Cold fusion theory takes critics' heat

By Douglas Cohen
FLORIDA TODAY

A consultant with the Florida Institute of Technology in Melbourne on Friday put yet another crack in the theory of two Utah chemists who say they achieved cold fusion.

Heat detected by two chemists in an experiment at the University of Utah was not the result of cold fusion but instead was caused by a the embrittling effects of hydrogen on metals — a phenomenon studied for decades by aerospace scientists, said Ali AbuTaha, a Virginia technical consultant associated with F.I.T.

"Most people agree the fusion claim is questionable at best; the big question is where does the heat come from," said Marshal Kaplan, acting director of F.I.T.'s Space Research Institute. "AbuTaha has figured out where the heat source is coming from."

Fusion, the combining of lightweight atomic nuclei with a resulting release of enormous amounts of energy, is seen as the "cleanest" energy source because it causes no pollution. The sun's heat comes from fusion, and the discovery of fusion at room temperature could provide a limitless source of energy.

Chemists Martin Fleischmann and B. Stanley Pons claimed just before Easter that they had created nuclear fusion in Utah by running electricity through a water-filled bottle containing palladium.

"If it was fusion, Pons and Fleischmann would have been killed" by the neutrons bombarding the room, AbuTaha said.

Like AbuTaha, scientists at the Massachusetts Institute of Technology and Georgia Tech discounted the cold fusion claim after recreating the experiment and finding not enough neutrons were released to signify cold fusion. But they could not explain the heat released.

AbuTaha said the warming effect the two witnessed is more consistent with the release of energy discharged when the palladium cracks.

On Friday, AbuTaha gave a preliminary talk on hydrogen embrittlement to his colleagues at F.I.T. He likened the effect of hydrogen on metals to that of external pressure on a piece of steel.

When 40,000 pounds of pressure per square inch was applied to opposite ends of a metal strip, the metal cracked. For several seconds, it was warm along the crack.

Pons and Fleischmann thought they were conducting a controlled experiment in April but failed to take into account that the palladium was being weakened and cracked by deuterium, a heavy form of hydrogen that was in the water, AbuTaha said.

"We've been studying hydrogen embrittlement extensively for three decades as part of the space program in an effort to minimize its effects on metals," he said. "Pons' and Fleischmann's discovery was hailed as room-temperature fusion, but ... hydrogen embrittlement is worst at room temperature."

The Orlando Sentinel

SATURDAY, May 6, 1989

OR D

FIT engineering expert spurns fusion theory

By Cory Jo Lancaster

OF THE SENTINEL STAFF

MELBOURNE — A national engineering expert Friday dismissed the now famous room-temperature fusion theory as nothing more than the process of metal corroding.

Recently hired by Florida Institute of Technology's Space Research Institute, Ali AbuTaha explained to students and faculty how two University of Utah scientists started a chain-reaction of heat with little more than a car battery, test tube and a rod of metallic palladium.

The Utah scientists claimed in March they achieved a sustained hydrogen fusion reaction, possibly harnessing the energy of an H-bomb explosion and opening the way for an enormous energy source.

Since then, scientists worldwide have tried to repeat the experiment with differing results. Many doubt that fusion took place.

The Utah experiment has generated nationwide publicity because room-temperature fusion, if sustained, would be a breakthrough discovery in the 35-year effort to harness energy from hydrogen. Scientists worldwide are using everything from lasers to extreme heat reaching millions of degrees in efforts to achieve fusion.

Experts say fusion using deuterium, a heavy form of hydrogen that naturally occurs in sea water, would make an excellent energy source because it doesn't produce carbon dioxide, which is blamed for the greenhouse effect. In theory, a single cubic foot of sea water contains enough deuterium to produce as much energy as 10 tons of coal.

AbuTaha, who has worked for the Department of Defense and a series of high-tech and space technology companies, said he believes the Utah scientists triggered the reaction of heat for more than 100 hours as the rod of palladium began cracking and releasing energy.

During a demonstration for faculty members, AbuTaha used a mechanical vice with more than 30,000 pounds per square inch to

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THEORY

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pull apart a rod of steel. The steel became warm as it fractured.

