuterons to accelerate toward one another."

B. Dr. Leaf Turn of Los Alamos National Lab proposes resonance-enhanced deuteron Coulomb barrier penetration in a paper, "Peregrinations on Cold Fusion," presented at the Workshop on Cold Fusion Phenomena, Santa Fe, New Mexico, May 23-25, 1989.

C. Dr. Robert W. Bass, former BYU Physics Professor (1971-81), in five phone calls in June 1989 urges five publicly known investigators of Cold Fusion (Drs. Don Baker, Scott Chubb, Hal Fox, Peter Hagelstein, and Leaf Turner) to look at *Duane's Rule (1923)* as explained in Lande's Cambridge U. Press book, *New Foundations of Quantum Mechanics* as one of **three axioms** from which Schrodinger's Equation (1926) can be derived, and as being a "clear anticipation of the **Mossbauer Effect** by almost 35 years." The fact that a **single nuclear event** can exchange linear momentum with an **entire crystal lattice** is the most obvious and principal embarrassment to the high-energy particle physicists and hot fusioners who have claimed dogmatically that "cold fusion violates known physical laws;" but their simplistic "back of the envelope" arguments purporting to "prove" the impossibility of Cold Fusion would also "prove" the impossibility of the Nobel Prize-worthy and accidentally discovered (but quantum theoretically predictable) **Mossbauer Effect** and therefore must be fallacious!

D. Dr. Robert T. Bush of Cal Poly, Pomona, stimulated both by Dr. Leaf Turner's Santa Fe presentation, and Turner's letter to the editor of *Physics Today* [vol. 42, page 140, Sept. 1989], in which Turner formulated a **Transmission Resonance Condition (TRC)** in terms of an unevaluated integral, further refines Turner's TRC concept (including an explicit evaluation of the integral in closed form) in a 12 December 1989 presentation to the ASME at San Francisco, and then gives a simplified **one-dimensional** version of a TRC on which he bases his partly phenomenological **Transmission Resonance Model (TRM)**, in the following form:

$$\text{TRC: } (m + \frac{1}{2}) \times (\lambda)_m = L, \text{ where}$$

$m = 0, 1, 2, 3, \dots$ and where the length L is the lattice period (between bound deuterons) and where $(\lambda)_m = h/p_m$ is the de Broglie wavelength of an incoming deuteron which, according to the TRC, can freely penetrate the multiple potential barriers between deuterons by resonance-enhanced tunneling.

E. Nobel Laureate Dr. Julian Schwinger, UCLA Emeritus Prof. of Physics, partly summarizing work which he had submitted in October 1989 to *Z. Naturforschung* [published in vol. 45a, p. 756, 1990] and in November 1989 to *Z. Physik D* [published in vol. 15, pp. 221-225, 1990], presents his theory of "Nuclear Energy in an Atomic Lattice (NEAL)" to the **First Annual Conf. on Cold Fusion**, Salt Lake City, Utah, March 28-31, 1990. This theory includes an absolute, first-principles estimate of the reaction rate of fusion of a pair of bound deuterons in a quantized oscillator in a hypothetical doubly-loaded region of a Pd-DD lattice in which the deuterons in the zero-point ground state would be close enough to fuse by tunneling with high probability if the ratio of their mean oscillation length LAMBDA to the lattice period length L were increased by a mere 25%! An obvious modification of Schwinger's theory, incorporated in the Bass QRT principle mentioned below, would achieve the same end simply by raising the energy level of the quantized "Schwinger oscillator" above its zero point. A further improvement, suggested to Bass by Dr. Scott Chubb, involves applying the preceding theory to a fully-loaded Pd-D lattice rather than the more rare double-loaded Pd-DD regions of the lattice used by Schwinger in evaluating L and LAMBDA.

F. In October 1990, Drs. Scott R. Chubb and Talbot A. Chubb present a theory of "Lattice Induced Nuclear Chemistry (LINC)" at a conference on Anomalous Nuclear Effects in Deuterium/Solid Systems at BYU in Provo, Utah. This theory includes a solid-state theoretical formulation which includes a **three-dimensional** version of **Duane's Rule**, calls the Fleischmann-Pons Effect analogous to an **"inverse Mossbauer effect"**, and predicts effluent ⁴He gas.

