An Assessment of Claims of Excess Heat in Cold Fusion Calorimetry

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Miles' response[1] fails to adequately address either of the major conclusions of our paper[2] criticizing his work.

1. The "anomalous" radiation and helium-4 observed by Miles are artifacts. Miles' response addresses some of our concerns regarding his radiation detectors. He admits that "this is one area where the criticism by S. E. Jones et al. may have some validity."[1] However, he maintains, "Nevertheless, anomalous radiation was detected by X-ray film exposure, by the use of several different GM detectors [Geiger counters], and by the use of NaI detectors."[1] He did not address our concerns regarding well-documented artifacts in X-ray film[3] such as he used in some experiments or our questions regarding discrepancies between instruments. For example, his Ludlum safety monitor showed no response when his GM detector allegedly showed a signal. We argued that this discrepancy between detectors "suggests that fluctuations in the Geiger counter led to a spurious signal."[2] Only the most reliable, state-of-the-art instruments could establish a new phenomenon such as cold fusion, and Miles et al. did not use such instruments.

Miles et al.[4] posit the following reaction as the source of the helium-4 observed.

$$D + D \rightarrow {}^4He + 23.8\ MeV \quad (lattice) \qquad (1)$$

That is, the 23.8 MeV of energy released in this D−D fusion reaction is supposed to be absorbed by the palladium metal lattice. But this claim is demonstrably wrong. Conservation of momentum and energy requires that most of the energy be carried by the lighter particle (^{4}He in this case) rather than by the lattice—as is indeed observed in the Mossbauer effect where the emitted particle carries essentially all of the released energy. Miles et al. attempt to turn the observed Mossbauer effect on its head, with the lattice somehow absorbing the lion's share of the energy (and momentum). Just as serious, the nuclear energy cannot be transferred to the lattice without violating constraints imposed by the uncertainty principle and the speed of light.[2] These fundamental arguments do not depend on information obtained from hot-plasma fusion studies. Why are these crucial points ignored by Miles?

2. Calorimetric errors can account for the "excess heat" claimed by Miles et al. The accuracy of Miles' heat measurements depends on the assumption that the temperature measured by a point sensor accurately represents the average temperature of the calorimeter wall. This can only be tested by checking the calorimeter calibration with a standard chemical reaction with a well-known heat effect. Electrolysis is not an acceptable standard reaction. It has now been over 2 years since our critique[2] of Miles' calorimetry appeared, but we have not seen any attempt by Miles to verify the accuracy (as opposed to precision) of his calorimeters. During that time we have done further work[5] that supports the conclusions in our critique of Miles' work. We have built and operated calorimeters similar to Miles' and shown that heat measurements made with such calorimeters are usually precise, but subject to large systematic errors if stirring is inadequate to validate the above assumption. This is particularly true for experiments involving high heat rates such as are obtained at the high currents used by Miles. Furthermore, Miles' response[1] discloses that "all cell components are repositioned in each experiment." It is not clear why this repositioning of "all cell components" is necessary or desirable. However, changes in the calibration constant with repositioning of temperature sensors and other parts in the calorimeter are an indication that Miles' calorimeters are indeed affected by systematic errors stemming from inadequate stirring.[5] Miles says nothing to convince us that such systematic errors are not the source of the apparent "excess heat" observed in his experiments.

Whether $E_h = -\Delta H/zF$ or $-\Delta H/F$ depends on whether the units on ΔH are given in moles or equivalents.

References and Notes

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