FUSION facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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SALT LAKE CITY, UTAH

UTAH FUSION COMMITTEE AGREES SOLID-STATE FUSION IS REAL.

Ray Hixson, Chairman of the Utah governor's Fusion/Energy Advisory Committee, announced that all nine members of the committee have unanimously voted that the solid state fusion experiments do produce excess heat and meet the guidelines for funding set by the Utah State Legislature. This action of the Committee is the first step to release the five million dollars voted by Utah's legislature in support of the fusion discovery by two scientists working at the University of Utah.

In anticipation of the release of funds by the Fusion/Energy Advisory Committee, the University of Utah has secured about 25,000 sq. ft. of facilities on the University of Utah Research Park. Tentative plans by the University of Utah are to have a staff of about 25 persons working full time on solid-state fusion research.

The newsletter staff believes this action by the Fusion/Energy Committee will lead to an increase in favorable media coverage of cold fusion experiments. The end result will be an increased interest by managers, scientists, and engineers in the applications of solid-state fusion and on the potential future impact of this exciting discovery on various industries. These two key issues of applications and future impact on business will be covered in each issue of this publication.

OTHER TOPICS

DEPARTMENT OF ENERGY FUSION COMMITTEE FAILS TO RECOMMEND ADDITIONAL FUNDS.

After visiting fusion research laboratories at University of Utah, Brigham Young University, Texas A & M University, California Institute of Technology, Stanford University, and SRI International, the members of the Cold Fusion Panel to the Energy Research Advisory Board have drafted an interim report.

Draft recommendations to be considered by the panel for submission as an interim report include the following:

No funds should be allocated for cold fusion research centers at this time.

More effort should be made by researchers to support excess heat by the measurement of fusion products at suitable levels.

Experiments to check tritium production are desirable.

The reports of neutrons at low level are of interest scientifically but have no apparent utility for power production.

In view of the difficulty of performing suitable experiments and measurements, collaborative efforts are encouraged.

The committee's interim report is scheduled for submission July 31, 1989 and a final report on November 15, 1989.

LABORATORIES SUPPORTING SOLID-STATE FUSION.

The fusion cell experiments carried out by Prof. Stanley Pons (University of Utah Chemistry Dept.); Dr. Martin Fleischmann (then with Dept. of Chemistry, The University, Southampton, Hants.); and Prof. Marvin Hawkins (Dept. of Chemistry, U/U) were first published in the J. Electroanalytical Chemistry volume 261 (1989) pages 301-308 with the title "Electrochemically induced nuclear fusion of deuterium". Here is a partial list of other experimental successes:

1. B.Y.U. has proven that nuclear reactions occur in metal lattices at room temperature. (See Article about Prof. Jones, this issue.)

2. UNIVERSITY OF UTAH Department of Metallurgy found excess heat and bursts of energy.

3. TEXAS A & M - at least three departments. Found excess heat (Appleby et al), measured neutrons and tritium (Wolf et al).

4. STANFORD UNIVERSITY. Huggins reported excess heat using a conservative method of measuring heat input. Huggins stated that "we are material scientists and not nuclear physicists" in an answer to a question as to why others fail to reproduce F-P Effect.

5. UNIVERSITA' DE ROMA. Gozzi et al of the Dept. of Chem. and others from Physics Lab I.N.F.N. in "Nuclear and Thermal Effects During Electrolytic Reduction of Deuterium at a Palladium Cathode" reported heat and neutrons at about 150 times background level. The palladium cathode size was a 5 x 6 x 20 mm. parallelepiped. Current density of 200 ma/sq cm was sustained for 150 hours before heat and neutrons were observed.

6. BEIJING NORMAL UNIVERSITY. Zhou et al of the Institute of Low Energy Nuclear Physics had some success. They report that with five runs of experiments, neutrons and tritium production were observed in a certain period during each experiment. An unknown feature was found: Intermittent production of neutrons.

