Conference Report

Scientists' understanding of cold fusion remains elusive

by Carol White

This report on the Sixth International Cold Fusion Conference in Hokkaido, Japan, is drawn from a longer article which will appear in the Winter 1996 issue of 21st Century Science & Technology *magazine.*

Seven years ago, when Martin Fleischmann and Stanley Pons laid claim to being able to create a "cold" fusion reaction, they were subject to a furious attack by the scientific establishment. The situation was so bad, that Nobel Prize winner Julian Schwinger resigned from the American Physical Society in protest over the society's censoring of scientists, including himself, who believed that such a thing as cold fusion might exist.

To continue researching in this field demanded an intrepid spirit in the United States and Europe, in a climate in which scientists were many times threatened with loss of tenure and loss of grant money. The situation was better in Japan, but even there, where the Ministry of International Trade and Industry (MITI) sponsored a broad-based effort to probe the phenomenon, the scientific community at large was hesitant to accept cold fusion as a *bona fide* area for scientific inquiry.

Notwithstanding, there has been progress. Over the years, cold fusion research in Italy received modest institutional support, and some of the tab was picked up by industry. In the United States, research at Stanford Research Institute was supported by the Electrical Power Research Institute (EPRI), and by the Japanese. The ENECO consortium has sponsored research—notably by Dr. Edmund Storms, formerly of Los Alamos National Laboratory—in the United States and Russia. ENECO has purchased the University of Utah interest in the original Fleischmann-Pons patents. And, Clean Energy Technology, Inc. (CETI) is trying to market a light-water cold fusion device, which, they say, is at the point of commercial development.

Certainly, the high hopes expressed by the two inventors, that a cold fusion generator was in the offing, have not yet materialized. Nonetheless, evidence has steadily accumulated that appears to substantiate the claim by Fleischmann and Pons, that it is possible to, as it were, *catalyze* a nuclear reaction by chemical means. The political climate, however, remains negative, and Fleischmann and Pons have yet to be granted a patent for their work.

Unfortunately, there has been little advance beyond the "is it or isn't it real?" phase, to understanding what might actually be going on. Moreover, the classic Pons-Fleischmann experiment is still not easily repeatable, perhaps because of as-yet-unidentified differences in the palladium, or other hidden variables. While there are many theories claiming to explain cold fusion, these will remain a somewhat empty exercise, until the experiment is under better control.

The Hokkaido conference

To date, there have been six international cold fusion conferences. On Oct. 13-18, the Sixth International Cold Fusion Conference was held in Hokkaido, Japan, sponsored by the New Energy and Industrial Technology Development Organization (NEDO), which is under contract from MITI. There were 176 registered participants—from Australia (1), Canada (1), China (4), France (6), Germany (3), Hungary (1), India (1), Italy (15), Japan (91), South Korea (2), Russia (8), Spain (3), Switzerland (2), Taiwan (1), United Kingdom (2), and the United States (37).

Stanley Pons (of IMRA Europe) reported on his continuing efforts to create a cell which can operate over an extended period of time in near-boil-off conditions. He has a new cell design, in which there are four thermistors located in different parts of the cell, in order to improve on the accuracy of excess heat measurement in an extremely turbulent environment. Three of eight cells produced energies in the range of 294 megajoules. He estimates his accuracy and precision of measurement in the range of 5% possible error. This would indicate a 250% rate of production of excess power.

One of the major attacks leveled against cold fusion researchers has been their failure to explain how a nuclear process could be taking place, considering that the typical products of fusion—tritium and helium-3—are not produced in sufficient abundance to account for the excess heat. That neutrons and tritium were observed, is of great scientific interest, even if another mechanism is involved.

Thomas Claytor (Los Alamos National Laboratory) could

Cold fusion researchers Stanley Pons (left) and Martin Fleischmann (center) with Rep. Marilyn Lloyd (D-Tenn.), at hearings on Capitol Hill in 1989. Since the first announcement of the discovery of "cold fusion," and the furious controversy surrounding it, there has been little advance beyond the "is it or isn't it real?" phase, to understanding what might actually be going on.

not attend the conference, but his paper was delivered by Edmund Storms. Claytor and Storms are among those who have demonstrated the production of tritium. In the past year, Claytor had concentrated on testing different palladium alloys. He uses a closed system in which deuterium is loaded onto a palladium plate or wire by glow discharge methods; and tests the production of tritium by two methods—in real time, and by collection in water. Using a cobalt and rhodium palladium alloy, Claytor achieved a huge tritium burst that produced peaking at around 1.5 nanocuries/liter. Similar results were reported by the Russian group led by Vitaliy Romodanov (Lutch Laboratory, Moscow).

Helium-4

While in a *hot* fusion reaction, two deuterons (heavy hydrogen isoptopes) will fuse to produce either the still heavier hydrogen isotope tritium (and an additional proton), or a new element, helium-3 (and an additional neutron), the way to account for the occurrence of a *cold* fusion event might perhaps be the highly unlikely, but still possible, fusion of two deuterons to produce helium-4.

The fusion pathway involving production of helium-4 is not usual in a fusion reaction, and detection of helium-4 is relatively difficult in a laboratory experiment, due to the possibility of contamination. Thus, the first reports of the finding of helium-4 were challenged. In order to maintain the energy balance, one would also expect to see gamma ray emissions—but these are not typically correlated to the reported production of helium-4 in cold fusion experiments.

At the Second Annual Cold Fusion Conference, Melvin Miles, from the Naval Weapons Laboratory at China Lake in California, reported experiments in which he got an amount of helium-4 commensurate with the excess heat. At the next conference, in Nagoya, Japan, Eiigi Yamaguchi reported findings of helium-4.