G. In April 1991, after Dr. Robert T. Bush had argued persuasively that his TRM was **NOT** contained in Schwinger's NEAL, Dr. Robert W. Bass points out to Dr. Bush that the Turner-Bush TRC stated above is **precisely equivalent** to Duane's Rule in the form:

(Duane, 1923): $\Delta p = p_m - p_k = n(h/L)$,
where n is identically = to m - k,

which causes Dr. Bush to remember that he had himself, a number of years earlier, published several papers on the **"Duane Ansatz"** in *Il Nuovo Cimento*, but had neglected to mention them in his own Cold Fusion papers.

H. In June 1991, attempting to combine the best features of the Turner-Bush TRC with the theory of lattice-bound deuteron oscillators in the Schwinger NEAL theory, as a contribution to the Chubb's LINC theory, Dr. Robert W. Bass submits a patent application (later presented as a Poster Paper at the Second Annual Cold Fusion Conf.,

Lake Como, Italy, on 3 July 1991) for a **Quantum Resonance Triggering (QRT)** principle which makes several **falsifiable** [capable of being proven false by experimental means. Ed.] predictions (**including excess enthalpy in Pd-D of up to 3 kW/cm²**, shortly thereafter measured by Bush and his colleague Dr. Robert D. Eagleton in their thin-film experiments). [Bass shared an early draft of his prediction with Drs. Bush and Eagleton who were experimenting with thin-film Pd on Ag cathodes. The two papers of Bass and the Bush-Eagleton paper were, therefore, being worked on in about the same time period. Ed.] The Bass QRT results include the prediction that if a 5.1 eV deuteron enters a fully-loaded lattice parallel to a plane of bound deuterons then its collision with a bound pair of deuterons will raise this "Schwinger oscillator" to such a high energy level that the bound deuterons collide and fuse, creating a ⁴He nucleus in an essentially **Radiationless Reaction (RR)** with **Internal Conversion (IC)** of the 23.8 MeV of fusion energy into Pd lattice phonons as first proposed [in *J. Phys. Chemistry*, vol. 93, pp. 4693-97, 15 June 1989] by Drs. Cheves Walling and Jack Simons of the University of Utah in cooperation with the initial public disclosure there of Drs. Martin Fleischmann & Stanley Pons in March 1989. Bass also claims that his QRT principle fulfills the **prescription** for a successful Cold Fusion theory laid down by Dr. Steven E. Koonin on 19 April 1989 prior to his present public position of radical skepticism toward the reality of the Fleischmann-Pons Effect!

/s/ Best Regards, Bob

EDITOR'S COMMENTS

I can think of no finer illustration of the importance of the interaction of great minds with the unfettered exchange of ideas and concepts based on studied scholarship. Dr. Bass did, indeed, in 1989 call my attention to Duane's work and to Lande's book. I still have a copy of Lande's book (dredged from the U/U library's old book storage) at my bedside and ponder over it on occasion. We commend Koonin, Mallove, Turner, Bass, Bush, Eagleton, Schwinger, the Chubbs, Walling & Simons, Fleischmann & Pons, et al. for the communication among scientific peers that is leading to the solution of one of the world's most pressing problems: clean, inexpensive, inexhaustible **energy**. Thanks for sharing and letting me be your friend and oftentimes cheerleader. Hal Fox, Ed.

COLD FUSION SEMINAR TAPES

Seminar Program on Cold Fusion at Cal Poly – Videotapes Available.

A notice from Dr. Robert T. Bush, Cal Poly, Pomona

"Three seminars and a roundtable discussion on cold fusion among eight scientists working in the area of cold fusion were recently held at Cal Poly, Pomona [California.] The fact that all sessions were videotaped may make this an historic first.

"On May 8, 1992, Dr. Melvin Miles of the Naval Air Weapon Systems Command (NAWSC) China Lake, CA, presented the first seminar, Correlation of Excess Enthalpy and Helium Production in Cold Fusion Experiments. . . .

"On May 22, 1992, Dr. M. Srinivasan, Head of the Neutron Physics Division of the Bhabha Atomic Research centre at Trombay, Bombay, India, presented a seminar, Cold Fusion Experiments at BARC: A Status Report. . . there is a presentation here of some of the earliest light water experiments in cold fusion, which are sure to be viewed later as classics along with the rest of BARC's work on cold fusion.

