FUSION ANTECEDENTS

1920s discovery, retraction

Munich

WHILE researchers around the world spend sleepless nights in the laboratory trying to reproduce evidence of cold fusion, reports from the United States of a 1926 'mystery paper' on cold fusion in the German-language literature have sent more reflective physicists scurrying to their libraries.

Paul Allison and Klaus Lockner, of Los Alamos National Laboratory, began the chase by sending out an informal translation of a paper from the respected German researchers Fritz Paneth and Kurt Peters, in the 1920s at the Chemical Institute of the University of Berlin, reporting the creation of helium from hydrogen using a palladium catalyst. But the results were retracted eight months later, after new sources of error were identified.

The episode exhibits striking parallels to the current furore over cold fusion. The theory of the day could not explain the results of Paneth and Peters, but there was good reason at least to attempt the transmutation of hydrogen into helium. And the news caused great excitement, as indicated by the response in *Nature* (see excerpts reprinted on page 706).

Little was understood of thermonculear fusion in 1926, although Paneth and Peters do mention in their introduction to their paper the hypothesis that helium is produced from hydrogen in stars. But neutrons were discovered only in 1932, and physicist Hans Bethe demonstrated in 1933 that fusion was the likely source of stellar energy.

Paneth and Peters published their results first in the journal *Berichte der Deutschen Chemischen Gesellschaft* (**59**, 2039; 1926). The results were then reprinted in *Die Naturwissenschaften* (**14**, 956; 1926). This paper and its 1927 retraction (*Berichte der Deutschen Chemischen Gesellschaft* **60**, 808; 1927), reprinted in *Die Naturwissenschaften* (**16**, 379; 1927) are models of clarity. A letter of retraction was also sent to *Nature* (**119**, 706; 1927).

The technique for the spectroscopic detection of amounts of helium as small as 10^{-8} cubic centimetres was by far the most difficult part of the experiment, and had taken 'several years' to develop. The first stage, in which helium was 'created' from hydrogen, was more a shot in the dark, although palladium was recognized as a catalyst.

At first, Paneth and Peters passed about 1 litre of hydrogen gas through a red-hot palladium capillary to "create" helium "spontaneously". But when they noticed that spectral lines of helium could be seen even when the capillary was at room temperature, they simplified their apparatus. They exposed hydrogen to a number of palladium preparations — a 'black', a sponge or palladinized asbestos — for various periods of time. After twelve hours, enough helium was formed to show four or five spectral lines.

Paneth and Peters tried hard to account for possible errors in their method. For example, helium might have been trapped inside the palladium. They convinced themselves that this could not be so by repeatedly exposing their palladinized asbestos catalyst to hydrogen and oxygen. Only in the presence of hydrogen was helium released. Therefore, they concluded, the helium must have derived from hydrogen and not from an experimental artefact.

Unlike Pons and Fleischmann, Paneth and Peters did not observe the release of large amounts of heat from their apparatus. They write that they would have expected only a fraction of a calorie of heat to be produced by the creation of 10^{-8} cubic centimetres of helium. Paneth and Peters conclude that the energy must be released in the form of radiation, but add that they had not detected it.

In April 1927, came the retraction. Paneth *et al.* had tested their results at Cornell University and in Berlin and drew the conclusion that they had "underestimated" two sources of error.

The first clue emerged during experiments designed to check whether helium could have diffused from the atmosphere through the glass walls of the apparatus. While performing numerous control studies, Paneth *et al.* found that glass heated in a hydrogen atmosphere yielded up absorbed helium, in amounts of about 10^{-9} cubic centimetres, whereas glass heated in a vacuum yielded none. Helium detections at this level, they concluded, were to be discounted.

The second blow was the realization that the palladinized asbestos catalyst that had given the best results was, like glass, a considerable source of helium, which it released readily in the presence of hydrogen, but not in that of oxygen. In an almost self-mocking tone, Paneth *et al.* write that they must strike from their results all the trials with a palladinized asbestos catalyst, in which helium was 'created' in amounts up to 10^{-7} cubic centimetres, and upon which they had earlier placed "particular value".

The story also has an addendum which parallels modern activities.In February 1927, John Tandberg of the Electrolux Research Laboratory filed for a Swedish patent on a device which produced "helium and useful energy". This invention was an electrolytic cell, using ordinary water, based on the work of Paneth and Peters but with a "significant increase in efficiency". The patent was never granted.

Steven Dickman

NUCLEAR EXPORTS

Complicity alleged against physicist

Munich

A Max-Planck Society physicist has been implicated in illegal exports to Pakistan of sensitive nuclear technology. Testimony given before a parliamentary committee in Bonn on 20 April revealed that the physicist, a prolific inventor who received a number of patents for himself and his employer, the Max-Planck Institute for Plasma Physics (IPP) in Garching, may be prosecuted for his involvement in the exports. He was dismissed from his post on 17 April when the institute's directors learned the extent of his involvement.

It had been known since December that Pakistan, South Africa and India had received nuclear technology from the West German companies NTG (Neue Technologien GmbH) and PTB (Physikalisch-Technische Beratung) without the necessary export licences having been issued by the West German government.

The physicist was also mentioned in the news as a consultant for NTG. But IPP defended him at the time, saying that his consulting work did not go beyond installing a tritium-removal apparatus using the so-called TROC process (Tritium Removal with Organic Compounds). TROC is used to remove tritium from glove boxes and other work areas. It cannot be used for the production or holding of the large amounts of tritium that can intensify the effect of a nuclear bomb. The physicist had developed TROC and IPP holds the patent on it.

But last week it emerged that the physicist also helped NTG install a "tritium handling system" for holding large amounts of tritium free from contamination. The use of this system for bomb production cannot be ruled out, though by itself it cannot produce tritium. The physicist did not inform IPP of his activities nor did he say that he had formed his own consulting firm.

The technology exported to South Africa and India could have been used only for peaceful purposes, said Hanau prosecutor Albert Farwick, who is handling the case against NTG, which is located in Geln-hausen, in the *Land* of Hesse. Pakistan denies that it broke West German export law.

The decision whether to prosecute the physicist will be reached by the autumn, said Farwick, who said that the physicist was "in no way the head" of the export operation. The case has generated some sympathy for the physicist, who is looked upon by some of his IPP colleagues as a "tragic case".

The physicist, who is estimated to have earned about DM50,000 for his work for NTG, is appealing against his dismissal by IPP. His case is expected to be heard in two weeks.

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