In a water-filled test tube, he explained, metallic palladium will soak up atoms of deuterium. The Utah scientists hoped the palladium rod would confine the atoms long enough to fuse them together as the scientists ran an electrical current through the water.

But once the atoms are absorbed, they begin forming cracks and stress the metal. At a certain point, AbuTaha explained, the atoms trigger a splitting action similar to a zipper. As the metal slowly unzips, heat is released.

The theory may explain why many scientists, who have tried to duplicate the Utah experiment, have detected heat but not neutrons and other byproducts of fusion, he said.

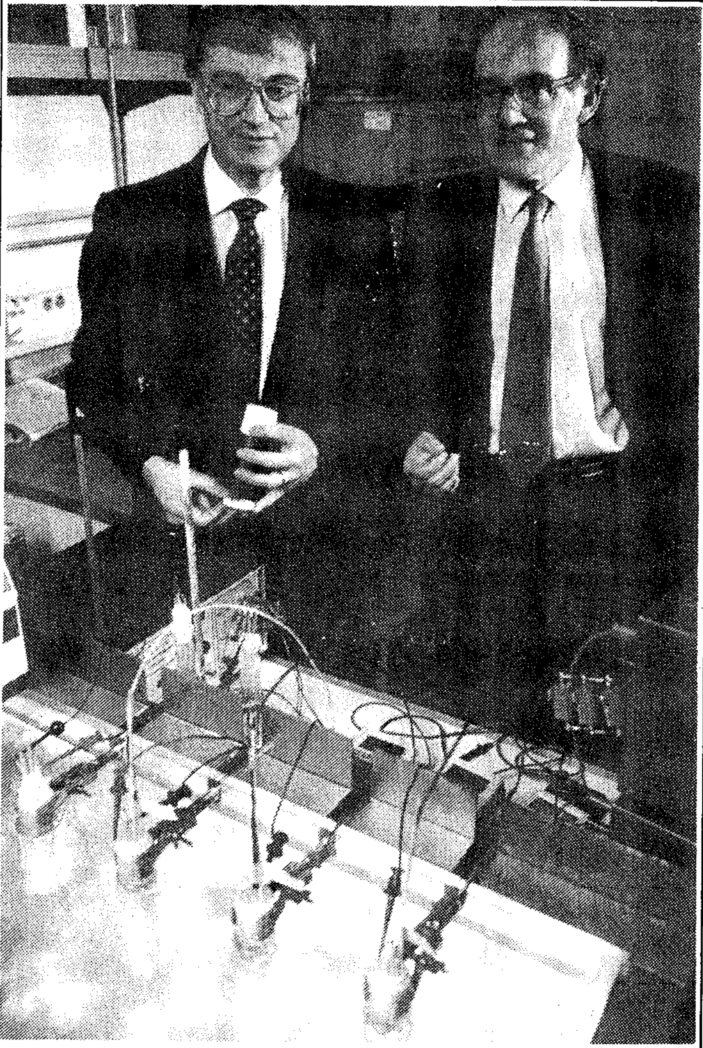
"It's so simple, it's ludicrous," AbuTaha said. "Basically it's corrosion. . . . Hopefully we won't have to spend billions of dollars to learn that we're cracking metal."

AbuTaha said he hopes his findings will lure state and federal money to FIT's space research institute to study the chain reaction of energy. The applications could help explain why some metal airplane bodies rip apart unexpectedly.

Molecules of hydrogen and deuterium build up in all metals and at a certain point begin cracking them open like a zipper, AbuTaha said.

"It's so logical," commented FIT oceanography Professor Geoffrey Swain, who teaches a class on corrosion. "It's too simple."

باحث اردني يتوصل الى تفسير لغز حرارة الاندماج النووي البارد



في اذار الماضي اعلن الكيميائيان بونز وفليشمان عن توصلهما الى تحقيق اندماج نووي بارد في ظروف حرارة الغرفة وبادوات بسيطة وتكاليف زهيدة، مما يعني الحصول على طاقة هائلة نظيفة غير ملوثة للبيئة ورخيصة... اي ان مشكلة الطاقة في العالم تكون في حالة صحة يقولانه قد حلت.،

وقد اثار اعلانهما هذا هوسا في المختبرات العلمية وفي مختلف الاوساط ذات العلاقة في العالم، واخذ الاف العلماء يعيدون تجربة هذين العالمين اللذين اجرياها في جامعة يوتا الاميركية، للتأكد من صحتها.