[Roundtable discussion on May 22, 1992] ". . . we arranged a roundtable discussion with eight cold fusion scientists . . . Participating (listed alphabetically) were Dr. Walter Bacino & Dr. Pam Boss (both NAWSC, San Diego); Dr. Ben Bush (NAWSC, China Lake); Dr. Robert T. Bush, Dr. Robert D. Eagleton (both Cal Poly); Dr. Melvin Miles (NAWSC, China Lake); Dr. M. Srinivasan (BARC, India); Dr. Joe Waisman (consultant to Southern California Edison). . . ."

"The third seminar was presented on June 5, 1992 by Dr. Robert T. Bush and Dr. Robert D. Eagleton [both of Cal Poly] entitled, Cold Fusion Research at Cal Poly: A Status Report. Included in this [seminar] are the details of our new computerized data acquisition system, thin film work and silver alloy work, recent light-water work and results from an electrolytic experiment involving a mixture of light and heavy water. The successful fit of the TRM to data is presented along with experimental support. . .

"All five videotapes (three seminars plus two tapes on the roundtable discussion) are available. . . ."

Price: Individual tapes: \$25.00. Two tapes: \$47.00. Three Tapes: \$70.00. All Five Tapes: \$115. (Note that these prices are subject to increase after October 1, 1992.)"

Make checks or money orders to: **Cal Poly Foundation**. Mail to Dr. Robert T. Bush, Physics Department, California State Polytechnic University, 3801 West Temple Ave., Pomona, CA 91768, U.S.A.

LETTER FROM CHINA

The following letter from Dr. Xing Zhong Li and his choices of top events pictures current science in China:

Dear Mr. Fox,

Congratulations for the third anniversary of *Fusion Facts*. Enclosed [see below] is my list of top ten events ... I wish that my volunteer team might reproduce the light water experiments by Dr. Mills. However, the recent policy of science and technology in China drives the scientists towards the money, and the academic interest is less important [Same as some of our hot fusioners.] Our volunteer team became hesitated before they started the experiment. I tried to contact another scientist . . . and is still interested in cold fusion. He said that if he received a letter from you directly ... he would consider the possibility of working more closely [on light-water fusion]...

TOP TEN EVENTS OF PAST THREE YEARS

1. First Annual Conf., March, 1990.
2. The BYU Conf., Oct. 1990.
3. Second Annual Conf., July, 1991.
4. Continuous publication of *Fusion Facts*.
5. Mallove's book, Fire From Ice, 1991.
"The above five events are selected for the dedication of the organizations, or personal dedication which promoted the cold fusion research in the past years".
6. Dr. Srinivasan's, "Copious Low Energy Emissions from Palladium Loaded with Hydrogen or Deuterium", Dec. 1991.
7. Dr. Takahashi's, "Nuclear Products by D₂O/Pd Electrolysis and Multibody Fusion", Jan 1992.
8. Dr. Mill's, "Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion," April, 1991.
9. Dr. Will's, "Studies of Electrolytic and Gas Phase Loading of Palladium with Deuterium", in 1991.
10. Dr. McKubre's, "Isothermal Flow Calorimetric Investigations of the D/Pd System."
"The above five are selected for their importance in confirmation of anomalous effects in the specific conditions."
11. Foundation of Cold Fusion Research Advocates by Jed Rothwell & Gene Mallove.
12. Founding of Fusion Energy Applied Technology in 1992.
These two events are specially selected for their braveness in adventure for science."

"As a Chinese scientist I put another four important events in the Chinese cold fusion research:

- 1) The Chinese Engineering Physics Institute's pioneering and continuous research on "Cold Fusion in a Discharge Tube," which started the earliest work in a discharge tube in April, 1989.
- 2) The proposal of the detection of energetic charged particle instead of the detection of neutron, which led to the positive evidences of energetic charged particles emitted by deuterized palladium, using CR-39 detector in 1989.
- 3) Drs. Scaramuzzi, Jones, and Menloves' gas-loading experiments, which makes the CR-39 techniques compatible, and reveals the advantage of charged particle detection over the neutron detection.
- 4) The proposal to search the PRECURSOR of anomalous nuclear effects, which leads to a new theoretical model and new set of experiments."

/s/ Li, Xing Zhong

[I have used editorial license to shorten the presentation of items 1 through 12. Dr. Li, we thank you for a thoughtful presentation. May the decision by MITI to fund cold fusion have a favorable impact on cold fusion funding in your great country. Ed.]

