Chapter 1 : Hideo Kozima: Science of the Cold Fusion Phenomenon (ePUB) - ebook download - english

Publisher Summary. This chapter provides a general overview of the cold fusion phenomenon (CFP). The future of cold fusion research is not smooth, and it reflects the social and scientific situation of the end of the twentieth century.

Since the s, there has been speculation that nuclear fusion might be possible at much lower temperatures by catalytically fusing hydrogen absorbed in a metal catalyst. Since the initial announcement, cold fusion research has continued by a small community of researchers who believe that such reactions happen and hope to gain wider recognition for their experimental evidence. Early research The ability of palladium to absorb hydrogen was recognized as early as the nineteenth century by Thomas Graham. However, the authors later retracted that report, saying that the helium they measured was due to background from the air. After a brief period of interest by the wider scientific community, their reports were called into question by nuclear physicists. Pons and Fleischmann never retracted their claims, but moved their research program to France after the controversy erupted. Events preceding announcement Electrolysis cell schematic Martin Fleischmann of the University of Southampton and Stanley Pons of the University of Utah hypothesized that the high compression ratio and mobility of deuterium that could be achieved within palladium metal using electrolysis might result in nuclear fusion. Current was applied continuously for many weeks, with the heavy water being renewed at intervals. These high temperature phases would last for two days or more and would repeat several times in any given experiment once they had occurred. The calculated power leaving the cell was significantly higher than the input power during these high temperature phases. Eventually the high temperature phases would no longer occur within a particular cell. Fleischmann and Pons and co-workers met with Jones and co-workers on occasion in Utah to share research and techniques. During this time, Fleischmann and Pons described their experiments as generating considerable "excess energy", in the sense that it could not be explained by chemical reactions alone. Jones, however, was measuring neutron flux, which was not of commercial interest. Its discovery 30 years earlier had also been unexpected, though it was quickly replicated and explained within the existing physics framework. Peterson , Fleischmann and Pons, backed by the solidity of their scientific credentials, repeatedly assured the journalists that cold fusion would solve environmental problems, and would provide a limitless inexhaustible source of clean energy, using only seawater as fuel. The first paper submitted to Nature reproducing excess heat, although it passed peer-review, was rejected because most similar experiments were negative and there were no theories that could explain a positive result; [notes 1] [38] this paper was later accepted for publication by the journal Fusion Technology. Nathan Lewis , professor of chemistry at the California Institute of Technology , led one of the most ambitious validation efforts, trying many variations on the experiment without success, [39] while CERN physicist Douglas R. Morrison said that "essentially all" attempts in Western Europe had failed. The Times called it a circus the same day, and the Boston Herald attacked cold fusion the following day. At the end of the session, eight of the nine leading speakers stated that they considered the initial Fleischmann and Pons claim dead, with the ninth, Johann Rafelski , abstaining. Koonin of Caltech called the Utah report a result of "the incompetence and delusion of Pons and Fleischmann," which was met with a standing ovation. Morrison , a physicist representing CERN , was the first to call the episode an example of pathological science. Nuclear fusion of the type postulated would be inconsistent with current understanding and, if verified, would require established conjecture, perhaps even theory itself, to be extended in an unexpected way. The panel was against special funding for cold fusion research, but supported modest funding of "focused experiments within the general funding system. Salamon, a physicist from the University of Utah , and nine co-authors reported negative results. The lawyer later apologized; Fleischmann defended the threat as a legitimate reaction to alleged bias displayed by cold-fusion critics. On 30 June the National Cold Fusion Institute closed after it ran out of funds; [69] it found no excess heat, and its reports of tritium production were met with indifference. These small but committed groups of cold fusion researchers have continued to conduct experiments using Fleischmann and Pons electrolysis set-ups in spite of the rejection by the mainstream community. Current research Cold fusion research continues today in a few specific venues, but the wider scientific community has generally