At the Hokkaido conference, there were important new results reported, which correlated the production of excess heat and helium-4.

Yoshiaki Arata and Yue-Chang Zhang at Osaka University in Japan have developed a two-stage cold fusion experiment, in which electrolysis is used to create extremely pure deuterium gas, which is then diffused into a pressurized inner cell containing palladium microcrystals. At the conclusion of their experiment, they were able to detect the existence of large amounts of helium, after the palladium host solid was heated to a temperature of over 1,300°Kelvin.

From Italy, two labs reported significant helium-4:

A group led by Daniele Gozzi (University of Rome) has been working on a system that would correlate production of excess heat and helium-4. The problem is to eliminate helium contamination from the atmosphere. This year, they have achieved much-improved reliability. In one experiment using four cells, run for 950 hours, from which more than a thousand samplings were taken, they believe that their data established a satisfactory correlation between the production of excess heat and the release of helium-4.

At the University of Turin, Tullio Bresani's group reported the detection of helium-4 from a gas-loading (rather than electrolysis) experiment.

Both Giuliano Preparata (University of Milan) and Fran-

cesco Celani (Instituto National Fiscia Nucleare, Frascati) continue to report interesting results using a long, thin wire, to which high voltages are applied longitudinally in an electrolysis experiment. The aim is to demonstrate the efficacy of inducing electromigration down the wire in increasing the cold-fusion effect.

An interesting series of experiments has been run at the Russian Academy of Sciences in Moscow, and were reported on by Aleksei Roussetski and Andrey Lipson. Using a thin palladium film, coated with palladium oxide on both sides, and subjecting it to electrolysis, Lipson found that after the electrolysis ended, there was a strong heat flash, which lasted from two to seven seconds. Lipson believes that the mechanism involves storage of energy from cold fusion which is first converted to elastic energy in the palladium while electrolysis is taking place, and then released in the form of excess heat.

The new alchemy

Fleischmann and Pons have supposed that the proclivity of palladium to sponge up hydrogen could be enhanced through electrolysis, so that a sufficient density (or loading) of deuterium into the palladium (around a ratio of one deuteron to one palladium atom) might allow the fusing of the stuffed-in deuterons to take place. Deuterium is a heavy isotope of hydrogen (containing one additional neutron in its nucleus).

One of the stranger features of the cold fusion story, is a dichotomy that has developed between proponents of the classic cold fusion experiment by Fleischmann and Pons, and a grouping which believes now in a much broader range of possibilities. According to the prevailing notions of how a fusion reaction might occur on earth, it is not possible to fuse two ordinary hydrogen nuclei (protons), but it is necessary that at least one of the partners in the reaction contain one or two extra neutrons (to form a deutron or triton).

But the "new alchemists" have put forth experimental evidence to show that it is possible to get excess heat, and in some cases nuclear products—even the transmutation of light elements to heavier elements—by using ordinary purified tap water and substituting nickel for palladium as the target for the deposit of protons.

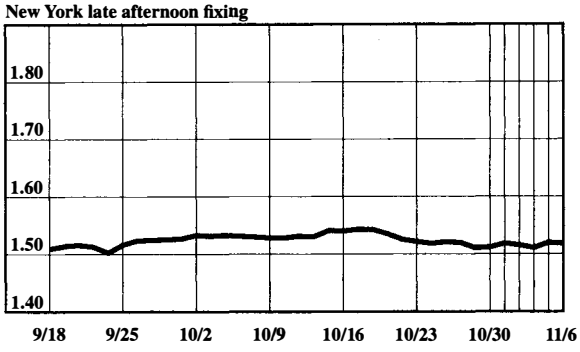
There was a strong showing at Hokkaido on the alchemical side, with George Miley (University of Illinois) reporting on astonishing results, using thin-film microspheres, whose metallic coatings underwent transmutation, so that the heavy element reaction products such as copper, aluminum, and silver, exceeded 50% of the original weight of the metal, in some cases. Some transmutations occurred with lighter elements as well.

Certainly these were the most dramatic results reported at the conference, but, as Miley himself said, he has yet to rule out the possibility of contamination. While his samples and his electrolyte were tested for purity, it is possible that even minute trace elements can deceptively be accumulated on a cathode surface.

Currency Rates

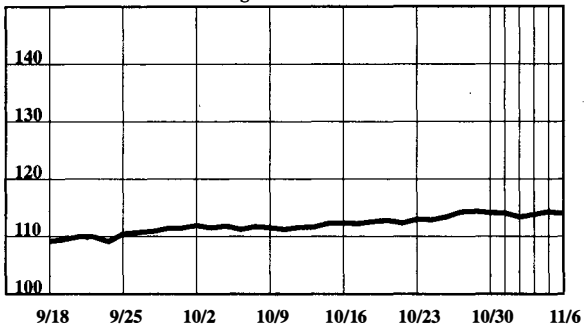
The dollar in deutschemarks

New York late afternoon fixing



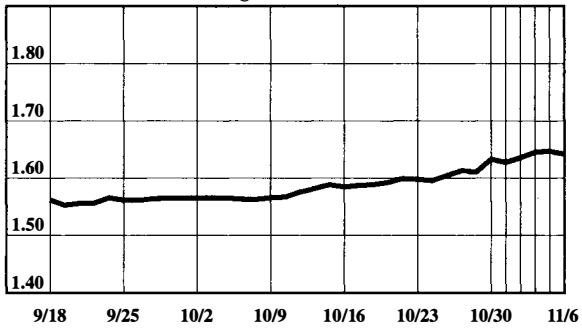
The dollar in yen

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing