Will New Evidence Support Cold Fusion?

Nearly 7 months after "cold fusion" was announced, some controlled studies of the phenomenon are nearing completion

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AS A HARD-HEADED PHYSICIST, Kevin Wolf is skeptical about cold fusion. He doesn't want to believe that the tritium he is finding in a number of electrochemical cells is really coming from some unknown nuclear process. "I'm doing everything I can think of to prove that it doesn't," he says. But, the Texas A&M University researcher adds, "We just keep getting more and more evidence all the time [that it does]."

Wolf is one of several dozen scientists investigating cold fusion who will meet next week in Washington, D.C., to present their most recent results and debate what it all means. The meeting will be held under the auspices of the National Science Foundation and the Electric Power Research Institute.* The wild claims about commercial fusion power are gone, and "cold fusion" is not even mentioned in the official title of the workshop, but evidence from a number of laboratories hints that some unknown type of nuclear process may indeed be going on inside electrochemical cells.

In addition to several teams at Texas A&M and two groups at the University of Utah, where the original cold fusion work was done, groups at Stanford University, the University of Florida, Los Alamos National Laboratory, Brigham Young University, Case Western Reserve University, and the Bhabha Atomic Research Centre in India have all reported various hints of confirmation. Much of this work, however, has been tainted by what observers felt were insufficient controls and a failure to rule out other possible explanations for the data. More careful tests should be offered at next week's workshop by several groups, researchers say.

Wolf's team is one of these. Wolf, who works at the Texas A&M Cyclotron Institute, has been testing for nuclear by-products from electrochemical cells similar to those in which Stanley Pons and Martin Fleischmann claim they have produced room-temperature fusion. The cells consist of two electrodes—a palladium wire surrounded by a cylindrical nickel mesh—in a test tube of heavy water to which lithium deuteride has been added as an electrolyte. When a current is applied across the electrodes, deuterium atoms from the heavy water are absorbed into the palladium. Pons and Fleischmann claim that, under the right conditions, pairs of deuterium atoms will fuse in the palladium, releasing energy in the form of heat.

Pons and Fleischmann based their original claim on having measured excess heat coming from the cells, but these heat measurements are tricky and susceptible to error. Many scientists have therefore preferred to believe that Pons and Fleischmann made mistakes in their heat measurements rather than accept that they discovered the existence of a seemingly impossible fusion process. So several researchers have concentrated on finding the other footprint of fusion: nuclear by-products. When a pair of deuterium ions fuses, it forms either a proton and a tritium ion or a neutron and a helium-3 ion. Pons and Fleischmann originally claimed to have detected neutrons, tritium, and helium from their fusion cells, but their data did not stand up under close inspection.

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Wolf, among others, is looking to get good, statistically valid data on what nuclear products may be produced in the fusion cells. "That's what is lacking in this whole business—statistics," he says. Because the Pons/Fleischmann effect, if it exists, is so hard to reproduce, researchers have generally spent most of their time and money just trying to get cells that work. They generally have not set up control cells, which would eat up half the researcher's supply of scarce palladium.

But Wolf's group and a second team at Texas A&M led by John Bockris have found that they can reliably get tritium from almost every cell they set up. Their first concern was that they were inadvertently using palladium that had been contaminated with tritium and that somehow the electrolysis was releasing the tritium, making it appear as if the tritium were produced by a fusion process. Both groups have tried to remove every possible source of contamination, including possible sabotage by an overzealous team member or some outside trickster. Now the essential test is to do the experiment with a proper blank control—cells with regular water in place of heavy water so that no deuterium-deuterim fusion is possible. Wolf is running an experiment with six fusion cells and six control cells with regular water.

As *Science* went to press, one of the six cells with heavy water had produced a large amount of tritium, but Wolf had not finished taking data on the control cells. "It doesn't prove anything until we run all the light-water blanks," he said. If several of the fusion cells do indeed show tritium and none of the blank cells do, that would be strong evidence for a nuclear process taking place in the cells.

One puzzling aspect of the tritium production is that the tritium produced inside the palladium electrode (if indeed it is produced there) apparently does not fuse with the deuterium atoms in the palladium. Nuclear physicists know that energetic tritium ions—such as are produced in deuterium-deuterium fusion—have a large probability of fusing with any deuterium atoms in the neighborhood, and each such fusion will produce a neutron that is easy to detect. Working from well-known tritium-deuterium reaction rates, Wolf calculates that the cells should produce 1,000 to 10,000 times as many neutrons as he actually observes. Thus, he says, "If tritium is being produced, it certainly is not from conventional deuterium-deuterium fusion. Either it's tritium contamination or it's some unknown nuclear reaction."

Wolf says his controlled series of experiments should be finished by the time of the Washington, D.C., workshop, and there may be other interesting reports as well. Steve Jones of Brigham Young, who reported neutron production from cold fusion cells, and Moshe Gai of Yale, who was one of the severest critics of cold fusion, have collaborated on a repetition of Jones' experiments, and their data could be discussed at the meeting. It is an open secret in the community that Jones is saying he convinced Gai of his results, while other reports have Gai saying that he is still a doubter.

■ ROBERT POOL

*NSF/EPRI Workshop on Anomalous Effects in Deuterated Metals, 16 to 18 October, Washington, DC.