marginalized the research being done and researchers have had difficulty publishing in mainstream journals. A pariah field, cast out by the scientific establishment. Between cold fusion and respectable science there is virtually no communication at all. On the other hand, because the Cold-Fusioners see themselves as a community under siege, there is little internal criticism. Experiments and theories tend to be accepted at face value, for fear of providing even more fuel for external critics, if anyone outside the group was bothering to listen. In these circumstances, crackpots flourish, making matters worse for those who believe that there is serious science going on here. The report was released in While significant progress has been made in the sophistication of calorimeters since the review of this subject in , the conclusions reached by the reviewers today are similar to those found in the review. The current reviewers identified a number of basic science research areas that could be helpful in resolving some of the controversies in the field, two of which were: The reviewers believed that this field would benefit from the peer-review processes associated with proposal submission to agencies and paper submission to archival journals. The grant was intended to support research into the interactions of hydrogen with palladium, nickel or platinum under extreme conditions. Hubler, a nuclear physicist who worked for the Naval Research Laboratory for 40 years, was named director. He claims that the new experiment has already seen "neutron emissions at similar levels to the observation". In â€”, the ENEA started a research program which claimed to have found excess power of up to percent, and in , ENEA hosted the 15th cold fusion conference. India In the s India stopped its research in cold fusion at the Bhabha Atomic Research Centre because of the lack of consensus among mainstream scientists and the US denunciation of the research. Electrolysis cells can be either open cell or closed cell. In open cell systems, the electrolysis products, which are gaseous, are allowed to leave the cell. In closed cell experiments, the products are captured, for example by catalytically recombining the products in a separate part of the experimental system. These experiments generally strive for a steady state condition, with the electrolyte being replaced periodically. There are also "heat-after-death" experiments, where the evolution of heat is monitored after the electric current is turned off. The most basic setup of a cold fusion cell consists of two electrodes submerged in a solution containing palladium and heavy water. The electrodes are then connected to a power source to transmit electricity from one electrode to the other through the solution. The Fleischmann and Pons early findings regarding helium, neutron radiation and tritium were never replicated satisfactorily, and its levels were too low for the claimed heat production and inconsistent with each other. Various sources of energy input and output are continuously measured. Under normal conditions, the energy input can be matched to the energy output to within experimental error. In experiments such as those run by Fleischmann and Pons, an electrolysis cell operating steadily at one temperature transitions to operating at a higher temperature with no increase in applied current. In support of their claim that nuclear reactions took place in their electrolytic cells, Fleischmann and Pons reported a neutron flux of 4, neutrons per second, as well as detection of tritium. The classical branching ratio for previously known fusion reactions that produce tritium would predict, with 1 watt of power, the production of neutrons per second, levels that would have been fatal to the researchers. The report presented to the United States Department of Energy DOE in indicated that deuterium-loaded foils could be used to detect fusion reaction products and, although the reviewers found the evidence presented to them as inconclusive, they indicated that those experiments did not use state-of-the-art techniques. This creates a high partial pressure, reducing the average separation of hydrogen isotopes. However, the reduction in separation is not enough by a factor of ten to create the fusion rates claimed in the original experiment. Electron screening of the positive hydrogen nuclei by the negative electrons in the palladium lattice was suggested to the DOE commission, [] but the panel found the theoretical explanations not convincing and inconsistent with current physics theories. There are a couple of reasons why known fusion reactions are an unlikely explanation for the excess heat and associated cold fusion claims. Huizenga says they had misinterpreted the Nernst equation , leading them to believe that there was enough pressure to bring deuterons so close to each other that there would be spontaneous fusions.

Chapter 2 : the science of the cold fusion phenomenon | Download eBook PDF/EPUB

3 Science of the Cold Fusion Phenomenon Potency of a Model - Examples in Modern Physics The TNCF Model - A Phenomenological Approach Explanation of the Cold Fusion Phenomenon by the TNCF Model.