LETTER FROM ITALY

The following is from a friend we made at the cold fusion conference held last year in Como, Italy:

Dear Hal Fox,

"... The conference that we were organizing for in July in Rome fell through the last minute because the president of the committee for physics of the National Research Center (CNR), where the conference was to be held turned out to be an opponent of cold fusion. We therefore decided to postpone such a conference until autumn.

We had a very successful conference in Milan on April 9, 1992 which is why we wanted to organize another one in Rome. I have enclosed a couple of articles on that conference. ... As soon as we can confirm the next conference or know of any new information that can be published in *Fusion Facts*, we will be happy to inform you.

My best regards, /s/ Evanthia Frangou

[The articles sent are in Italian and will be reviewed in the next issue of *Fusion Facts*. Thank you, Evanthia, Ed.]

DON MAY'S FUSION COMMENTARY

Don May sends us copies of his new *Fusion Commentary*. With his July 1992 edition he sent the following note:

Hal -- You'll find that experimental evidence is irrelevant. It was never an issue prior to 1989 because Cold Fusion "violated the laws of physics." Evidence is still irrelevant. Thirty glamorous movie stars endorsing cold fusion would have a major impact. We may have to wait until Toyota sells CF card in the U.S.

/s/ Don

EDITOR'S COMMENTS

Don May's note relates to public recognition of cold fusion. He is, of course, correct, at least in our American culture. A positive comment about cold fusion from Magic Johnson would greatly aid public acceptance more than all of the experimental reports that *Fusion Facts* shares with its readers. Sorrowful, but true.

Don May makes the following comment in his May issue: After reporting that a huge Yangtze River Dam was approved by China's parliament and expects to spend \$11 billion to build an 18 megawatt hydroelectric plant states, "If they spent the \$11 billion on Cold Fusion research, they'd save their environment and have abundant energy to progress [into the 21st Century]."

Don May in his June issue cites the cost that the U.S. and 6 other industrial nations plan to spend (\$9 to \$11 billion) to prevent another Chernobyl-type disaster. He comments: "This clean up is on the order of 500 times the Cold Fusion research budget. Altogether the world wastes billions of dollars by not going over to Cold Fusion."

Don May makes the following comment in his July issue: "SCALE CF DOWN, maybe up too. I still stick by everything I wrote in 1979; most particularly the part about the tiny machines. There's much to learn by trying to scale down the process, and spin off technologies would be created. Successes by present researchers can only **increase** the demand for further research. The CF boom will dwarf the Aerospace/Defense boom which provided tens of million jobs for a generation. Every college in the world will have a CF experiment. This might surprise some people. Isn't it possible that rapid success by present researchers will achieve most of the progress? No. When the transistor was invented, an industry flourished which has had ever increasing research requirements to this day. CF is even more basic, and will give birth to far more than the first transistor did! We will also need more of every technical specialty to apply CF."

We applaud the above bit of technological forecasting and share the concept. However, when even the Encyclopaedia Britannica discovers CF, can the *WSJ* and *The New York Times* be far behind?

Don May's *Fusion Commentary* began in March 1992. Don sells his four page monthly commentary for \$15 for the year 1992 (includes all 1992 issues). Write Don May, 23715 W. Malibu Rd. #140, Malibu, CA 90265.

H. MEETINGS AND MISCELLANEOUS

MARCH 1991 MEETING OF American Physical Society Information courtesy of the *Bulletin of the American Physical Society, March 1991, Vol 36, No. 3, pp 1016-1017.* For those interested in C.F plus NMR.

Session R19: Hydrogen in Metals: NMR
Friday morning, 22 March 1991

R19 1 Modulations of Nuclear Magnetic Cross-Relaxation in Metal-Hydrogen Systems. D.B. BAKER, R.E. NORBERG, and M.S. CONRADI, Washington U., R.C. BOWMAN, Jr., Aerojet ElectroSystems, and D.R. TORGESON and R.G. BARNES, Ames Laboratory** and Iowa State U. -- Anomalous frequency dependence of proton T_1^{-1} at low temperatures in TaH_x and $Nb_{0.5}V_{0.5}H_x$ has been explained by a nuclear magnetic cross-relaxation mechanism. Two novel experiments have unambiguously shown the model to be correct. Overlap between the protons and nuclear electric quadruple broadened metal spectra permits spin energy exchange via dipole-dipole interactions. Both ac magnetic field modulation and sample rotation serve to increase the overlap of the proton and metal resonances. As a result, increased rates of proton relaxation T_1^{-1} are observed in the above system as well as Zr_2PdH_x . These results are unique signatures of enhanced cross relaxation effects.

