Cold Fusion, The Science

Serious thinkers will pay close attention to the achievements of Yasuhiro Iwamura and his colleagues at the Mitsubishi Advanced Technology Research Center, in identifying the transmutation of individual elements at room temperature in a gas-charged cold fusion cell.[1]

The crucial importance of cold fusion research has always been the potential it holds for fundamental breakthroughs in science. Practical applications, even one so necessary as a new supply of cheap, clean energy, have always been the issue of secondary import.

The Iwamura work implies a revolution in our understanding of the nucleus and its transformations. However, problems in our intellectual culture, affecting both the courageous few who have pursued cold fusion work as well as the mob which opposes them, are holding back that revolution. We turn to that problem shortly. First, both as an aid to the general reader, and to locate the significance of the Iwamura findings, we offer a brief review of the subject of nuclear transmutation.

The transmutation of elements was first detected in the early years of the 20th Century as a natural process in the radioactive decay of uranium, thorium, and radium. It took several years before the phenomenon, which challenged the long-held tenet of the immutability of matter, became generally accepted by physicists and chemists.

Artificial transmutation was first observed, but not proven, in Ernest Rutherford's Manchester, England laboratory in 1914. On introducing a sample of radium C′, a natural emitter of alpha particles, into a container of nitrogen gas, scintillations were observed on a zinc sulfide screen, indicating that a proton was being released. The alpha particle, an emission observed in the radioactive decay of certain elements, had earlier been determined to be the nucleus of a helium atom, possessing

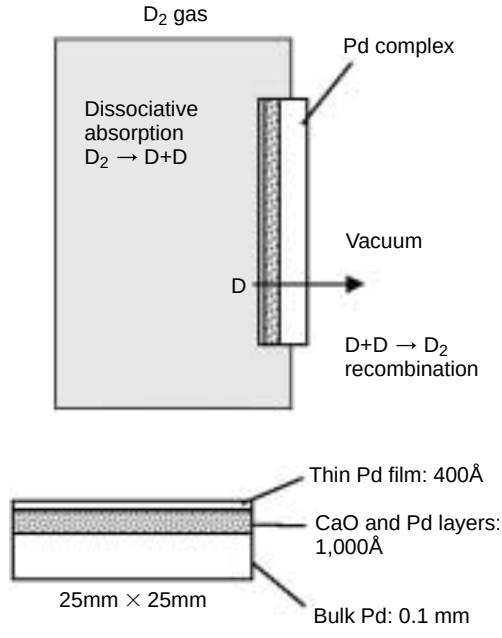


Figure 1
A SCHEMATIC OF THE IWAMURA CELL
Deuterium gas under pressure passes through a thin film of the element to be transmuted, which is coated on the sandwich of palladium and calcium oxide indicated as "Pd complex" in the schematic. The detail shows the "sandwich."

Source: Iwamura, Y., M. Sakano, and T. Itoh, "Elemental Analysis of Pd Complexes: Effects of D_2 Gas Permeation," *Jpn. J. Appl. Phys.* A, 2002, Vol. 41, p. 4642.

two protons and two neutrons.

Later, in the 1920s, it was concluded that the proton earlier observed in the nitrogen gas was the result of a transmutation, produced when an alpha particle collided with the nitrogen nucleus, yielding oxygen-17 and releasing a proton. Soon, the transmutations of other light elements were accomplished by similar means. By the late 1920s, it had become possible to achieve transmutations by accelerating hydrogen nuclei (single protons) in the powerful electric field of such devices as the van de Graaf and Cockcroft-Walton generators, the predecessors of modern particle accelerators.

The Difference

The distinction between these earlier means of bringing about transmutation, and those reported by Iwamaura, et al., is this. In both the case of the natural decay of an alpha particle (which travels at speeds up to one-tenth the velocity of light), and the artificially accelerated charged particle, enormous work is being exerted to accomplish the transmutation.

That is not the case in the recently observed transmutations, which are brought about with very little exertion. To accomplish the fusion of deuterium by previously known methods requires temperatures of millions of degrees. The mass defect of the most common products shows that an energy of about 3 to 4 MeV (million electron volts) had been produced per fusion. In the transmutations observed by Iwamura, an energy per fusion of 50 to 67 MeV is achieved, at approximately room temperatures with little expenditure of energy.

Using a sophisticated detection apparatus, as Dr. Edmund Storms reviews the case in our cover story this issue, Iwamura's team observed the transmutation by deuterons of thin layers of the elements strontium, cesium, and barium which had been coated onto a sandwich of palladium and calcium oxide. The transmutations observed were:

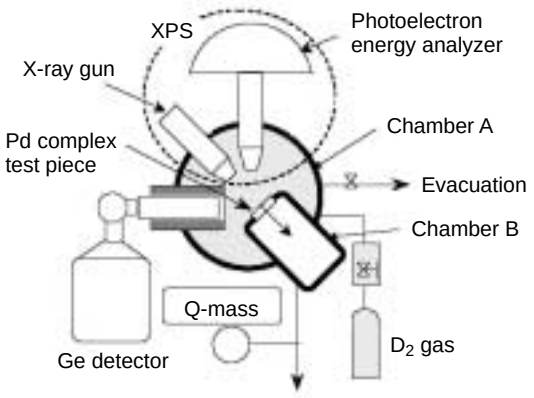
$$4D + {}_{55}Cs^{133} \longrightarrow {}_{59}Pr^{141}$$
$$4D + {}_{38}Sr^{88} \longrightarrow {}_{42}Mo^{96}$$
$$6D + {}_{56}Sr^{138} \longrightarrow {}_{62}Sm^{151}$$

The isotopic distributions of the new, transmuted elements matched those of the original element (although these are far from the natural distributions for the transmuted element) lending credence to the conclusion that a true transmutation is being observed, and not the concentration of a previously present impurity.

Figure 2
IWAMURA DETECTION APPARATUS

A schematic of the detection apparatus for real time observation of the transmutation in Iwamura's cold fusion cell.

Source: Iwamura, Y., M. Sakano, and T. Itoh, "Elemental Analysis of Pd Complexes: Effects of D_2 Gas Permeation," *Jpn. J. Appl. Phys.* A, 2002, Vol. 41, p. 4642.



The implications for science of these results are wonderfully exciting. Just as the first discoveries of transmutation at the beginning of the 20th Century gave birth to nuclear science, we have now the hope that an understanding of this new process occurring in a cold fusion cell will lead us to a deeper understanding of the nucleus, the chemical bond, and much more that is as yet unimagined.

The Problem in Science

As the Storms article reviews, dedicated individuals and small groups of scientists from around the world have shown great courage and personal integrity in pursuing the trail of cold fusion. This, despite the vicious and continuing smear campaign which began within a few months after Drs. Martin Fleischmann and Stanley Pons announced their results on March 23, 1989.

The principal weakness of most of the work we have seen, both in cold fusion and in some other areas where the accepted paradigm is being challenged, has been the failure to come to grips with the axiomatic errors dominating modern scientific thinking. What is in fact a systemic error is too often viewed as a mere aberration.

The cold facts are these. The teaching and practice of science today is dominated by a cult, a high priesthood obsessively committed to a radical form of empiricist reductionism. By that, we mean a denial of the effective existence in the universe of ideas. All actions are to be explained by the motions of presumed elementary particles, and the *a priori* statistical laws supposed to be governing their behavior. Among the leading forms of expression of the disease are a utopian's belief in the efficacy of blackboard mathematics, and a persistent falsification of the history of science, in which the real act of discovery (and often the name of the discoverer himself) is replaced by a textbook formalism. The latter is akin to a dictionary nominalism respecting the ideas contained in words.

Remedying the effects of that miseducation, and the continuing social pressures to which nearly all of us are subjected, has been the principal ongoing commitment of this journal.

Respecting the first expression of the priesthood's ideology, the 1799 polemic of Carl Friedrich Gauss against the obsessive errors of Euler, d'Alembert, and Lagrange on the subject of the Fundamental Theorem of Algebra, is much to the point.[2] We have had some things to say on this matter and the broader topics correlative to it in past issues, and will be saying more.

Here, we devote ourselves to that second expression of the problem, wherein the gloved hand of the scientific mafia reaches into realms relevant to the pursuit of cold fusion.

'Worse than Cold Fusion. . .'

In 1990, in the course of contacting leading figures in nuclear science about the breakthrough in cold fusion, my colleague Charles B. Stevens had a memorable phone call with the prominent nuclear physicist Hans Bethe, whom Stevens had known for over a decade. In the course of the discussion, Stevens told

National Academy of Sciences

William Draper Harkins, the originator of nuclear science in the United States.

Dr. Bethe of his recent historical researches into the work of William Draper Harkins, the distinguished head of the University of Chicago Physical Chemistry Department, during the pre-World War II decades. Harkins had originated nuclear research in the United States in the years before World War I, and had been the teacher and colleague of our colleague and teacher, Dr. Robert J. Moon.

No sooner had Stevens mentioned the name of Harkins, than Bethe interjected: "The only thing worse than cold fusion, is Harkins."

Knowing that there would not have been a Manhattan Project, nor a nuclear science in the United States, without Harkins and his students, I coined the term "Bethe decay." Yet this was no recent event. As I discovered upon deeper research, it had had a long half-life.

Bethe's telephone outburst made clearer to me an idea which had already been germinating in my mind from comparing the stories told me by the first-hand participant Moon, to what I had read in the textbook accounts of the history and development of nuclear science. To put it plainly, there was the stink of fraud. Subsequent research has confirmed and reconfirmed the initial suspicion, with increasing sharpness.

The conclusion was at first frightening. For, once recognizing that the conventional history of the science is false, one soon comes to see that conventionally taught and accepted theory is also riddled with error and assumption. The fear arises in realizing that all that one had previously accepted must be reconsidered—and that at the price of becoming largely an outcast among those one had considered one's teachers and peers.

This is the task which faces all those who persist in cold fusion research. If we are to make advances in the science of cold fusion, the systemic errors within the history of our conceptions in the field must be put on the table. The battle between Bethe and Harkins provides a useful reference point for the re-examination. We share this brief summary of some observations, with that in mind.

For example, the issues raised by the Iwamura results go to the heart of our understanding of the nucleus. Shaking off all the mountain of formalism, in truth our understanding of what goes on when two nuclei collide to form a new one, is painfully scant. Do we wish to rethink the assumptions we bring to the interpretation of this process? Harkins's account of his development of the concept of the intermediate nucleus, and his battles with Rutherford, the Cavendish Laboratory, and Bethe (who insisted the intermediate nucleus was impossible) must be known. Harkins's 1946 account, "The Neutron, the Intermediate of Compound Nucleus, and the Atomic Bomb" (*Science,* Vol. 103, No. 2671, pp. 289-302) is a good place to look.

Or, to take another example. Cold fusion, in most forms we have seen so far, implies a relationship between a crystal lattice or some form of chemical bond, and the nucleus. What do we actually know of that? The early writings of another student of Harkins, Robert Mulliken (like Moon, both an accomplished physical chemist and physicist), shed important light on a re-examination of that subject.[3]

The work of Moon himself, is the most directly relevant. We had devoted our previous (Fall 2004) issue to the subject. Moon began his scientific work from a principled and moral opposition to any form of reductionism. The achievement of nuclear fusion was the central devotion of his work from about the age of 18. From an early period, Moon's work on fusion was guided by his understanding of the flaw in the Maxwell presentation of electrodynamics. No serious scientific discussion with Moon could take place without the subject of the 1870 paper of Wilhelm Weber arising.[4] There, the conditions for the stable aggregation