7. AUSTIN COLD FUSION. Little et al report slight excess heat production using a 1 cm Pd sphere. Experiments continuing.

8. WASHINGTON STATE UNIVERSITY.

9. CASE WESTERN UNIVERSITY.

10. ONE UTAH CORPORATION AND TWO GOVERNMENT LABORATORIES (NOT MADE PUBLIC).

11. GENERAL MOTORS RESEARCH was first (after U/Utah lab) to report tritium.

12. UNIVERSITY OF FLORIDA.

SANTA FE WORKSHOP PAPERS SUPPORTIVE OF COLD FUSION.

EXPERIMENTAL:

At the Santa Fe Workshop, nine papers presented positive results. Thirty-four papers presented negative evidence or that the experiment had been tried and no success was achieved.

We are assured that there were many other failures to reproduce the Pons-Fleischmann Effect without success. We also are aware of several groups whom we believe have achieved success but are not reporting their successes to the public.

THEORY: MODIFICATIONS OF OLD THEORIES AND ENHANCEMENT OF FUSION RATES.

Twenty-seven workshop theoretical and physics papers were positive or implied that the effect could be explained. Thirty-eight were negative or implied that the effect could not be explained or wasn't reproducible. Thirteen other papers were informational or background type.

Several theoretical papers have been written that explain the theoretical probability of cold nuclear reactions taking place in a metal lattice. Some of the Santa Fe papers are:

1. LOS ALAMOS. D.A.Baker in a paper "On the Determination of Fusion Rates of Light Nuclei Imbedded In Solid." This paper is important in that it summarizes some of the theory and problems and outlines some experimental approaches that will help determine fusion rates.

2. CAL STATE POLY. Eagleton & Bush. "Design Consideration For Cold Nuclear Fusion Palladium Electrodes as Suggested by the Bush - Eagleton Theory for the Explanation of Cold Nuclear Fusion." Theory is based on the formation of sufficiently large deuteron globule formation within the crystalline lattice. Factors affecting size, density, and rate of formation are discussed.

3. JUSTUS-LEIBIG UNIV. GERMANY. Hora et al. "Nuclear Fusion in Host Lattices Discussed by the Model of a Nondegenerate Positive Hydrogen Isotope Ion Gas". Electrons are more locally bound to states of unfilled shells with stronger energetic levels while the positive ions consist of ideal non-degenerate gas of plasma of high density but low temperature. If this theory is correct then only small scale energy generation can be expected.

4. HELSINKI UNIV OF TECH. Salomaa and Soininen. "Cold Nuclear Fusion: Exotic Quasiatoms?" Alternate explanation may be the formation of a quasiatom of deuterons orbiting a metal (Ti, Pd) nucleus. Should be metastable and possibly explain the transient, nonequilibrium situation suggested for cold nuclear fusion catalyzed by quasiatom formation, rather than be condensed matter.

5. CAL STATE POLY. Bush & Eagleton. "Cold Nuclear Fusion: A Hypothetical Model to Probe an Elusive Phenomenon." See also item 2 above. Theory based on a "symmetry force catalyzation" of cold nuclear fusion. Accounts for D + D --> ^{4}He. Production of heat and nuclear reactions predicted to be pulsed.

6. WASH. STATE UNIV. Collins, et al. "Deuteron Tunneling at Electron-Volt Energies." Two deuterons combine to form a 0+ state. Fusion then occurs via an electron-conversion process with excess energy transferred to an atomic or conduction electron. The theory explains D + D + e yielding tritium, protons, and energetic electrons.

7. NIST. M. Danos. "Coulomb Assisted Cold Fusion." Uses Feynman tree graphs to show how fusion may work. (Furry representation propagators required.) Theory would show that P + D fusion rates are 10,000 times faster than D + D rates.

8. U of OREGON. Girardeau. "Dynamical Plasma Mechanisms for Enhancement of Fusion Rates in Metallic Hydrides and Deuterides." Mechanisms for dynamical plasma enhancement of fusion rates are discussed. Some explanation of neutron bursts.

9. BEIJING NORMAL UNIV. Zuqia Huane. "A Possible Explanation of the Room Temperature Nuclear Fusion." Theory that deuterons absorbed in Pd lattice form a sublattice in a non-equilibrium state. Vigorous oscillation could be part of process to cause nuclear fusions.

10. B.Y.U. Jensen and Mortensen. "Beyond Fusion, Annihilation Reactions of Confined Hydrogen." Antineutrons in Metal Lattice decay into antiprotons and release energy. Gamma rays heat lattice. Dissipation of energy continues until wavelength matches lattice (4.1 Ang for Pd).

11. PURDUE. Yeong E. Kim. "New Cold Nuclear Fusion Theory and Experimental Tests." Theory involves n + ^{6}Li --> ^{4}He + T and T + D --> ^{4}He + n. Theory predicts self-sustaining chain reaction and explains F - P Effect.

12. U. of ILL at URBANA-CHAMPAIGN. Ragheb and Miley. "Deuteron Disintegration in Condensed Media." Oppenheimer-Phillips process is a possible phenomenon leading to deuteron disintegration. Process is highly exothermic and leads to neutron capture from d into the Pd isotopes. Possible explanation for high energy, T production, and neutron suppression.

13. UNIV OF TEXAS. Tajima et al. "Influence of Attractive Interaction Between Deuterons in Pd on Nuclear Fusion." Shows that PdD exhibits attractive interaction at 0.1 to 0.7 Ang due to screening of 4d electrons. Result can be that fusion reactions are 50 orders of magnitude more likely.

14. LOS ALAMOS & U. CAL. Leaf Turner. "Peregrinations on Cold Fusion." Ideas to consider: Tendency of Bosons to condense in a crystal lattice. Resonance effect in lattice-contained deuterons caused by periodic potential to increase fusions events.

15. M.I.T. Hagelstein. "A (Slightly Revised) Simple Model for Coherent DD Fusion in the Presence of a Lattice." Coherent process derived from electromagnetic coupling in a three-body process, in which two are initially deuterons and third is an electron. Results are that neutron and tritium production is suppressed and energy extraction occurs from virtual states in which many fusions have occurred.

NOTE BY EDITOR. The Santa Fe Workshop was richly supplied with theories concerning cold fusion. Many theories show that fusion is unlikely. The above selections show the many different explanations that are being studied to explain the F-P Effect.

THE IMPACT OF SOLID-STATE FUSION ENERGY ON EDUCATION.

A. BACKGROUND.

Two Utahns were primarily responsible for "A Nation at Risk", a Department of Education study published during Dr. T. H. Bell's tenure as Secretary of Education during President Reagan's administration. Dr. David P. Gardner, a former president of the University of Utah, chaired the prestigious group that produced this widely acclaimed document. Problems cited in that study are still unresolved.

The impact of a vibrant and pervasive new technology of solid-state fusion will compound some of the recognized shortcomings of our educational system. The current needs for retraining industrial workers are expected to strongly increase. The demand for qualified high school graduates will increase. Qualified college graduates to work in many aspects of the growing fusion industry will be in strong demand.

Education at all levels will be dealing with new scientific facts and with new technological systems. The corporate classroom will be especially impacted. Educators should review the current educational problems (such as those presented in *A Nation at Risk*) and seek to anticipate how these problems may be affected by solid-state fusion technology and training demands.

This is the time to plan to improve educational performance and to set and achieve new educational goals. There have been some excellent successes in education. The open-entry, open-exit programs; mastery- or concept-based (competency-based) instruction; and quality technology-assisted instruction are examples of successful innovations. Successful educational programs need to be replicated at all educational institutions.

B. EDUCATIONAL IMPACT ON PRE-COLLEGE, COLLEGE, AND INDUSTRY.

1. PRE-COLLEGE EDUCATION.

Solid-state fusion may be the most important discovery in this century. The expected result will be strong impacts on the training of teachers, and on the improved education of students. Improvements in math and science education will be strongly needed to adequately prepare for the many new job opportunities.

New training programs for teachers will be needed, especially for science teachers. These are the teachers who will inspire (or inhibit) high school students to prepare for the explosion of jobs in those industries where solid-state fusion will provide new career choices.

The enormous increase in fusion research will create rapid changes in scientific and technical information. It will be difficult to keep textbooks and workbooks up to date. Accessible on-line information will need to be available to teachers and students as well as to industry. Schools will need to budget for on-line computers and for computer-read optical media. Because the information content of many books can be put on each compact disk, that costs $3 to $5 to replicate, the demand for new equipment to read compact disks will rise dramatically.

New equipment will be needed for high school science laboratories to be able to teach the new solid-state fusion concepts. If palladium is the only metal that can be used in fusion cells, then the equipment will be expensive. The result will be that students attending the better funded schools will have an advantage.

A generation that has been subjected to fears of nuclear horrors will need to be reschooled in the concepts of solid-state fusion nuclear reactions. It has already been demonstrated that solid-state fusion reactions can be controlled to favor those nuclear reactions that are not life threatening.

Career guidance counselors will need to be trained concerning the many new career opportunities that will become available. Careful analysis of the expected demands for new skills needs to be made and communicated to the high school guidance counselors.

2. COLLEGE EDUCATION.

Many aspects of college education will be changed or impacted by solid-state fusion. In addition to the many new technical courses that will be offered, there will be many legal and social aspects of the growing use of fusion energy. For example, the lessening dependence on nearby power lines may alter the choice of home sites. Homes established away from the normal urban service areas will impact the demand for rural services such as roads, water, schools, fire protection, and police protection. These demands will impact colleges and universities by requirements to supply a different mix of college graduates to enter a changing labor marketplace.

In solid-state research, we will learn new concepts about the structure of matter and the nature of nuclear reactions. Many new concepts will lead to entire new industries and new technological systems in medicine, metallurgy, engineering, and in many other specialties. All of these developments will impact educational institutions and the subjects to be taught.

Many prestigious research institutions (including several major universities) will immediately be faced with dramatic changes as the research funding shifts from hot fusion to solid-state fusion. Many research specialists will need to be retrained. This need for career changes will place more demand on educational institutions.

The impact of changes from hydro-carbon fuels to deuterium fuels will cause many international changes. Emerging nations may have less of their resources flow to hydro-carbon rich countries (such as to the Persian Gulf nations). Opportunities will expand for persons trained in building new industries in foreign lands. The monies now going to purchase oil may be directed to building a modern infrastructure to support industrialization. The result may be a larger demand for foreign language training as well as an increased demand for educators, industrial engineers and designers.

3. INDUSTRIAL EDUCATION.

Dramatic changes will occur at the corporate and industrial level. Some companies will thrive and others be faced with a decreasing market share. In general, the traditional energy industries will experience a slowing in demand for energy and ultimately a decrease in demands for natural gas, oil, and coal. Governments may enact legislation requiring that corporations become more responsible for retraining their displaced workers.

Unions will suffer to the extent that new industries will likely outpace the growth of union-organizing activities. Gas, oil, coal, and electrical power industries may suffer the loss of many union jobs. Union bargaining may soon include retraining provisions in labor contracts.

The need for corporate retraining may outpace the growth of the corporate classroom. The vocational (as contrasted with professional) schools and community colleges will have many new opportunities to work more closely with business and industry to handle their retraining needs.

Basic skills testing and review will be strong needs as these skills may require strengthening as a prelude to further studies. Such needs can most effectively be met with concept-based testing and quality concept-based courseware. Tests should identify concepts not understood and teaching should not include concepts the student has already mastered. Skill building should be individualized. Such concept-based education has proven to be much more cost effective than traditional chalk-and-talk presentations.

Where existing educational institutions do not adequately serve the changing needs of the business community, private educational institutions will grow rapidly. Private institutions that specialize in training for the new fusion-related industries are expected to experience rapid growth. It may be that one of the fastest-growing industries (in the new fusion world) will be private schools, especially vocational schools.

Note: Next month's impact article will outline the perceived impacts on the energy industry.

BYU'S FUSION WORK CONFIRMED.

SQUEEZING HYDROGEN: AN EARLY PUBLICATION ON COLD FUSION.

Professor Steven E. Jones has been called "the father of cold fusion." This professor from Brigham Young University and C. Dew Van Siclen submitted "Piezonuclear Fusion in Isotropic Hydrogen Molecules" to the Journal of Physics G: Nuclear Physics. The paper was received 12 June 1985 and published in March 1986.

Fusion Facts recently met with Dr. Jones and his Department Chairman, Dr. Daniel L. Decker, in our truth-seeking search in this area of "fusion frenzy" that erupted with the initial Pons and Fleischmann announcement. In the Department of Physics and Astronomy at Brigham Young University, Dr. Jones is the principal scientist of the B.Y.U. "cold" (piezonuclear) fusion team.