وفي حين تلقت هذه التجربة دعما من بعض المختبرات، الا ان العديد من المختبرات الاخرى شكت في صحتها، اذ على الرغم من قياس كمية من الحرارة نتجت عن التجربة، فان العلماء لم يتوصلوا الى قياس اية كمية هامة من النيوترونات او المنتجات الثانوية المفترضة في حالة حدوث تفاعل اندماجي حقيقي.

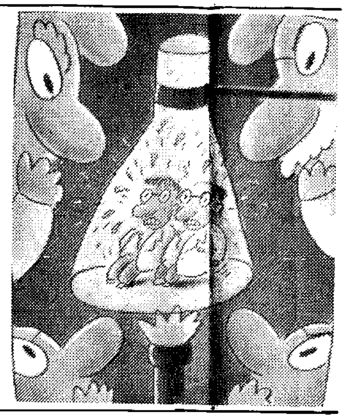
وعلى مر الاسابيع الماضية، ظهرت فرضيات عدة تحاول تفسير ما حدث، على الرغم من التأكيد المستمر لبونز وفليشمان بانهما حققا تفاعلا اندماجيا فعليا، وقد كنا نشرنا لعدة مرات في هذه الصفحة عن التطورات المتلاحقة بهذا الشأن.

مؤخرا نشرت الصحف العالمية خبرا عن توصل باحث اردني الى تفسير سبب الحرارة المنطلقة من تجربة يوتا، الامر الذي قد يساهم في القضاء نهائيا على ادعاء بونز وفليشمان.

فقد اعلن د. علي ابو طه الذي يعمل مستشارا لدى معهد فلوريدا للتقنية في ملبورن /فلوريدا/ الولايات المتحدة، ان الحرارة التي تم تسجيلها في تجربة يوتا، ليست نتيجة تفاعل اندماجي، وانما نتيجة التأثيرات الهشة للهيدروجين على المعادن. وهي ظاهرة درست على مدى عشرات السنوات من قبل علماء الطيران والفضاء.

يقول د. ابو طه الذي عمل مستشارا في وزارة الدفاع الاميركية وفي عدة شركات مختصة بالتقانة الرفيعة وتقنيات الفضاء.

"ولو كان ما حققه بونز وفليشمان اندماجا حقيقيا، لتسببت النيوترونات



المنطلقة من التجربة في موتهما".

والواقع ان ابو طه، والعديد من الباحثين في مختبرات العالم، ومنها معهد ماساشوستس للتقنية ومعهد جورجيا للتقنية قد حسموا مسألة التفاعل النووي البارد وذلك باعادتهم للتجربة واكتشافهم عدم وجود نيوترونات بالكمية المفترض انطلاقها في حالة تفاعل اندماجي فعلي. لكن احدا لم يستطع تفسير سبب الحرارة المنطلقة من التجربة. الا ان ابو طه يقول ان الحرارة المنطلقة تنسجم فعلا مع تلك المنطلقة من تصدع البالاديوم. وهو يعتقد ان تجربة يوتا استمرت لاكثر من مئة ساعة بحيث ان قضبت البالاديوم بدأ بالتصدع واطلاق حرارة. وقد ربط ابو طه بين ما يحدث للمعدن في هذه الحالة وما يحدث له نتيجة تأثير ضغط خارجي عليه، حيث قام بتجربة اثبت فيها حدوث حرارة عند تصدع معدن لدى التأثير عليه بضغط وصل الى اكثر من ٣٠ الف باوند على البوصة المربعة.

وفي توضيحه لما حدث في تجربة يوتا، يقول ابو طه، ان معدن البالاديوم عند وضعه في قارورة الاختبار المليئة بالماء يقوم بامتصاص ايونات الديتيريوم (الهيدروجين الثقيل)، وقد كان امل باحثي يوتا ان يتم اندماج هذه الايونات معا اذا تم احتجازها لوقت كاف في البالاديوم، مع استمرار تمرير تيار كهربائي في الماء. لكن، اذا جرى امتصاص للايونات، فان تراكمها داخل المعدن حتى حد معين يجهده ويسبب تصدعا فيه، ويؤدي بالتالي الى انطلاق تدريجي بالحرارة منه.

ويوضح ابو طه بقول: ان هذا قد يفسر فشل الباحثين الذين قاموا بتكرار التجربة في الحصول على نيوترونات والنواتج الثانوية الاخرى للتفاعل الاندماجي الفعلي، رغم انهم تمكنوا من قياس حرارة.

ثم يقول معلقا: انها المسألة بسيطة جدا، والامل ان لا نقوم بانفاق بلايين الدولارات لنعرف اننا نحطم معدننا.

د. جيوفري سوين الباحث في معهد فلوريدا للتقنية يؤكد ما توصل اليه ابو طه، ويقوله ان التفسير منطقي جدا... وبسيط جدا ايضا.

إجمالي الأيام في السنة الدراسة

ألمانيا الغربية

ACCESS TO ENERGY

A Pro-Science, Pro-Technology, Pro-Free Enterprise Monthly Newsletter

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COLD FUSION EXPLAINED

I believe the cold fusion story is at last nearing its end with an explanation provided by materials engineer Ali AbuTaha in two papers to be published in MIT's *Journal of Fusion Technology*, of which he kindly made preprints available to me.

To explain AbuTaha's explanation, let me start off with a high-school puzzle: what happens to the energy stored in a compressed spring when you dissolve it in acid?

When the spring is *not* compressed, a chemical reaction takes place between the metal and the acid, in which the heat of reaction is liberated. This heat of reaction is precisely known for each chemical reaction. (It is liberated, or positive in this "exothermic" case; in the "endothermic" case it has to be supplied to make the reaction take place.) On a molecular level this means that as the molecules rearrange themselves into new patterns or new chemicals, they are more agitated or more intensely vibrating than before, for heat is nothing but kinetic energy of the vibrating molecules. And "molecules rearranging themselves" means that they form new electron bonds between their atoms. The resulting energy of these electrons (radius of their orbits) is smaller than in the original molecules; that is why the heat, or difference in energy, is given off rather than being absorbed.

Now when the spring was compressed, its molecules were under stress; the bonds between its own atoms and molecules were at a higher energy level than normal. As the spring dissolved in the acid, this stress disappeared when the molecules entered the chemical reaction. But the energy associated with it cannot disappear; it is added to the energy of the chemical reaction. What happens is that the atoms of the stressed metal are "thrown out" of the molecule at a slightly higher velocity than by the chemical reaction alone, and the resulting molecules and atoms vibrate slightly more intensely.

If you have been intimidated by all this talk about molecules and chemical reactions, the gist is this: the resulting solution is very slightly warmer when the spring dissolved in the acid was compressed. The additional heat is equal to the energy expended in compressing the spring. And the additional heat is neither of chemical nor of nuclear origin.

Petr Beckmann

was born in Prague, Czechoslovakia, in 1924. He received his M.Sc. and Ph.D in Electrical Engineering from Prague Technical University in 1942 and 1955, and a Dr.Sc. degree from the Czechoslovak Academy of Sciences in 1962. In 1963 he was invited by the University of Colorado as a Visiting Professor, defected to the US, became a US citizen, and taught at the University of Colorado until his retirement in 1981.

He has published more than 60 scientific papers, mostly devoted to electromagnetics and probability theory. His scientific books include *The Scattering of Electromagnetic Waves From Rough Surfaces* (with A. Spizzichino, 1963, reprinted 1987), *The Depolarization of Electromagnetic Waves* (1968), and *The Structure of Language* (1973); his textbooks include *Probability in Communication Engineering* (1967), *Elementary Queuing Theory and Telephone Traffic* (1967), and *Orthogonal Polynomials for Engineers and Physicists.* His best selling popular books are *A History of π (Pi)* (1970, 5th ed. 1981) and *The Health Hazards of NOT Going Nuclear* (1976, 10th printing 1985).

He is editor and publisher of the "pro-science, pro-technology, pro-free enterpise" monthly newsletter *Access to Energy*, now in its 15th year with some 7,000 readers.