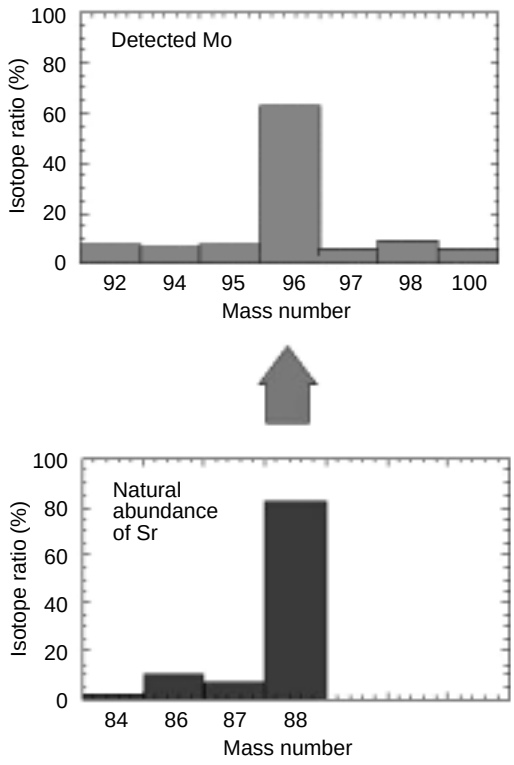


Figure 3
ISOTOPIC RATIO OF TRANSMUTED ELEMENTS

The isotopic ratios of the transmuted element molybdenum (Mo) are quite similar to the ratios of the element transmuted, strontium (Sr), although these ratios are not characteristic of natural molybdenum.

Source: Iwamura, Y., M. Sakano, and T. Itoh, "Elemental Analysis of Pd Complexes: Effects of D_2 Gas Permeation," *Jpn. J. Appl. Phys. A,* 2002, Vol. 41, p. 4642.

of two like charges were derived from the known law of electrodynamics.

With his 1986 breakthrough in identifying a nested grouping of Platonic solids as the form of symmetry for the nuclear charges, it became apparent to Moon that there would exist certain straight-line paths of entry into the nucleus, free from Coulomb resistance.[5]

Moon had much earlier explored forms of cold fusion in crystalline substances, and had achieved proof-of-principle confirmation in materials including lanthanum hexaboride. He was thus not surprised at the results announced by Fleischmann and Pons in March 1989.

The Promise

Fraud may seem a strong term to describe the situation in modern science. Yet it is scientifically precise. Indeed, it has a long history. The history of science since classical times, is nothing but a battle between two opposing philosophic views. The cultural problem is that university education during the lifetimes of most people alive today has supported the anti-science side of the matter. In the controversies of Plato vs. Aristotle, Kepler vs. Galileo, Leibniz vs. Newton, Gauss vs. Euler, and Riemann vs. Cauchy, modern education has taken the side of reductionism and empiricism in each case. So much so, that for most today, even the chosen method of resolving the controversies is a pragmatic empiricism.[6]

Real science, as opposed to a textbook mastery of the digested bolus of past work, begins with the certainty that there is something wrong with our present view. To find that error of assumption or omission in the framework of presently accepted conceptions, or to discover that new phenomenon which helps light our path to the embedded error, is our passion. This is the true promise of cold fusion research.

—Laurence Hecht

Notes

1. See, Iwamura, Y., M. Sakano, and T. Itoh, "Elemental Analysis of Pd Complexes: Effects of D_2 Gas Permeation," *Jpn. J. Appl. Phys. A,* 2002, Vol. 41, p. 4642, and Edmund Storms, "An Update of LENR for ICCF-11," pp. 7-8, at www.lenr-canr.org.
2. See Lyndon LaRouche "Visualizing the Complex Domain," *21st Century,* Fall 2003 and at www.21stcenturysciencetech.com for a comprehensive treatment of the problem.
3. Mulliken, who collaborated with the great Göttingen spectroscopist, Friedrich Hund, found himself in early opposition with the Heitler-London and Slater-Pauling conceptions of the chemical bond. Although his work on the molecular orbital concept was belatedly incorporated into the currently accepted smorgasbord, it is the probing analysis and historical approach which make his papers of the early 1930s thought-provoking reading for whoever would try to rethink the present from the standpoint of the future. Blackboard jugglers can wave the quantum equations all they wish. G.N. Lewis's cube (the valence "octet"), remains to be explained, as Mulliken will remind us.
4. Wilhelm Weber, "Electrodynamic Measurements—Sixth Memoir, Relating Specially to the Principle of the Conservation of Energy," *Phil. Mag.,* S.4, Vol. 43, No. 283 (Jan. 1872), pp. 1-20 and 119-149.
5. An examination of the electrodynamic force on a charge entering the nucleus along the line of orientation of what I described as a "Weber pair" (Fall 2004, pp. 58-73) will illustrate the point.
6. For a full historic treatment of the subject in the context of the cold fusion question, see: Lyndon H. LaRouche, Jr., "Cold Fusion: Challenge to U.S. Science Policy," Science Policy Memo (Washington, D.C.: Schiller Institute, August 1992).