An Italian Cold

Late breaking news: An apparent startling new method to generate excess power from hydrogen and metals

Physics professor Francesco Piantelli of the University of Siena, Italy had relegated Pons' and Fleischmann's and others' claims about "cold fusion" to the proverbial "dust bin of history." He just didn't believe them. Then in late 1989, by sheer accident, he glimpsed an aspect of the cold fusion "Genie" others hadn't seen, and since then he hasn't let go of the phenomenon.

The method of generating excess energy that he and his associates have discovered is simplicity itself. It is powerful, reproducible, and without the many problems of electrochemistry—*if* the results hold up. The excess energy released in their small reactors, they say, are "at least three orders of magnitude"—a thousand times— beyond any possible chemical explanation.

Piantelli and his colleagues, physics professors Sergio Focardi and Roberto Habel have just published a paper in the Italian physics journal *Il Nuovo Cimento* (February 1994) about work, which if substantiated by others, may soon revolutionize all of cold fusion. It could make excess energy much easier to generate than heretofore possible.

[Since the brief scientific paper had just gone to press shortly before this magazine went to press, only preliminary information was available for this magazine. *"Cold Fusion"* will follow up on the story with further details in its next issue as more facts emerge. Editor Eugene Mallove attended a seminar at the University of Siena on February 14, 1994, at which this pioneering research was presented to a group of about 40 scientists.]

Serendipity personified

In December 1989, serendipity struck at the University of Siena, which is an ancient and beautiful city. Above the stone streets of Siena in a laboratory that specializes in biomedical applications of physics, Professor Piantelli was trying to measure the charge on an organic molecule called a "ganglioside." He was working at an ultra-cold, cryogenic temperature more than 70 degrees C below zero (near 200 degrees K), and magnetic fields were involved in the apparatus employed.

The sample of biological material had been tagged with deuterium, the doubly heavy non-radioactive isotope of hydrogen. Unexpectedly, the cooling apparatus was having difficulty maintaining the low temperature necessary to carry out the measurement. It seemed that there was a mysterious source of heat production coming from the sample—heat that Piantelli could not account for in any way.

The organic sample was resting on a piece of nickel, an element whose crystal structure bears some resemblance to that of palladium, and which has figured prominently in cold fusion experiments in ordinary water. [Nickel is element 28 and palladium is element 46, but they both are in the same column in the Periodic Table of Elements.] A non-observant scientist might have dismissed the apparent heat generation and a possible link to claims of excess heat associated with palladium-heavy water cells. But Piantelli and his colleagues Focardi and Habel, who soon joined him in the scientific detective work, were up to the task. In the back of Piantelli's mind was another mysterious electrical anomaly he had seen back in 1966 in hydrogen-loaded palladium, but which he had not then explained.

The Italian group, which until its 1994 disclosure had been unknown to mainline cold fusion researchers, worked part-time on this excess heat problem after 1989. Their goal was to design an experiment that would demonstrate on a larger scale and in another way the heat anomaly they had seen in late 1989. By the end of 1992, Piantelli, Focardi, and Habel had their equipment ready. Their first major success in producing excess heat was achieved apparently in the spring of 1993—a few tens of watts excess power.

Simplicity in action

Their present apparatus is simple, indeed. It is described in the *Il Nuovo Cimento* article, "Anomalous Heat Production in Ni-H Systems," by Sergio Focardi, Dept. of Physics, Bologna University and INFN Bologna; Roberto Habel, Physics Institute, Faculty of Medicine, Cagliari University and INFN Cagliari; and Francesco Piantelli, Department of Physics, Siena University, IMO Siena, and INFN Siena. [IMO stands for International Center for Biophysics and Biochemistry of Molecules and Organisms; INFN stands for National Institute for Nuclear Physics].

The one-sentence abstract: "Evidence for a 50 watt anomalous heat production in a hydrogen loaded nickel rod is reported." The three-page article references only the famous 1989 paper by Pons and Fleischmann in the *Journal of Electroanalytical Chemistry*.

E. MALLOVE

Professor Sergio Focardi at 14 February 1994 lecture at the University of Siena.

A cylindrical stainless steel chamber 50 mm diameter and 100 mm long houses a rod made of nickel, 5 mm diameter, 90 mm long. The nickel rod is enclosed by a cylindrical ceramic spindle (20 mm diameter), around which are wound 42 turns of platinum (Pt) wire (1.0 mm diameter wire). The Pt wire is a resistance heater that is

FUSION HOT POTATO

BY EUGENE F. MALLOVE

fed by a voltage-stabilized power supply. The heater's purpose is to bring the nickel rod to a temperature over a few hundred degrees C.

This reactor chamber is connected through a valving system to a high-performance vacuum pump and (alternately) to a bottle of ordinary hydrogen gas, H_2, and to a bottle of deuterium gas, D_2. The team has developed specific protocols for loading the hydrogen into nickel by alternately evacuating and then pressurizing the reactor (always to below one atmosphere) with either hydrogen or deuterium. They found clear evidence for this loading of the nickel with hydrogen, because the chamber pressure drops with time slightly below its initial value. Keeping the temperature elevated is the key requirement for loading.

This work has the initial appearance of a great breakthrough in 'cold fusion.' If it turns out to be truly a reproducible experiment that can be duplicated by others, it has major implications.

The group carried out very accurate calibration of the apparatus by putting in various heater powers up to a few hundred watts and observing the stable temperatures reached at the surface of the Ni and the Pt. Upon triggering the effect, presumably with a gas pressure pulse and/or magnetic field, the nickel temperature rises rapidly tens of degrees C. [The triggering method is temporarily incompletely disclosed (for patent considerations), but the known precondition is temperature above 173°C and sub-atmospheric pressure in the gas.]

Then the input power falls, the temperature of the nickel drops back, and it is found that the original high temperature (over 400°C is possible) can be maintained with much less input power—clear evidence of a heat source operating within or at the surface of the nickel. The highest excess power produced, they claim, was 57 watts excess for 20 days, but the group has observed 37 watts excess for as long as 100 days. The example cited in the short journal article is 44 watts for 24 days. These excess power levels for those extended periods of time imply an energy source within the reactor that releases many thousands of times the energy of any conceivable chemical reaction between the hydrogen and nickel. Bear in mind, there was no sign that these reactions were weakening; it is possible they would have persisted much longer.

The group has hypothesized that the "cold fusion" nuclear reaction involved might be between H and D—even when ordinary hydrogen gas is being used. Hydrogen gas, of course, has naturally-occurring deuterium in it. However, the group has not presented evidence to prove that, say, helium-3 nuclear "ash" has been found. Test results for helium were awaited. The group has looked for neutrons and gamma rays—at least for safety purposes—and finds no evidence of radiation.

The paper offers seeming proof that at all input powers to the platinum (Pt) heater, it remains several degrees hotter than the nickel (Ni) sample *before* the triggering of the reaction. The evidence looks solid that the Pt is on the order of 10°C cooler than the Ni *after* triggering the reaction. This seems to substantiate that the heat source is within the nickel rod or at its surface. The excess power in the tens of watts range is roughly constant no matter what the input heater power, provided the temperature of the Ni is kept hot enough after triggering. The phenomenon appears to be surface area-dependent, leading to the expectation that it can be readily scaled up.

The upper limits to this reaction may be even higher. One day in late 1993 at about 4 a.m., while the reactor was being monitored by the computer data collection system, a nickel rod undergoing an excess heat production test suddenly elevated in temperature hundreds of degrees and destroyed the attached temperature probes. The nickel sublimed partially—evaporated!—and blackened the white ceramic holder. [Note: The melting point of Ni is 1453°C.] This apparent "run-on" reaction lasted six-hours, the last few hours of which were spent by Piantelli and others trying to quench the reaction—even after the heater was (presumably) shut off.

Cold fusion breakthrough?

This work has the initial appearance of a great breakthrough in "cold fusion." If it turns out to be truly a reproducible experiment that can be duplicated by others, it has major implications. These are some of them:

* Easy-to-produce large magnitude excess heat from nickel surfaces in contact with gas, hydrogen or deuterium. Inexpensive materials, works with hydrogen or deuterium gas and non-precious metals. Easy scale-up.
* Uses a completely dry, non-electrolysis process.
* Is completely reproducible and apparently never fails to start up.
* Triggering of excess power production is nearly instantaneous.
* Works at temperatures of hundreds of degrees C, leading to possibly excellent thermodynamic efficiency in technological applications. No known upper limit to temperature, other than the melting point of the metal.
* The reaction continues for months, with no apparent decrease in the reaction intensity during months of operation. The reaction has reportedly *never* stopped by itself.
* It seems nearly certain that the reaction will self-sustain (i.e require no input heater electrical power), if the system were engineered to maintain adequate temperature in the nickel sample through self-heating.