R19 2 High Temperature Anomalous Relaxation in Metal-Hydrogen Systems. N.L. ADOLPHI, D.B. BAKER, M.S. CONRADI, and R.E. NORBERG, Washington U., and D.R. TORGESON and R.G. BARNES, Ames Laboratory and Iowa State U. -- NMR data in several metal-hydrogen systems reveal anomalous, unexpected relaxation mechanisms at high temperatures ($T > 700$ K). We report recent measurements to identify the source of the fluctuating magnetic field responsible for the additional, anomalous relaxation. Specifically, we compare the proton relaxation in $NbH_{0.02}$ to its 90 percent deuterated analog, $NbH_{0.02}D_{0.18}$. The NMR frequency dependence of this anomaly to 340 MHz will also be presented.

R19 3 Resonance frequency Dependent Proton Relaxation Times in Several Zirconium-Hydrogen Systems. D.R. TORGESON, Ames Laboratory and Iowa State U. and R.C. BOWMAN, JR., Aerojet Electronic Systems Div. -- In light of recent revelations regarding various cross-relaxation contributions to proton relaxation times in metal-hydrogen systems, new NMR studies of the resonance frequency and temperatures dependence of the proton T_1 spin-lattice relaxation times were conducted on $ZrBe_2PdH_{1.43}$, $c-Zr_2PdH_{1.84}$ and great diversity of apparent hydrogen diffusion behavior with potential contributions from localized motion as well as distributions in activation energies due to structural disorder. Detailed measurements were made in the region of the diffusion T_1 minima for resonance frequencies between 7 and 90 MHz. Diffusion parameters derived from BPP-model analyses of these results will be compared with published rotating-frame relaxation times.

R19 4 Anomalous Proton Spin-Lattice Relaxation in Zirconium dihydrides for $T > 900$ K. J.W. HAN, # D.R. TORGESON, D.T. PETERSON and R.G. BARNES, Ames Laboratory and Iowa State U. -- Proton spin-lattice relaxation times T_1 have been measured in several zirconium dihydride concentrations ZrH_x as functions of temperature to 1300 K. Above 900 K, an anomalously sharp decrease in T_1 was observed for all x values. At the onset temperature for the anomalous relaxation, defined as the intermediate T_1 maximum, the hydrogen hopping rate approximately $10^{10} s^{-1}$, decreases with increasing hydrogen concentration x , suggesting that proton-proton interaction may be responsible for the anomaly.

R19 5 NMR Study of the Amorphous $Ni_{1-y}Zr_yH_x$ System A.F. MCDOWELL, A. ADOURIAN, R.M. COTTS Cornell University. -- We report on initial results from a survey of the amorphous $Ni_{1-y}Zr_yH_x$ system using 1H NMR. The second moment and relaxation rates for a sample with $y=0.67$ and $x=1.5$ have been measured in both the laboratory and rotating reference frames. These data show typical amorphous behavior as a function of $1/T$. We continue to develop a data analysis scheme for amorphous metal-hydrogen systems.¹ In this analysis the BPP forms of the dipole-dipole correlation functions are replaced with Sholl's more accurate lattice-specific results for crystalline systems.² It is not possible to fit all the data simultaneously if a single activation energy is assumed. However, the positions of the relaxation peaks along the $1/T$ axis determine a "most probable" activation energy $E_a = -0.38 \pm 0.04$ eV. A much better fit to the data is achieved using a Gaussian distribution of E_a . We discuss the applicability of such data analysis to amorphous metal-hydrogen systems.

J.T. Market, *et al.*, Phys. Rev B **37**, 6446, (1988).

C.A. Sholl, J. Phys. C **21**, 319, (1988).