Definition[edit] Irving Langmuir coined the phrase pathological science in a talk in Pathological science, as defined by Langmuir, is a psychological process in which a scientist, originally conforming to the scientific method , unconsciously veers from that method, and begins a pathological process of wishful data interpretation see the observer-expectancy effect and cognitive bias. Some characteristics of pathological science are: The maximum effect that is observed is produced by a causative agent of barely detectable intensity, and the magnitude of the effect is substantially independent of the intensity of the cause. The effect is of a magnitude that remains close to the limit of detectability, or many measurements are necessary because of the very low statistical significance of the results. There are claims of great accuracy. Fantastic theories contrary to experience are suggested. Criticisms are met by ad hoc excuses. The ratio of supporters to critics rises and then falls gradually to oblivion. Langmuir never intended the term to be rigorously defined; it was simply the title of his talk on some examples of "weird science". As with any attempt to define the scientific endeavor, examples and counterexamples can always be found. N ray Langmuir discussed the issue of N-rays as an example of pathological science. It is still considered a traditional case of pathological science. He devised experiments in which a barely visible object was illuminated by these N-rays, and thus became "more visible". Blondlot claimed that N-rays were causing a small visual reaction, too small to be seen under normal illumination, but just visible when most normal light sources were removed and the target was just barely visible to begin with. N-rays became the topic of some debate within the science community. After a time, physicist Robert W. Wood asked how it was possible that he could measure something to 0. Blondlot repeated his most recent experiments and got the same resultsâ€”despite the fact that Wood had reached over and covertly sabotaged the N-ray apparatus by removing the prism. Langmuir offered additional examples of what he regarded as pathological science in his original speech: Flying saucers and UFOs in the late s and early s. Martian canals Observed in late 19th century and early 20th century, they turned out to be optical illusions.

Chapter 3 : What the 'cold fusion' debacle has revealed

Broken up in to three sections, The Science of the Cold Fusion Phenomenon gives a unified explanation of all the significant data on the Cold Fusion Phenomena to date. It presents a history of the Cold Fusion Phenomenon (CFP), gives the fundamental experimental results of the CFP and presents a quantum mechanical treatment of physical problems associated with cold fusion.

Saeta, an assistant professor of physics at Harvey Mudd College, responds: Eight years ago researchers Martin Fleischmann and Stanley Pons, then both at the University of Utah, made headlines around the world with their claim to have achieved fusion in a simple tabletop apparatus working at room temperature. Other experimenters failed to replicate their work, however, and most of the scientific community no longer considers cold fusion a real phenomenon. Nevertheless, research continues, and a small but very vocal minority still believes in cold fusion. Schaffer, a senior scientist at one of the major U. I also read many of the papers published on cold fusion, however. I attended the last three International Conferences on Cold Fusion, and I myself ran two sets of cold fusion experiments, both with no clear evidence of excess power release. Overall, I consider myself to be a fairly neutral observer. Fusion is a nuclear reaction wherein two smaller nuclei join fuse to form a new, larger nucleus. When that large nucleus is unstable, it quickly breaks apart and releases energy. The big difficulty is that because the initial nuclei are all positively charged, they are strongly repelled as they approach one another. Therefore, only nuclei having a high kinetic energy approach closely enough to fuse. High-speed nuclei can be made on the earth either by particle accelerators or by extremely high temperatures--on the order of 50 million degrees Celsius or more. The idea, which has its roots in research going back to the s, is that hydrogen and its isotopes can dissolve to such high concentrations in certain solids that the hydrogen nuclei approach closer to one another than even in solid hydrogen. Furthermore, negative electrical charges from the electrons of the solid host partly cancel the repulsion between the nuclei. Early experiments did not detect any signs of fusion, however. Furthermore, modern theoretical calculations show that the proposed effects, while real, are much too small to produce detectable rates of fusion. Their technique is to pass current through an electrolytic cell consisting of a palladium Pd cathode, platinum Pt anode and LiOD a compound of lithium, oxygen and deuterium, or heavy hydrogen electrolyte in heavy water water containing deuterium in place of the ordinary hydrogen. The cathodic reaction liberates unbound atoms of deuterium D , which enter palladium much more rapidly than do deuterium molecules. Under proper conditions, the concentration can build up to 0. Pons and Fleischmann announced their results at a now famous news conference on March 23, They also thought they had detected gamma radiation characteristic of neutrons passing through water, but these results later had to be retracted. A few experimenters reported success, many others failure. Even those who reported success had difficulty reproducing their results. Furthermore, no one was seeing the expected fusion products. But they could not be detected; if they were present at all, it was only at an extremely low level. Some experiments eventually did report helium 4 production, although great care must be used to avoid contamination by trace amounts of helium normally present in the air. This led many cold fusion researchers to postulate that somehow the third fusion reaction was catalyzed in the palladium. Moreover, it was necessary to postulate the suppression of the gamma radiation, which was never observed. There is no widely accepted theory that might explain such effects, however. Excess power remained small and sporadic. If some of the recent reports of new work can be verified, however, the years of effort might be paying off. Pons and Fleischmann now report excess powers of watt percent of the input power sustained over a day run. The Pons and Fleischmann technique calls for about 20 days of electrolytic conditioning, after which the cell is allowed to heat to boiling for the power run. This technique was reportedly reproduced by a separate group under G. Other groups in Japan and Italy are beginning to report excess powers in the 30 to percent range. Experimental results of this magnitude are far beyond ordinary chemistry and point toward the possible existence of some new effect. Whether the effect is a new kind of chemical reaction, a new pathway for nuclear reactions, or something either more surprising or more mundane will only be known after more research. Here I will highlight only electrolysis using nickel

