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Talk of the Nation Science Friday
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Ira Flatow: Welcome back to Talk of the Nation's Science Friday. I am Ira Flatow. Just a little bit over ten years ago, two professors, Stanley Pons and Martin Fleischmann, announced at a press conference in Utah that they had seen something they called cold fusion - nuclear fusion in a jar of heavy water on a table top, not in some huge hot-as-the-sun nuclear reactor. And their announcement got a lot of attention right off the bat, but it soon faded into the background as others tried to reproduce the results, without much success.

But, the idea of cold fusion hasn't gone away. Over the past ten years, hundreds of researchers around the world have been doing and continue to do cold fusion experiments - even the U.S. government, its Naval Laboratory, said last year, "Further investigations of these and related questions seem desirable," though it reportedly has no research programs currently running on cold fusion. There are other true believers, though, that do. Cold fusion research is alive and well in small, independent laboratories and sometimes scientists see interesting, unexplainable results - unexplainable even to themselves. For example, two weeks ago, one of those scientists who formally, in an informal presentation, made that presentation - the results of his cold fusion research - at the American Physical Society meeting. The results have not been peer-reviewed, a normal step in scientific publication, and because it's so hard to get mainstream scientists to take cold fusion research seriously. In fact, when I tried to find someone who could comment on this paper, I couldn't find anyone in what so-called "mainstream" science who would look at the research and would comment on it. They just are afraid to even talk about it.

We have to think of this as a work in progress at this point and maybe if you are a scientist listening to Science Friday and you would be willing to review it for us, take a look at it, because as we know in science, the facts are what's important - what's coming out, the data, where is the data. So, maybe you will be able to look at this research yourselves and talk to us.

And joining us now to talk about it is the author of that paper, Russ George, who is a chief scientist for Saturna Technologies in Palo Alto, California, who presented the paper there and also Michael Schaffer, who is a senior scientist at General Atomics in San Diego, California, a hot fusion research organization, who was intrigued by it. Welcome to the program, gentleman. Thank you for coming.

Russ George, ever since Pons and Fleischmann, people have been very dismissive of cold fusion research. Why? I mean, it's not working, they say.

Russ George: Well, of course, the first response was that it was one of the greatest discoveries of mankind, but very shortly thereafter the standard physics community, or part of it, began to expound their particular spin on why it wasn't possible.

Ira Flatow: They basically say that no one has been able to get it to work.

Russ George: That has been a persistent claim; however, it's been reproduced countless times and now there are several methodologies - several that I have been involved with directly, three that I've been very intimately involved with - that are highly reproducible and produce both the anomalous heat that is the useful product of cold fusion and even more importantly, we now have the nuclear product signature very well identified.

Ira Flatow: Tell me about the paper you presented in the informal presentation.

Russ George: Well, what happened at the centennial meeting of the American Physical Society two weeks ago in Atlanta is that there was a session on this topic and, while I had not been invited... I hadn't proposed to present my paper there because it's still in a preliminary form. The head of, the chairman of that session, Dr. Chubb from the Naval Research Laboratory, prevailed upon me to present at least the data from it, which show... which is an experiment that I ran at Stanford Research International with their cooperation last year. We saw... We ran an experiment that in a sealed steel vessel with a hydrogen control experiment and a heavy hydrogen active experiment, we watched helium grow into the experiment in a very dramatic fashion over a period of a month.

Ira Flatow: You put heavy hydrogen in in the presence of palladium? Was it the same kind of palladium that Pons and Fleischmann used?

Russ George: What we used was a different kind. We used palladium certainly, and we used heavy hydrogen - heavy hydrogen gas, deuterium gas - as opposed to heavy water. And we simply... The palladium is in the form of tiny nano-particles. These are particles of palladium that are in the neighborhood of 50 nanometers in diameter and that's a tiny size. There's only a million atoms or so per particle. Those particles are on a material that's known as a hydrogenation catalyst, which is commonly used in industry for the manufacture of hydrogenated vegetable oil, like margarine.

Ira Flatow: So, it's easy to get this material?

Russ George: Very easy to get. Typically margarine manufacturers use this in 100 ton quantities and we used it in tens of grams. So, we put this material that bore the palladium particles, which being very small have huge surface area, in stainless steel tubes that were 50 cc capacity. We had two matched experiments, one that started out with H_2, ordinary hydrogen, and one with deuterium. And, lo and behold... We heated them up nearly to 200 degrees Celsius and fairly promptly in the experiment the heavy hydrogen bearing vessel began to produce helium. Now, we were hooked up to this experiment, rigidly fixed with all steel fittings, to a state-of-the-art mass spectrometer that belongs to the Electric Power Research Institute, which is of the instrument located at SRI. So, we were able to monitor over ... in essentially a real-time basis by every day or so, taking a small sample of the gas from the reaction vessel and looking at it in the mass spec and watching helium grow. Of course, we have terrific controls and calibration that we were running simultaneously. For instance, we would always take a sample of the laboratory air and look at that and we know that air has 5.22 parts per million helium. Our hope was that we would exceed that atmospheric concentration of helium in the experiment and, in fact, we more than doubled that. So, we were certain that we were not dealing with a contamination source. The only conclusion is that we were manufacturing helium in these vessels and at an astonishing rate.

Ira Flatow: And you don't know why it's happening?

Russ George: Well, of course, we live in a world of cold fusion, some of us, and get branded with the name true believers and pathological scientists, but cold fusion is as good a name as any.

Ira Flatow: But why would you get success when everybody else is having such failure with it?

Russ George: Well, in fact, this was the replication of an experiment that had been run by a scientist on the east coast in association with Oak Ridge National Laboratory. And he had done a much cruder version of this experiment, where he was looking for heat in this kind of material. He shipped the entire reaction vessel down to Oak Ridge after his experiment and Oak Ridge sniffed the gas inside and said, "Wow, there's a lot of helium in there." It wasn't very quantitatively secure, so I said, "This is deserving of looking at in as refined a manner as we can possibly do it" and fortunately SRI, EPRI, and myself were able to collaborate and put this experiment together.

Ira Flatow: Michael Schaffer. Now, you do hot fusion research, right?

Michael Schaffer: That's right. I consider myself a mainstream scientist really, but I try to keep an open mind about cold fusion as well.

Ira Flatow: And, so, you saw the presentation made at the Physical Society meeting. Were you impressed? Does he do good science?

Michael Schaffer: I was at the meeting. I was at the session where he presented it. I was impressed with the experiment and I have also sent... I talked with him afterward and I've read his pre-print on his web page and it looks to me like he has done a good experiment. He has done a lot of the right things to avoid common errors and I think this looks very promising and other people should reproduce it as soon as possible. In science - in physical science especially - a good experiment is what rules. And if you can do good experiments and get past this thing about "we can't reproduce it, nobody else can find it" problem... It's late in the field for about ten years. I think this will be a real breakthrough.

Ira Flatow: Russ George, how... Have people been able to... Is it easy to reproduce your experiment?

Russ George: Well, we're just learning about this particular technique with these catalyst materials. However, that experiment that I've reported on is, in fact, a reproduction of the original experiment of that nature and it has been... There are several additional experiments that we have under way. They are not complete yet, so I really can't report on the data. As you do a new science, you learn as you go. We have been successful in some experiments and we have failed in other experiments. And we're trying to sort out why they work sometimes and not others. I think we're getting very close to the answer to how to prescribe the perfect experiment that will reproduce every time.

Ira Flatow: What about... Don't physicists say that you should also be getting radiation coming off if you are doing real nuclear reactions?

Russ George: Oh yeah. That's the biggest problem of cold fusion. People have said... Conventional nuclear scientists always relied on the ease at which one can observe energetic penetrating radiation. So, that's what people think of as radiation. However, helium is born in these fusion experiments as what's known as alpha radiation. And, in fact, we have... Fortunately, alpha radiation is the weakest form of radiation and is stopped almost immediately when it comes in contact with any kind of number of matter. So, an alpha radiation particle is stopped by passing through a material that's only a few atoms thick and when it's stopped it becomes helium. So, when we measure the helium, we're in fact measuring what was born as alpha radiation. And the intensity of the radiation in our experiment - the alpha radiation - is incredibly intense, but fortunately we are not seeing the high energy neutrons or high energy gamma radiation that ... At the rate of alpha radiation that we've observed, we'd be instantaneously killed by the expected gammas.

Ira Flatow: We're talking about the tenth anniversary of cold fusion this hour on Talk of the Nation Science Friday on National Public Radio. Yeah, go ahead, you were going to say something, Michael?

Michael Schaffer: Right. I think Russ sort of glossed over the radiation problem a little bit, because the reaction that most people who try to form a theory of cold fusion... The reaction they postulate as taking place should emit a very powerful gamma ray, which penetrates out through many inches of lead and would be very easy to measure outside of that. That's missing, so that to me says that that reaction that they, or at least many people not all, think would be occurring is not occurring. But if they are producing some nuclear effect as the detection of helium, by Russ George and a few others, suggests that this has to be a real effect. So, if it can be shown that they really are doing that, and as I say, their experiment works good, looks valid to me, then we need to get the word out and pique an interest in a few scientists. Pretty soon all kinds of people will be piling onto this, as long as it is something that's reproducible...

Ira Flatow: I'd love to have people reproduce it and come back and talk to us about it. As I say, I could not get a "mainstream" scientist besides yourself to even look at the results which are on our web page at ScienceFriday.com You can go look at it yourself and look at his measurements and comment on it... Because people walk around cold fusion, as one MIT scientist said, "Like you're carrying a giant refrigerator." So, tip-toeing around it. Russ George, I want to thank you very much for coming on and talking about this and maybe also we'll be able to see somebody else who might be able to reproduce your experiment and come and talk to us about it.

Russ George: Oh, sure, and I welcome anyone contacting me who wants to reproduce this. We're certainly willing to help them out.

Ira Flatow: Russ George is chief scientist for Saturna Technologies in Palo Alto, California. And Michael Schaffer, thank you for coming on and joining us this hour and maybe we'll be talking with you in the future.

Michael Schaffer: Thank you.

Ira Flatow: He's senior staff scientist at General Atomics in San Diego, California, where he does hot fusion research.

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