The present experiments are scientific calorimetry trials that do not attempt to self-sustain. The six-hour temperature excursion re-

ported to have occurred late in 1993 is more than an indication that the reaction can self-sustain.

The group is reported to be working actively with (unspecified) industrial support to produce a demonstration device(s) as soon as possible. It has long since applied for patent protection and promises to release further details on its process—perhaps within a few months—when it has received proper clearance. The group appears to be aware that powerful demonstration units are required to eliminate any possible doubt about the reality of this phenomenon.

> **'I found the whole thing very convincing and very beautiful.'**
>
> *—Professor Giuliano Preparata of the University of Milano, February 14, 1994*

Scientists at the February 14th presentation seemed pleased with what they heard. Dr. Francesco Celani, a cold fusion experimentalist from the Frascati National Laboratory, mentioned a few concerns about how input power was being measured. Others thought these would not affect the basic result. Cold fusion theorist Professor Giuliano Preparata of the University of Milano, ended the seminar with praise for the work: "I found the whole thing very convincing and very beautiful."

Monument in a tranquil atrium at the University of Siena.

IMPOSSIBLE & PREPOSTEROUS

"I was convinced for a while it was absolute fraud. Now I've softened. They [Pons and Fleischmann] probably believed in what they were doing. But how they represented it was a clear violation of how science should be done."

Dr. Richard D. Petrasso, MIT hot fusion scientist, New York Times, *Sunday, March 17, 1991, p. 1.*

* * *

Petrasso said he thought there was a "one in a trillion" chance that the claims of cold fusion are correct.

Dr. Petrasso quoted in Boston Globe, *April 17, 1992, article by David Chandler.*

"If you buy the excess heat measurements then you have to invent some kind of nuclear process to explain them. I just haven't bought into the heat claims yet. I think there is a subtle mistake . . . if it's a mistake, it's a very interesting mistake."

Petrasso quoted in Popular Science, *August 1993, article by Jerry Bishop.*

* * *

"Inept scientists whose reputations would be tarnished, greedy administrators who had involved their institutions, gullible politicians who had squandered the taxpayers' dollars, lazy journalists who had accepted every press release at face value— all now had an interest in making it appear that the issue had not been settled. Their easy corruption was one of the most chilling aspects of this sad comedy.

"To be sure, there are true believers among cold-fusion acolytes, just as there are sincere scientists who believe in psychokinesis, flying saucers, creationism, and the Chicago Cubs. The lesson from "Too Hot to Handle" by Frank Close is that a Ph.D. in science is not an inoculation against foolishness—or mendacity."

Dr. Robert Park, Professor of physics, University of Maryland, and Director of the Washington office of The American Physical Society, quoted in The Washington Post, *May 15, 1991.*

* * *

"Cold fusion, the all-but-utterly discredited notion that once promised to create cheap nuclear power in a jar of water, made a tentative bid for credibility yesterday as two groups of researchers separately announced new explanations for the controversial phenomenon."

Reporter Curt Suplee, The Washington Post, *April 26, 1991.*

* * *

"What they [Pons and Fleischmann] had was nothing. Yet they started an avalanche that swept up scientists all over the world, mesmerized gullible backers from the Utah state legislature to the Electric Power Research Institute, and wasted tens of millions of dollars of seemingly not-so-scarce research funds. Even now the rubble has not completely ceased to jitter."

Nicholas Wade, science editor of The New York Times, *in* Nature, *August 5, 1993, in a review of Gary Taubes' "Bad Science".*

* * *

"Do we regard this [cold fusion] fiasco with detached resignation, or express more strongly our dissatisfaction with the deceptions, exaggerations, and ethically disoriented presentations that stimulate vast diversion of international resources? If science does not ensure that its house is in order, who will?"

Dr. Frank Close, Theoretical Physics, Rutherford Appleton Laboratory, Chilton, UK, in American Scientist, *January-February 1993.*