cathodes in alkali salt solutions in ordinary, light water. These cells are much cheaper than ones using heavy water and palladium. They reported low concentrations of a range of heavy elements, including calcium, titanium, chromium, manganese, iron, cobalt, copper and zinc. George Miley of the University of Illinois, working with Patterson cells and either nickel or layered nickel-palladium cathodes, also reported a wide range of medium and heavy elements. Similar, but less detailed, results have been related by a few other groups. Production of such heavy nuclei is so unexpected from our present understanding of low-energy nuclear reactions, that extraordinary experimental proof will be needed to convince the scientific community. All available analytical techniques will have to be applied and the results reproduced. CETI recently started lending Patterson cells to independent laboratories to speed up research. Frankly, most scientists have not followed the field since the disenchantment of and They typically still dismiss cold fusion as experimental error, but most of them are unaware of the newly reported results. Even so, given the extraordinary nature of the claimed cold fusion results, it will take extraordinarily high quality, conclusive data to convince most scientists, unless a compelling theoretical explanation is found first. Several Japanese universities and industries also do cold fusion research. Morrison, who was a physicist at CERN for 38 years, is a longtime observer of cold fusion research; he has also attended the International Cold Fusion Conferences. Here is his assessment: But true believers soldier on. No excess heat was found. The second major experimental report came from the IMRA-Japan lab, where researchers built an improved calorimeter, which had no interaction with the surroundings. Twenty-six experiments were tried employing the various systems and tricks that had been suggested to cause excess heat, but no excess heat was observed. This result might be considered rather meager after five years of work conducted before the announcement and seven years after, when Pons and Fleischmann were well funded. A high-temperature near boiling cell was used at IMRA-Europe, although such a device had been shown to produce greater uncertainties. At low energies--that is, at room temperatures--this potential barrier makes fusion reactions have an incredibly low probability of occurring. True believers claim that in the lattice of a metal such as palladium, the rate of deuterium-deuterium fusion is much higher, so all that is needed is to fill the lattice with deuterium. Deuterium ions of a variety of low energies were fired into metals that had been saturated with deuterium; the measured rates of fusion were then compared with expectations. Some remarkable new claims were mentioned. James Patterson of Clean Energy Technologies CETI was scheduled to speak about his claims that tiny balls coated with metal, generally nickel, could generate energy, but he did not talk. Instead his collaborator, George Miley of the University of Illinois and editor of the journal Fusion Technology, reported that experiments using these balls produced transmutations of the nickel to many other elements even as heavy as lead; he did not worry about the origin of the extra neutrons needed to create lead. Many people who had reported a sensational first result now no longer speak of it or try to extend it. For instance, on the first day of the ICCF-3 conference in Nagoya, Nippon Telephone and Telegraph NTT had issued a press release saying that one of their researchers had solved cold fusion and had reproducible results. The experiment was widely criticized but since has neither been mentioned again nor formally withdrawn. To most scientists, this implies that cold fusion results are not believable, but true believers suggest that this unpredictability makes them more interesting! It is well known that D-D deuterium-deuterium fusion has a much higher rate, by many orders of magnitude, than H-H hydrogen-hydrogen fusion. In fact, early claims of cold fusion stated that the results must be attributed to fusion because they happened only with deuterium and never with hydrogen, which indeed was used as a control. Also, from onward, claims of transmutations have been made. But the cold fusion claims are mutually contradictory; if H-H fusion were to work, then D-D fusion should cause the apparatus to explode. Also, there are more experiments that find no effect than those claiming one, and these negative experiments tend to be more carefully carried out. Some claims can be rejected by other subsequent experiments: If this potential for recombination is blocked, there is no excess heat. The short answer is that true believers can always find something to encourage them, and they can ignore the rest. Cold fusion is much more persistent than previous examples of pathological science, such as polywater, which ended soon after the principal supporters gave up. Here there have been well-organized public relations campaigns. This technique keeps the flame alive. Also some editors publish cold fusion claims in sympathetic journals such as Fusion Technology. They claim that at