B.Y.U. began their experimental efforts early and by May of 1986, were taking their first measurements using electrochemical cells. May 23, 1986 was the day when they first added heavy water to their experimental cells and by May 27 found their first indications (although not statistically significant) that gamma rays were being emitted.

Professor Jones coined the word "piezonuclear" (piezo = squeeze) as a descriptive word to contrast with thermonuclear. As the studies progressed palladium was included in the metals to be tried because of its known ability to squeeze-in large amounts of hydrogen and/or deuterium.

On September 20, 1988 Prof. Jones records that he received and reviewed a grant proposal at the request of the U.S. Department of Energy (one of a continuing group of proposals Jones was asked to review as a scientist working in the area of cold fusion with DOE funds). This proposal was titled "The Behavior of Electrochemically Compressed Hydrogen and Deuterium" by Professors Stanley Pons and Martin Fleischmann.

History buffs, please note. Here is a well-documented case of synchronicity in science. Two groups of scientists, in the same state, working on similar projects, and unaware of each others efforts.

One of the interesting avenues explored by Dr. Jones and colleagues is whether piezonuclear fusion within the liquid metallic hydrogen core of Jupiter can account for the excess heat radiated by Jupiter? Now they are investigating a similar activity within the bowels of the earth.

The experimental findings of nuclear reactions in metal lattices at room temperatures (as predicted and measured by Jones, et al) has, in our judgment, been confirmed by other scientists. Several papers given at the Santa Fe Workshop on Cold Fusion Phenomena confirmed Jone's work.

Will the B.Y.U. team continue to be involved in piezonuclear Fusion? Most definitely. Will the B.Y.U. team continue to affect the course of solid-state Fusion? This writer believes they will and we will be around to report the facts!!

SOLID-STATE NUCLEAR REACTIONS (CONFIRMED AND PROPOSED).

The June 9, 1989 press release from the Fusion Information Center stated "The Fleischmann-Pons effect involves fusion reactions, the effect can be replicated, the nuclear reactions can be controlled, and the process has strong commercial applications." Following is a summary of the current findings:

NUCLEAR REACTIONS INVOLVING DEUTERIUM.

Two nuclear fusion reactions of deuterium nuclei are known to exist. The two nuclear reactions are the following:

FUSION OF DEUTERIUM TO PRODUCE TRITIUM AND PROTONS.

1. D + D --> T(1.01 MeV) + H(3.02 MeV)
   Tritium Proton

FUSION OF DEUTERIUM TO PRODUCE HELIUM 3 AND NEUTRONS.

2. D + D --> ^{3}He(0.82 MeV) + n(2.45 MeV)

The first states that 2 deuterium nuclei fuse to produce the tritium isotope (related to hydrogen and deuterium) plus a proton.

The second states that 2 deuterium nuclei fuse to produce helium with atomic weight of 3 plus a neutron.

In the experiments first reported by Fleischmann, Pons, and Hawkins (J. Electroanal. Chem. 261, (1989), 301-308) the authors listed the above two nuclear reactions and reported some measurements used to determine to what extent these reactions could be causing the observed excess heat.

Within about twenty days after the Fleischmann-Pons announcement (on April 10, 1989) the Salt Lake Deseret News reported "Researchers from Texas A & M University announced on Monday that they have successfully replicated the controversial research of a U. professor and his British colleague. But they stopped short of calling it fusion."

Since that time, researchers at Texas A & M have accomplished the following:

(a) Observed the production of neutrons.

(b) Discovered that the neutron-producing reaction could be controlled by controlling the electrical current through the experimental cell.

(c) Reported that tritium is being produced and is found in the electrolyte and in the gases bubbling from the palladium cathode.

(d) Found that the use of a nickel anode favors the production of tritium.

These findings support the statements (made by FIC) that nuclear reactions occur in the Fleischmann-Pons cell and that the reactions can be controlled, especially the neutron-producing nuclear reaction (strongly believed by our staff to be the nuclear reaction (1) above). It is important to note that no known chemical reaction produces either tritium or neutrons.

