Japan cold fusion conference sets new direction for science

by Carol White

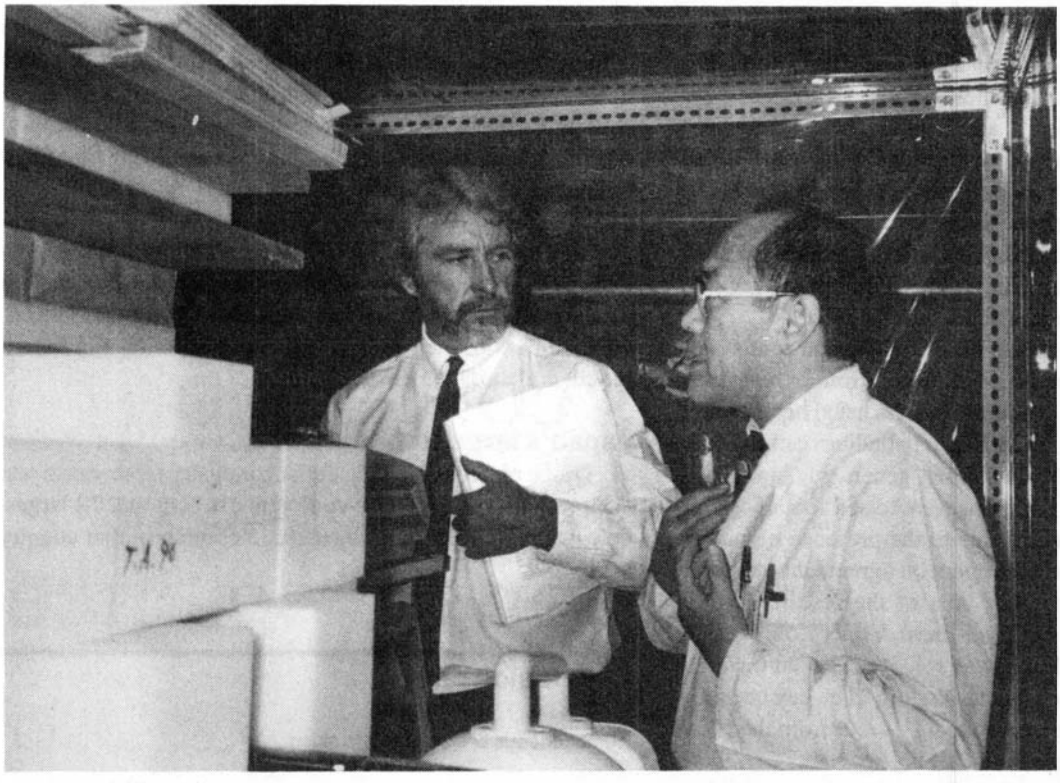
The Third International Conference on Cold Fusion held in Nagoya, Japan, Oct. 21-25 marks a turning point for this extraordinary new field of research. Now, three and a half years after Stanley Pons and Martin Fleischmann first captured headlines worldwide with their announcement that they could produce fusion in a test tube at room temperature, there is a body of experimental results which confirms their contention.

A high point of the conference was the showing of a video produced by Stanley Pons featuring four different experiments in which cold fusion was occurring. These cells went from a temperature of 40°C to a rapid boil and boiled out their contents in around 11 minutes. The video used time-lapse techniques to show the boiling, while a clock was shown ticking off the 600 to 720 seconds which it took for the 2.5 moles of water heavy water in the cell to boil off. A rough estimate establishes that, at best, 40 minutes would have been needed to achieve the same result by plain electrolysis, were a nuclear reaction not occurring. (The 40-minute figure discounts heat loss from the cell, due to radiation.)

Since the energy requirements for such a boiloff are 100,000 joules, calculations approximate that a power input of 144.5 watts would have been required. In fact, the power input was 37.5 watts, of which roughly 11 watts were lost to radiation from the cell. Thus, there was a more than 400% energy gain. Stanley Pons estimated that he achieved a power density of 2.7 kilowatts per cubic centimeter in these experiments.

Controlling the experiment

Japanese scientists have confirmed excess heat in many laboratories, although only experiments by Akito Takahashi of Osaka University approached these high levels of excess heat—as well as boiloff, on occasion. It is now the case that researchers, particularly in Japan and at the Stanford Research Institute in Palo Alto, California, regularly achieve similar repeatability, although, on average, at lower



Stanford Research Institute cold fusion researcher Michael McKubre is shown a cold fusion experiment at Hokkaido University in Japan. The Third International Conference Cold Fusion, held in Nagoya, gave impetus to new efforts in international cooperation in the field.

excess powers. A key feature which affects repeatability of the experiment is the varying quality of different batches of palladium: At least 30% excess heat can be expected by an experienced researcher using a "good" batch of palladium, whereas no results may come from a "bad" batch. Clearly, there are questions regarding metallurgy that still have to be resolved.

Over the past year, experimenters have been able to determine many of the crucial conditions necessary for the experiment to occur, even though, taken collectively, these are not sufficient. For example, while it is crucial to as closely as possible approach a 1:1 concentration of deuterons (deuterium atoms) to palladium atoms, it is not clear whether this is a sufficient condition to ensure that the reaction will take place. One critical factor appears to be the presence of chemical poisons in the electrolyte which promote the loading of deuterium inside the cathode. For example, while silicate—which is leached out of Pyrex glass after a sufficiently prolonged period of electrolysis—generally promotes loading, silicon-dioxide will act as an insulator. In the standard Fleischmann-Pons design, the anode, which is symmetrically wound around the cathode, is made up of platinum, which leads to some platinum deposition upon the cathode during electrolysis and may affect the loading of deuterium into the palladium (see figure). According to Stanford Research Institute researcher Michael McKubre, while silicate enhances the loading ratio, adding aluminum to the cell as a poison is more effective in promoting excess heat.

Another variable is the change of current from low to high density (although there are successful variations from the slow-loading procedures recommended by Pons, such as the saw-tooth loading practiced by Akito Takahashi [see "Japan Achieves Big Breakthroughs in Cold Fusion," *EIR*, March 20, 1992]). Another area to be researched in detail is how the treatment, and composition, of the metal affects the crystal structure, and especially the formation of cracks which are critically important in controlling the loading of the cathode. There is a whole range of other materials questions still to be researched, which also includes the important question of the crystal structure of the palladium hydride as the loading ratio approaches or even surpasses 1:1—the so-called gamma phase—and whether loading occurs at tetrahedral as well as octahedral sites, or elsewhere.

During the first three years of experimentation, many of these questions have been explored, but a great deal of the effort by the scientific community was put into establishing the repeatability of the phenomenon, attempting to answer the question: "Is cold fusion real, or is it 'pathological' science?" Now that Fleischmann and Pons's report of their work has been essentially confirmed, if not in every detail, scientists can move on.

In the summary session of the conference, Martin Fleischmann maintained that the role of "poisons" in enhancing the loading ratio was crucial. "We use glass apparatus experiments," he said, "and Mike [McKubre] puts aluminum in the solution." Both will be deposited as oxides on the

cathode over time.

Fleischmann also discussed what he believes to be the important role of heat in promoting the reaction once the palladium has been loaded to a ratio of 0.6 deuterium of the palladium atoms, which is known as the beta phase. In the lower loading, or alpha phase, the lattice releases heat as it is loaded, whereas in the beta phase, loading is endothermic. Fleischmann commented: "The trick is to cram the deuterium into the lattice, get the lattice into the endothermic regime, and then let the temperature rise."

Another new feature in this year's cold fusion conference was the appearance of an array of results from experiments using light water (H_20), as opposed to the usual heavy water (D_20), in which a nickel rather than a palladium cathode was used, and excess heat was consistently generated. Among the scientists present, many questions were raised about possible chemical reactions occurring due to the presence of carbon in the electrolyte, but there was general agreement that there is a need to explore this new area of the research which appears to be unfolding. Dr. Jean-Pierre Vigier from France, an editor of *Physics Review Letters A,* represented this outlook in his remarks at the closing session: "The key question is that we know we have excess heat . . . but from the point of view of the basic interpretation of the new facts . . . there are new effects in condensed matter and we have to understand what is happening with that. . . . There is something new at stake. Everything hangs now on the light water and hydrogen experiments."

'Dedication and courage'

Broadening international collaboration was a theme stressed at the conference. In the closing panel, Michael McKubre, who heads the premier U.S. research team based at Stanford Research Institute (SRI), pointed out that the field is too broad for what he called either a "horizontal or a vertical monopoly of talents." While SRI has been known in the past for its secrecy regarding experimental protocols, McKubre was quite open in discussing his work in detail with a variety of researchers from around the world and in proposing joint experimental projects.

Conference chairman Prof. Hideo Ikegami, of the National Institute of Fusion Science, closed the conference on a high note of optimism, declaring that Martin Fleischmann and Stanley Pons had opened up a new branch of scientific inquiry for mankind with their discovery of the occurrence of fusion in a solid state rather than a gaseous plasma.

"What is being created is an entirely new field of research from traditional nuclear science," he said. "Now, we can properly name what we used to call cold fusion 'fusion in the solid state.' This is a most important subject for science—one on which we have been working so patiently, with dedication and with courage—for our future generations, for those who will live in the twenty-first century."

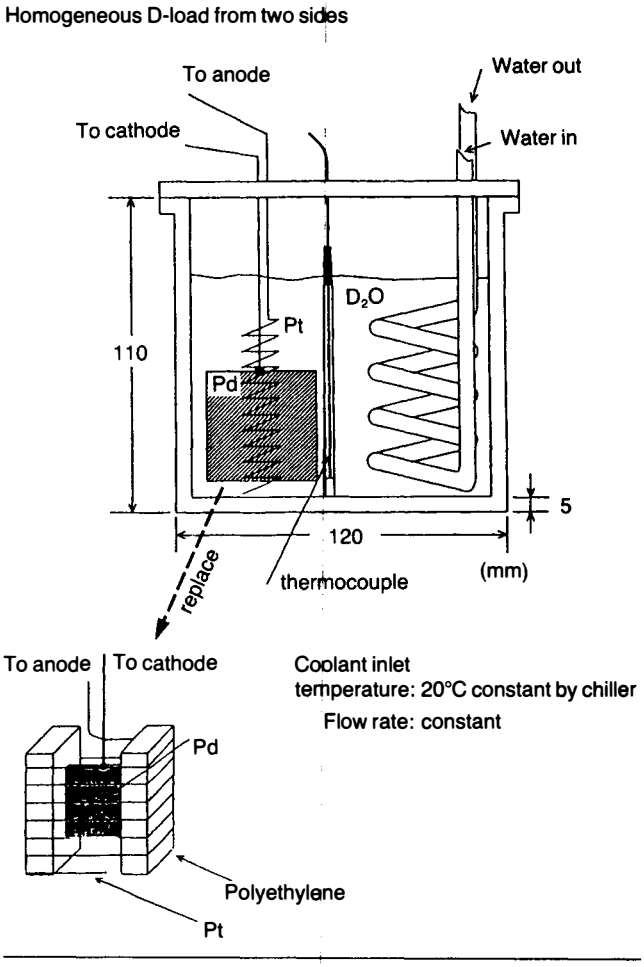
To illustrate, he cited the work of Nippon Telephone and Telegraph (NTT) senior scientist Eichii Yamaguchi, who made significant findings of helium-4, in a palladium plate to which deuterium had been introduced by gas loading, as well as a number of results substantiating the production of significant amounts of excess heat as reported by Dr. Akito Takahashi over this past year.

Dr. Edmund Storms from Los Alamos National Laboratory in New Mexico and Dr. Francesco Cellani from Frascati National Laboratory in Italy both reported at Nagoya on their positive results repeating the Takahashi experiment. Indeed, one hallmark of the year has been the beginning of a broad-based, collaborative effort.

Japan's large commitment

Of the more than 300 scientists, industry representatives, and press who attended the conference in Nagoya, the largest delegation were the 200 Japanese. Research in that country

Cold fusion cell



Source: *EIR*, March 20, 1992.

is taking off in a big way, with the involvement now of the Japanese Ministry of International Trade and Industry, which has proposed a budget of $25 million for the research over the next four years, beginning with the next fiscal year. Industry contributions to the research should at least double that amount.

Even this year, extensive resources have already gone into the program, exemplified by the building of a new scientific research complex in Hokkaido, which now houses Japan's Institute of Minoru Research Advancement (IMRA) cold fusion research center, and an extension of the older facilities located in France to include an IMRA Europe science center at Sophia Antipolis. When I visited the IMRA Japan laboratory, it seemed to me that the building (only part of which is occupied by IMRA) and equipment would have cost in the range of $20 million. The IMRA laboratories are financed by the Aisin Seki Co. whose honorary chairman is Minoru Toyoda, a senior member of the same family which produced Toyota automobiles. IMRA—the acronym is obviously derived from his name—was founded in the hope of fostering scientific research collaboration between Japan and, intitially, France.

Stanley Pons and Martin Fleischmann were offered research facilities at IMRA Europe by the Japanese, after their situation in the United States was made intolerable by accusations not only that their work was flawed, but even that it was deliberately fraudulent. Were it not for the Japanese, it is most likely that this extraordinary new window on nuclear phenomena would have been open for only a brief time. Certainly the actions of the U.S. and British science establishments were intended to drive the two cold fusion pioneers into oblivion. Not only did the Japanese company Technova offer financial support and laboratory facilities in France to Fleischmann and Pons, but the two experimenters have also embarked on an equally ambitious program in Japan itself.

Plan for international research cooperation

Minoru Toyoda addressed the conference participants at a banquet on Oct. 23, 1992. Unfortunately, Mr. Toyoda, 79, was ill and unable to attend; nonetheless his speech was delivered on his behalf. Toyoda, who was born on Aug. 3, 1913, has been a warm supporter of the efforts of Martin Fleischmann and Stanley Pons since their first announcement of the possibility of cold fusion on March 23, 1989, and he continues to support those researchers who follow in their footsteps.

"My name is Minoru Toyoda and I am honorary chairman of Technova, Inc.

"I was invited by Professor Ikegami, chairman of the committee of this international conference, to the dinner tonight, but because of a slight problem with my health, the doctor has advised me to excuse myself from official functions. I sincerely regret that I will not be able to enjoy meeting and conversing with all of you. I have asked Mr. Kyotani, chairman of Technova to kindly read this message expressing my convictions, on my behalf.

"I am delighted that the Third International Conference on Cold Fusion is being held on such a grand scale here in the city of Nagoya, in Japan. I am pleased to welcome eminent cold fusion researchers from all over the world. It is my fondest hope that you will be able to exchange ideas and information in spirited, open, and productive debates to make this a most fruitful occasion.

"Please continue to work with all your might to make this new form of energy a reality, because you offer such hope to the coming generations of the twenty-first century. You will help them to fulfill their greatest dreams and ambitions for the future."—Minoru Toyoda

"For a long time, I have held the strong belief that equitable growth in the world economy during the twenty-first century will only be achieved by the harmonious development of science and technology, through international cooperation.

"To make this belief a reality, I established Technova in Tokyo in May of 1978, as an organization which would have complete freedom to participate in the international forum of research. During the 14 years since its inception, in the ever-changing world of international research, we have made steady progress, thanks to the help of some of the best minds in the world, even under changing international circumstances. Technova has been very active in the development and application of advanced technology, and in adapting advanced technology to practical uses. We have also actively promoted the international interchange of technology and ideas. Technova's staff and advisers have made continuous progress, leaving their mark both nationally and internationally.

"I recall that, in June 1982, at the Eight Annual Summit of Developed Nations, in Paris, French President Mitterrand stressed the necessity for cooperation between science and technology. I examined future trends, and envisioned an ever-growing need for progress through the promotion of science and technology. With the cooperation of my many friends from beyond our borders, in July 1985, I established IMRA Europe, an international research and development laboratory, located in Sophia Antipolis, which is a research park in the suburbs of Nice, France. The laboratory began operations in June 1988, and it has been actively involved in advanced research since, mainly in the field of energy.

"When I established IMRA Europe, I had a vision, world-

wide in focus, to set up a global structure for the development of future technology. I named this project the 'IMRA Plan.' It had its research base in Japan, Europe, the U.S. and the rest of Asia, under the name IMRA. Its purpose was to network these four regions together in order to make more efficient use of human resources by exchanging people and ideas, while winning the world's confidence in order to achieve our goals. This plan progressed steadily, and now, IMRA Japan, IMRA Europe, and IMRA America have already begun work. Today, we are planning the establishment of IMRA Asia.

"Thus I have enthusiastically put my heart into promoting the development of future technology. At the same time, I have always felt anxious about the issue of alternative energy. The dire need to replace drained petroleum resources is a stark warning for the twenty-first century.

"I felt strongly concerned in March 1989, when Dr. Fleischmann and Dr. Pons announced the cold fusion phenomena. Fortunately enough, Dr. Kunimatsu [president of IMRA Japan] who is a common friend to both professors, was working in my affiliated company, and through that connection, I was able to invite both professors to Japan, where we became good friends. After close conversations with them, I became even more firmly convinced of the importance of cold fusion.

"Later, when Technova received a joint research proposal from Professors Fleischmann and Pons, I was determined to do everything I could to offer them an opportunity to work to their hearts content, and allow them to become totally engrossed in the research. It was my judgment that IMRA Europe, located, as I said before in Nice, in the south of France, would provide the ideal environment for them. So I offered this facility, and now, they are giving their undivided attention to advancing their research there.

"Furthermore, in July of this year, to advance cold fusion research more effectively, we have opened IMRA Japan in New Sappora Techno Park, in Hokkaido. With the cooperation of various experts we are working on cold fusion right here in Japan.

"To assure the success of a technology, obviously there must be support from a wide variety of scientific fields. In other words the harmonious development of science and technology is precisely the right way to achieve valuable results which can contribute to mankind. The reason we support cold fusion research activity is because, as a business enterprise, we feel that we must contribute more to science.

"Moreover, cold fusion is not just something to be studied by a single enterprise or a single nation. I am confident that it will become a precious asset to all mankind, as the ultimate, ideal form of energy, so that it must be shared among all of the nations of the Earth.

"Therefore, it is my hope, and my message to you, the cold fusion researchers: Please continue to work with all your might to make this new form of energy a reality, because you offer such hope to the coming generations of the twenty-first century. You will help them to fulfill their greatest dreams and ambitions for the future.

"Thank you for your attention."

Thomas O. Passell, Electric Power Research Institute project director, presents gifts to his hosts at Japan's high-technology laboratory IMRA. EPRI funds the Stanford Research Institute's cold fusion effort in the U.S.; IMRA Europe, based in France, is the home base for cold fusion pioneers Martin Fleischmann and Stanley Pons.