the next American Nuclear Society meeting in Orlando, to be held June 1 to 5, there will be a cold fusion session featuring a panel discussion with Miley and Patterson. They also expressed the opinion that some of the plaintiffs had lost touch with reality. True believers never give up, and the funding keeps coming in. At first, American and some Russian work was largely funded by the Electric Power Research Industry EPRI , which spent many millions of dollars, but that support has essentially stopped. Japanese funding seems to be on the decline after ICCF But private investors remain hopeful--they tend to reason that it is worth the odd-million investment if the return on investment is worth billions. They do not appreciate, however, that the likely return is about which means that even investing one penny to earn possible billions would be a bad bet. We all hope to be served a cup of cold fusion tea. Scientific skepticism requires that unless the experimental evidence justifies belief in these miracles, we must conclude that experimental errors are being misinterpreted as positive results. A preponderance of results showing excess energy might indicate something new. The inevitable signatures of fusion reactions--in which atomic nuclei combine, thereby releasing a large amount of energy--are combinations of energetic particles neutrons, positrons and ions and gamma rays. The direct conversion of fusion energy into heat is not possible because of energy and momentum conservation and the laws of special relativity. Energetic particles and their secondary effects should be easily detectable if the claimed levels of excess power were the result of fusion reactions. But measurements of these fusion signatures have been either nonexistent, inaccurate or orders of magnitude too low. The search for truth suffers now, in the quest to convert hydrogen into energy, just as it did 1, years ago in the quest to convert lead into gold. The allure of fame and wealth and the natural desire to believe in good news have been corrupting influences on scientific skepticism. So researchers working outside their main areas of professional expertise are even more likely to misinterpret experimental errors as positive results. And it is hard not to be skeptical about a revolutionary new discovery that would so conveniently have such tremendous and immediate economic value. I learned that the critical positive results have not been reliably and independently reproduced, and many careful and thorough studies have yielded negative conclusions, although often these unexciting results went unpublished.

Chapter 4 : Cold fusion - Wikipedia

In this book, a traditional approach is developed to explain the cold fusion phenomenon, using models, and quantum dynamics in tandem. The results show elements of the new science of the cold.