R19 6 NMR Studies of Hydrogen Diffusion in $Ti_2PdO_xH_x$. R.C. BOWMAN, JR., Aerojet Electronic Systems Division, A. ATTALLA and G.C. ABELL, EG & G Mound, A.J. MAELAND, Concrete Solutions, and J.S. CANTRELL, Miami University. Proton relaxation times have been determined between 100K and 500K for an oxygen-stabilized $Ti_2PdO_xH_{2.5}$ sample. Powder x-ray diffraction has shown the material to be single phase with a face-centered-cubic unit cell and a lattice parameter of 1.223nm. Although the activation energy of 0.39eV derived from the $T_{1\rho}$ data for $Ti_2PdO_xH_{2.5}$ was nearly identical to the value found for hydrogen diffusion in oxygen-free $Ti_2PdH_{1.47}$, with an orthorhombic crystal structure, the spin-lattice and rotating-frame minima were at much lower temperatures for the former sample which imply more rapid hydrogen diffusion rates in the oxygen-stabilized phase. The impact of host crystal structure and hydrogen site occupancy on the diffusion processes will be discussed.

CALL FOR PAPERS FOR NAGOYA

CALL FOR PAPERS for The THIRD INTERNATIONAL CONFERENCE on COLD FUSION, October 21 to 25, 1992 at Nagoya Congress Center, Nagoya, Japan.

It is our pleasure to announce that the Third International Conference on Cold Fusion will be held October 21 (Wed) - 25 (Sun), 1992 in Nagoya, Japan. The conference is supported by Physical Society of Japan. The Japan Society of Applied Physics, Atomic Energy Society of Japan, The Institute of Electrical Engineers of Japan, The Chemical Society of Japan, The Electrochemical Society of Japan, and The Japan Society of Plasma Science and Nuclear Fusion Research.

The conference will cover the broadest topics relevant to cold fusion phenomena in the research fields including nuclear physics, electrochemistry, and solid state physics. We believe that the conference will give us excellent opportunities to exchange ideas for further advances in cold fusion research. We would like to extend our warmest invitation to all of you to join us at this significant event in Nagoya.

TECHNICAL TOPICS (tentative)

1. Modeling and Theories of Cold Fusion
2. Studies on Material and Hydrogen Behavior in Metals
3. Nuclear Products Analysis
 - a) neutron
 - b) charged particles
 - c) tritium
 - d) helium
 - e) isotopes

4. Excess Heat Calorimetry
5. Electrochemical Studies on Cold Fusion
6. Phenomena Relevant to Cold Fusion
7. Miscellaneous

ABSTRACTS

Contributed papers will be presented as either posters, or oral presentation, in order to make the conference most active and useful, which will be informed to the authors as soon as the final program is settled after receiving abstracts.

All authors should submit three copies of 500-word, one-page abstract in English, to the following address by July 31, 1992.

ICCF3 Secretariat
c/o National Institute for Fusion Science
Chigusa-ku, Nagoya 464-01
JAPAN

Note: Hotel reservations should be made as soon as possible. For further information contact:

H. Ikegami (Chairman)
ICCF3 Secretariat
c/o National Institute for Fusion Science
Nagoya 464-01, Japan
Telephone: 052-782-5891 (office)
052-781-5134 (H. Ikegami)
Fax: 052-789-1037
E-mail: ikegami@nifs.ac.jp

CALL FOR PAPERS FOR BUDAPEST

The 3rd International Psychotronics Conference and Exhibition will be held in Budapest from April 28 to 30, 1993. The meeting will be devoted to new, non-polluting technologies, to their practical applications and to their scientific principles. (*Psychotronics* is an interdisciplinary science devoted to examine the relation of mind, matter and energy.) Energy converters (especially those tapping zero-point energy) are one of the most important subjects of the conference.

ABSTRACTS to be sent by September 1, 1992. Short (maximum 200-word) abstracts should be sent to:

George Egely, Ph.D.
Budakeszi, P.O.B. 38, Hungary, H-2092
Phone/Fax: 00-361-118 7253, Innohelp Foundation

2ND ANNUAL CONFERENCE PROCEEDINGS

Tullia Bressani, Emilio Del Giudice, Giuliano Preparata, Editors, VOLUME 33 - THE SCIENCE OF COLD FUSION, Conf. Proceedings published by Societa Italiana di Fisica, 46 figs, 528 pages, ISBN 88-7794-045-X.

Three years after the first announcement by Martin Fleischmann and Stanley Pons, it is possible to make a balanced appraisal of the discovery of cold fusion. This book contains the *Proceedings of the Como Conference*.

Orders should be sent to:

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Brief Letters to the Editor are also welcome. Topics of interest include latest business developments related to

cold fusion, patent information, and your constructive criticism of any cold fusion concepts. We especially welcome news of any **enhanced energy devices** that have been reduced to practice.

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