The Washington Times | WEDNESDAY, JANUARY 30, 1991 / PAGE G3

WARREN BROOKES

Fadeout for cold fusion

As 1991 unfolds, one of the brightest hopes for new energy resources seems to be fading into obscurity. In March 1989, Americans first learned of the possibility of fusion power being produced in a process conducted at room temperatures, instead of the solar-level temperatures heretofore assumed to be essential.

But within months, the claims of University of Utah scientist Stanley Pons and his colleague from England Martin Fleischmann were being debunked by scientists around the world. Nevertheless, a few hardy types continued to try and replicate their experiments that seemed to produce excess heat and neutrons simply by passing electrical current through palladium coils immersed in "heavy water" (deuterium) at room temperatures.

In the Nov. 9 issue of Science, one of its best journalists, Robert Pool, wrote that "Like the Cheshire Cat, cold fusion has slowly faded away," and that only "one part of the cold fusion cat has remained — call it 'the grin.' "

That "grin" is the unexplained evidence of excess neutrons, although they remain at a very low level, and their appearance is fitful and largely unpredictable, and thus undependable.

Nevertheless, Mr. Pool reports, a number of researchers both here and in Japan who met last Oct. 22-24 at Brigham Young University in Provo, Utah, at the first "annual" Cold Fusion Conference, were unwilling to give up. They plan to meet again in Italy next year under a grant from the Electric Power Research Institute. "Perhaps by then the cold fusion cat will have vanished, or perhaps the grin will have gotten wider."

But the last laugh in this fascinating science soap opera may belong to an obscure materials scientist named Ali AbuTaha. In two papers to be published in the Massachusetts Institute of Technology's Journal of Fusion Technology, Mr. AbuTaha explains how everyone from Mr. Pons and Mr. Fleischmann to their initial supporters (including us) to world-class nuclear physicist critics ignored an apparently rational explanation of what really happened.

As explained by Petr Beckmann in a recent issue of Access To Energy, what happened in the Pons/Fleischmann experiment is that "the energy put into the palladium by the manufacturer when he melted it was partly stored in it as stress energy when it cooled; it was then released as the deuterium entered the palladium cracks, and liberated as the heat of fracture."

Mr. Beckmann takes the reader through a simple explanation of what Mr. AbuTaha's experiments seem to demonstrate, by asking you to consider "what happens to the energy stored in a compressed spring when you dissolve it in acid."

What happens is that the energy stored in the spring compression process is released as excess heat, over and above that which is expected from the chemical reaction alone, "and the additional heat is neither of a chemical nor of a nuclear origin."

Almost the same excess energy process comes when you crack or break metals that have been formed under stress, particularly those that have been formed at very high temperatures and cast by quick cooling. Casting makes metals brittle, because the outer layers solidify first, forcing the metal inside the casting to "solidify in restricted, stressed structures."

Mr. AbuTaha demonstrates through a series of tests that when such metals are subjected to stress, and drawn to the breaking point, stress energy stored in the metal is released, and heat is released at the cracking or "embrittlement" point. He calls this "the heat of fracture." While all metals have this "embrittlement" character, palladium, used in the cold fusion experiments "is apparently particularly prone to it because of its surface and crystalline structure," and deuterium is unusually capable of "embrittling" palladium.

The result, Mr. AbuTaha suggests, is that when Mr. Pons and Mr. Fleischmann subjected the palladium coils to a combination of heat and deuterium, they began to crack, and that cracking released the heat energy stored in the metal to begin with. As Mr. Beckmann summarizes Mr. AbuTaha's work: "This explains why cast palladium worked [in the fusion experiments] and drawn palladium [formed with less-compressed stress] did not. It explains why several laboratories replicated the result and most did not. It explains why the cells would work in sudden, sometimes explosive, bursts, and lie dormant between them until eventually they were completely exhausted. Yet they started working again when the palladium was molten and recast."

In other words, the only energy produced in the so-called "cold fusion" experiments may have come from the cracking of cast metal — energy that was stored in that metal during manufacture.

The irony is that this well-understood physical engineering principle apparently escaped both Mr. Pons and Mr. Fleischmann, as well as their persecutors, the grandees of science. Why? Mr. Beckman says it is because "it came from a materials scientist . . . the lowest of the low. He can't possibly be right!"

If he is, even the grin of cold fusion may disappear, too.

Warren T. Brookes is a nationally syndicated economics columnist.