Share via Print Dr. Getty Images Advertisement Howard J. Wilk is a long-term unemployed synthetic organic chemist living in Philadelphia. The company is one of several that are developing processes that collectively fall into the category of new energy technologies. This movement is largely a reincarnation of cold fusion, the short-lived, quickly dismissed phenomenon from the late s of achieving nuclear fusion in a simple benchtop electrolysis device. Mills, announced at a press conference in Lancaster, Pa. Mills named this curious new type of shrunken hydrogen the hydrino, and he has been at work ever since to develop a commercial device to harness its power and make it available to the world. This story line is a common refrain for the researchers and companies involved. When the researchers applied a current to the cell, they thought deuterium atoms from heavy water that had penetrated into the palladium cathode were fusing to form helium atoms. The excess energy from the process dissipated as heat. The research was summarily condemned, and cold fusion became a synonym for junk science. Cold fusion and making hydrinos both hold the holy-grail promise of generating endless amounts of cheap, pollution-free energy. Scientists were frustrated by cold fusion. They wanted to believe it, but their collective wisdom told them it was all wrong. Part of the problem was they had no generally accepted theory to guide them and explain the proposed phenomenonâ€”as physicists like to say, no experiment should be believed until it has been confirmed by theory. The research community has stopped short of the public dismissal it gave cold fusion and has tended to just ignore Mills and his work. Mills has reciprocated by trying to stay out from under the shadow of cold fusion. In the meantime, the field of cold fusion was rebranded as low-energy nuclear reactions, or LENR, and survives. Some scientists continue to try to explain the Fleischmann-Pons effect. Still others have dismissed the notion of fusion but are investigating other possible processes that can explain the anomalous excess heat effects. Their primary interest is in generating energy for industrial, household, and transportation needs. The handful of companies that have emerged in the attempt to get these new energy technologies to market have a business model the same as any technology start-up: Identify a new technology, attempt to patent the idea, raise investor interest and secure funding, build prototypes and have demonstration events, and announce timelines for when working devices might be available for sale. In this new energy world, however, expired promises are the norm: None have made it to the last step of delivering a working device as advertised. But Mills says you can. The researchers offered possible electrochemical processes that might explain the heat, including irregularities in the electrochemical cell, possible unknown exothermic chemical reactions, or the recombination of split-apart hydrogen and oxygen atoms of water. These are the same arguments made by scientific critics of the Fleischmann-Pons experiments. However, the NASA team did say that researchers should leave the door open, just in case Mills really was on to something. Mills is a mile-a-minute talker who can go on forever spilling out technical details. Besides predicting the hydrino, Mills says his theory can perfectly predict the location of every electron in a molecule using his bespoke Millsian molecular modeling software, even in molecules as complex as DNA. With standard quantum theory, scientists struggle to predict the exact behavior of anything much more complex than a hydrogen atom. Mills further says his theory also explains why the universe is expanding at an accelerating rate, something cosmologists have yet to fully wrap their arms around. Mills also says hydrinos are created from burning hydrogen in stars such as our sun and are evident in the spectral lines of starlight. Hydrogen is recognized as the most abundant element in our universe, but Mills goes further to claim that hydrinos are the missing dark matter in the universe. Those proposals come as a bit of a surprise to astrophysicists: Mills has reported isolating hydrinos and characterizing them using standard spectroscopic methods such as infrared, Raman, and nuclear magnetic resonance. For example, a muonium is a known, short-lived exotic entity made of an antimuon particle a positive, electronlike particle and an electron. The energy released in going from the ground atomic state to a lower energy state comes off as a brilliant emission of light in a high-temperature plasma. The associated heat is then captured to create steam to