FUSION OF DEUTERIUM TO PRODUCE HELIUM 4 AND ENERGY (IS IT POSSIBLE?)

Fleischmann, et al carefully stated, "The most surprising feature of our results however, is that reactions (v) and (vi) (the two nuclear reactions listed above. Ed.) are only a small part of the overall reaction scheme and that the bulk of the energy release is due to an hitherto unknown nuclear process or processes." Since the publication of the Fleischmann, et al paper, others have suggested that helium 4 could be produced by a nuclear reaction involving deuterium. See the following:

3. D + D --> ^{4}He + energy.

This nuclear reaction states that two deuterium atoms combine to produce Helium (with an atomic mass of 4) plus energy.

The current controversy about solid-state fusion revolves around the following experimental results:

a. Excess heat is measured that cannot be explained by any currently known chemical reactions. Also the amount of heat generated is not supported by the observed levels of known nuclear reaction products (1 and 2 above).

(Note: It appears that researchers at Texas A&M are producing about the amount of tritium that would explain the excess heat. The experimental design has been "tuned" for tritium production. Ed.)

b. No other nuclear reactions that are known and observed are being offered as an explanation for the observed amount of excess heat being generated.

Nuclear reaction number 3 above would be a highly desirable reaction because no harmful radiation is produced (such as heavy neutron flux or the toxic tritium gas). In addition, the energy available from such a nuclear reaction is high in comparison with other possible nuclear reactions.

As of July 25, 1989 no reports have been published that support the finding of Helium 4 in the experimental results. However, researchers from Texas A & M report that using a nickel anode promotes the production of tritium. Tritium is found both in the electrolyte and in the flow of gas bubbles rising from the palladium cathode. Under these conditions, experiments are being conducted to determine if the total amount of tritium produced accounts for all of the excess heat being generated in the palladium cathode. No claims are being made by the Texas A & M group that only the tritium reactions can occur.

Cleves Walling and Jack Simons (U/Utah Chemistry Dept.), in an unpublished paper, "Two Innocent Chemists Look at Cold Fusion", propose that the process known as internal conversion may explain the method of obtaining heat from the production of Helium 4.

FUSION PROBLEMS TO BE RESOLVED.

Some of the problems to be resolved to better understand solid-state fusion are the following:

1. Some theories predict that a D + D --->^{4}He reaction would produce equal branches of He + n and T + p, where He is helium, n is neutron, D is deuterium, T is tritium, and p is proton.

Comments: Kevin Wolf (Texas A&M in "Neutron Emission and the Tritium Content Associated With Deuterium Loaded Palladium and Titanium Metals" in Santa Fe Workshop Proceedings) reports experiments with 25 active and gas phase cells. Only one cell showed clear indications of neutron production. Nine cells showed tritium production of levels that were 100 to 1,000,000 times higher than background. Assuming that there was no source of tritium contamination, then the experimental conditions that favor tritium production need to be explained. See this issue's discussion of Walling and Simons paper in Fusion of Deuterium to Produce Helium 4 and Energy (Is It Possible?).

2. Reports (especially from Pons and Fleischmann) that bursts of excess heat up to 50 times input values are observed need to be replicated, explained, and controlled.

3. Four suggested nuclear reactions may occur with a fusion cell:

a. D + D ---> ^{3}He + n + energy;

b. D + D ---> T + p + energy;

c. D + D ---> ^{4}He + energy; and

d. D + ^{6}Li ---> ^{4}He + ^{4}He + energy.

Problems: Reactions a and b have been shown to exist in a fusion cell using palladium cathodes (under proper experimental conditions). Do the reactions c and d exist? What conditions favor each type of nuclear reaction? Note that reaction c (if it occurs) produces only helium as a nuclear reaction by-product.

EDITOR'S TECHNOLOGICAL FORECAST: Nuclear reaction c will be found to exist and to reduce to heat within the palladium lattice under some experimental conditions. Check your table of Line Spectra of the Elements and notice how rich the lines are for Palladium in the ultra-violet region (3,000 to 4,000 Angstroms). The discovery that reaction c is valid and that this reaction is primarily responsible for the excess heat observed would satisfy some of the constructive criticisms concerning the lack of measuring suitable fusion by-products.

FUSION NOTES FROM CONTRIBUTORS.

PALLADIUM FROM SPACE.

H. Keith Henson of San Jose, CA (founder and first president of the L5 SOCIETY) proposes reducing the cost of palladium by mining the moon and/or the asteroids. The solid metal asteroids are believed to be 10 to 20 times as rich in palladium as the earth's crust. A processing plant, properly designed and operated, can be expected to provide palladium to the surface of the earth at an estimated $450 per kilogram. One stumbling block: The cost of placing the plant in space is estimated at about $50 billion. Henson is preparing an article on the subject.

PATENT APPLIED FOR SOLID-STATE FUSION ROCKET PROPULSION.

Dr. Dennis Cravens, a college professor from Vernon, Texas sent us a copy of his patent application (disclosed on April 13, 1989) titled "COLD FUSION PROPULSION APPARATUS AND ENERGY GENERATING APPARATUS". Wasting no time after the Pons-Fleischmann announcement (March 23, 1989), Cravens proposes an embodiment using deuterium gas or plasma to supply the deuterium to the palladium (or some other metal) lattice and create higher operating temperatures.

ELECTROLYTIC FUSION: A ZERO-POINT ENERGY COHERENCE?

Moray B. King, a scientist with Eyring at Provo, Utah sent a copy of the latest chapter to his book "*Tapping the Zero-Point Energy*" that will be published July 1989. This chapter uses a zero-point energy hypothesis to explain anomalous heat from solid-state fusion. King suggests that a coherent, collective deuteron resonance occurs in the supersaturated plasma within the palladium lattice that creates a macroscopic vacuum polarization. King suggests some experiments in which anomalies in time and gravity may be measured to check his theory. His book available from Paraclete Publishing Co. Department FIC, PO Box 859, Provo, Utah for $15.

CONTRIBUTIONS WANTED:

Free computer courseware with 40 concepts to understand solid-state fusion will be awarded to contributors whose material is used.

ENGINEERING NOTES:

One watt of excess power in a fusion cell should be accompanied by approximately 1,000,000,000,000 (10E12) particles per second.

The deuterium in one gram of heavy water, if converted fully to energy by fusing to helium, would produce 31,870 kilowatt hours.

It requires about 40 to 50 hours to charge a 0.5 mm palladium wire with deuterium to achieve fusion reactions and 70 days for a 5 mm palladium rod. The ratio is about ten times the diameter and about 35 times the number of charging hours. (More data points are needed to define the size/time function.)

Using small diameter wires, raising the current above 150 mm/sq cm, is reported to squelch neutron production. How does this value scale?

FUSION CONCEPTS TAUGHT BY COMPUTER COURSEWARE.

Technical staff of the Fusion Information Center have announced the August 1, 1989 release of a SOLID-STATE FUSION tutorial diskette that will run on desk-top computers compatible with International Business Machines desk-top computers.

About forty concepts from physics and chemistry are presented so that the user can review (or learn) the ideas important to solid-state fusion. The courseware is student-interactive, concept-based, and is supplied on either 3 1/2 in. or 5 1/4 in. diskettes.

Exposure to high school or college basic physics and chemistry courses are recommended as pre-requisites for this courseware. INFOFIND, a search and retrieval program, together with an index of all non-trivial words and the complete text of the tutorials, is also provided. The introductory price is $99 (two diskettes). The first 200 subscribers to the FUSION NEWSLETTER will receive these diskettes at no additional cost.

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PREVIEW OF THE AUGUST 1989 ISSUE OF FUSION FACTS:

- *SOLID-STATE FUSION IMPACT ON ENERGY INDUSTRIES.*
- THE FUSION INFORMATION CENTER'S POSITION PAPER - AUGUST 1989 REVISION.
- CALCULATING THE ENERGY AVAILABLE FROM DEUTERIUM FUSION.
- COMING EVENTS OF FUSION INTEREST.
- HISTORY NOTE: THE DISCOVERY OF THE FLEISCHMANN-PONS EFFECT.
- CALCULATING CHARGING TIME FOR PALLADIUM DEUTERIDE.

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