power an electric generator. An electric current applied to the silver ignites a hydrino-forming plasma reaction. When it comes to commercial development, Mills at times comes off looking paranoid and at other times like a shrewd businessman. BLP therefore forbids outside experimentalists from doing even the most basic hydrino research, which could confirm or deny hydrinos, without first signing an IP agreement. One of the validators is Bucknell University electrical engineering professor Peter M. Jansson , who is paid for his evaluations of BLP technology through his consulting company, Integrated Systems. I think it may take some period of time for the scientific community to absorb, digest, and accept the possibility of lower energy states of hydrogen. Mills has made a compelling case. Meanwhile, BLP has hosted several demonstrations of its latest prototypes for investors since , posting videos on its website after the fact. But these events do not provide clear evidence one way or the other as to whether the SunCell is legitimate. Our concerns about climate change are going to be eliminated. Despite the uncertainty surrounding Mills and BLP, their story is just one part of the ongoing new energy saga. After the dust settled on the original Fleischmann-Pons announcement, the two researchers began figuring out what was right and what was wrong. They were joined by dozens of other collaborators and independent researchers. Many of these scientists and engineers, often using money out of their own pocket, have been less concerned about commercial opportunities but rather have focused on basic science: They continue to rack up experiments showing excess heat gain, defined as the ratio of energy put out by a system to the energy required to operate it. But in the end, most of these researchers are just looking for an explanation and would be happy if even a modest amount of heat generated turns out to be useful in some way. Nagel , an electrical and computer engineering professor at George Washington University and a former research manager at the Naval Research Laboratory. The original branch of the field focuses on infusing deuterium into a palladium electrode by turning on the power, Nagel explains. Researchers have reported such electrochemical systems that can output more than 25 times as much energy as they draw. The other main branch of the field uses a nickel-hydrogen setup, which can produce greater than times as much energy as it uses. Nagel says the LENR field continues to grow internationally, and the biggest hurdles remain inconsistent results and lack of funding. For example, some researchers report that a certain threshold must be reached for a reaction to start. The reaction may require a minimum amount of deuterium or hydrogen to get going, or the electrode materials may need to be prepared with a specific crystallographic orientation and surface morphology to trigger the process. The latter is a common issue with heterogeneous catalysts used in petroleum refining and petrochemical production. Nagel acknowledges that the business side of LENR has had problems too: In , Rossi and his colleagues announced at a press conference in Bologna, Italy, that they had built a tabletop reactor, called the Energy Catalyzer, or E-Cat, that produces excess energy via a nickel-catalyzed process. Rossi posits that his E-Cat features a self-sustaining process in which electrical power input initiates fusion of hydrogen and lithium from a powdery mixture of nickel, lithium, and lithium aluminum hydride to form a beryllium isotope. Rossi says no waste is created in the process, and no radiation is detected outside the apparatus. One reason many people are having trouble believing Rossi is his checkered past. In Italy, he was convicted of white-collar criminal charges related to his earlier business ventures. Rossi says those convictions are behind him and he no longer wants to talk about them. He also once had a contract to make heat-generating devices for the U. But the delivered devices did not work according to specifications. In , Rossi announced completion of a 1-MW system that could be used to heat or power large buildings. But neither the factory nor the household units have materialized. In the meantime, Industrial Heat and Leonardo have had a falling out, and both are now suing each other in court over violations of their agreement. Rossi continues his research and has announced development of other prototypes. But he gives away few details about what he is doing. The household devices are still waiting for safety certification, he notes. Even if a device clears the hurdles of reproducibility and usefulness, he adds, its developers face an uphill battle of regulatory approval and customer acceptance. But Nagel remains optimistic. For that reason, Nagel has just outfitted a lab at George Washington to start a new line of nickel-hydrogen experiments. Scientific legacies Many of the researchers who continue to work on LENR are accomplished scientists and are now retired. Whether or not the claims of LENR researchers are valid, Kowalski believes a clear yes or no answer is still worth seeking. Not all start-up companies, even ones with sound technology, are successful for reasons that

are not scientific in nature: For example, consider Sun Catalytix. The company spun off from MIT is one example of a start-up built on strong science that fell victim to commercial pressures before it hit its stride. Nocera , now at Harvard, to economically and efficiently convert water into hydrogen fuel with sunlight and inexpensive catalysts. But the process needed significantly more capital and more time to develop than the company initially thought. After four years, Sun Catalytix abandoned its commercialization effort, turned to making flow batteries, and then was bought in by Lockheed Martin. Sun Catalytix no longer exists. He simply wants to know, does the hydrino exist? If the process generates liters of hydrino gas as he has calculated, it should be obvious. Langmuir coined the term more than 50 years ago to describe a psychological process in which scientists unconsciously veer away from the scientific method and become so engrossed in what they are doing they develop an inability to be objective and see what is real and not real. But he has never been a true believer. They always come back to the fact that no one has a commercial device on the market yet, and none of the prototypes seem workable on a commercial scale in the near future. Time will be the ultimate arbiter.

Chapter 5 : Pathological science - Wikipedia

The science of cold fusion phenomenon. [Hideo Kozima] -- Broken up in to three sections, this book gives a unified explanation of all the significant data on the Cold Fusion Phenomena to date. It presents a history of the Cold Fusion Phenomenon (CFP).

Chapter 6 : Cold Fusion Lives: Experiments Create Energy When None Should Exist - Scientific American

The Science of the Cold Fusion Phenomenon: In Search of the Physics and Chemistry behind Complex Experimental Data Sets - Ebook written by Hideo Kozima. Read this book using Google Play Books app on your PC, android, iOS devices.