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The E-Cat loses steam

Posted by Ugo Bardi on July 27, 2011 - 5:14pm
Topic: Alternative energy
Tags: cold fusion, e-cat, focardi, rossi [list all tags]

The "Energy Catalyser" (E-Cat) is a device that has been reported by two Italian scientists to be able to solve the world's energy problems by means of a nuclear fusion reaction. Unfortunately, there are serious doubts about these claims. In the figure above (from a paper by Peter Ekstrom) you see one of the problems with the E-Cat: the trickle of the steam produced by the device in operation is way too small to indicate that it actually produces energy.

Andrea Rossi and Sergio Focardi have recently claimed the development of a device (the "energy catalyser" or "E-Cat") able to produce useful energy from low temperature nuclear fusion reactions. If it were to work as reported, the E-Cat would be a true revolution not only in science, but also in everyday life. We would have a simple device able to produce plenty of low-cost energy without generating significant pollution and we could say good-bye to the energy crisis and to global warming as well. In a previous post of mine on "The Oil Drum," I examined the E-Cat, leaving open the possibility that it was a real fusion device. Here, I re-examine the question on the basis of new data. It looks now very unlikely that the E-Cat can work as claimed.

The E-Cat idea is rooted in the early work by Martin Fleischmann and Stanley Pons who, in 1986, had claimed to have succeeded in fusing deuterium nuclei together ("cold fusion") and in obtaining an abundant source of cheap energy. However, the claims of Fleischmann and Pons were based on flawed experimental measurements and it turned out that there was no such thing as cold fusion in their setup. That didn't deter other scientists from looking for similar phenomena; a search that continues to this date. Rossi and Focardi have reported that they have been able to fuse nickel nuclei with hydrogen ones at low temperatures, generating copper nuclei and useful energy in the process. Accdording to their claims, the reaction must be started by providing some energy to the reaction cell, but the excess heat produced may be 30 times larger or even more.

The initial reactions to the claims by Rossi and Focardi were of cautious interest (for instance by myself and by Kjell Aleklett) or even of straight endorsement (e.g. by Hanno Essen and Sven Kullander). However, these initial reactions were based mainly on the statements by the inventors of the E-Cat. In science, there is a shared belief that when a colleague tells you of something he/she has done, you don't assume right away that the measurement is wrong, a hoax, or a scam designed to make money. However, when the measurement is important, when it is crucial for the development of a new theory or disproving an old one, then it must be shown in detail that it was correctly performed and that it can be independently repeated. Of course, inventors don't have to show how exactly how their invention works, but it is in their best interest to show that it works.

So, let's examine the situation of the E-Cat as it stands at present. No direct evidence for a nuclear reaction inside the device has been reported, as would be, for instance, the emission of gamma rays. The only evidence available is indirect and it comes from the large amount of excess heat that is claimed to be produced by the reactor. As the only basis of the claim of nuclear reactions taking place, the excess heat (if any) produced by the reactor should have been measured with extreme care and with all the necessary precautions necessary to insure that it is significant. Unfortunately it appears that this is not the case. The set up for the heat measurements looks inadequate and amateurish; the results are unclear and repeatability has not been demonstrated. It appears legitimate to think that the claim of "cold fusion" by Rossi and Focardi rests on poor evidence, or even or no evidence at all.

A reasonably reliable calorimetric measurement of the heat produced by the E-Cat could be performed by cycling cooling water inside an insulated tank and measuring the temperature of the water. Knowing the amount of water, it would be possible to obtain a first estimate of the heat produced. That, in itself, would still not be enough. The heat measurement would have to be validated by replacing the E-Cat with a resistor and then measuring the power needed to heat the water at the same temperature as with the E-Cat in action. But the crucial test would be a "blank" one in which it would be shown that there is a significant difference in the heat generated by a functioning E-Cat and by a device where the "catalyser" is absent.

It is clear, however, that the inventors of the E-cat did nothing of that sort. They didn't close the cooling cycle, they let the steam vent out and they estimated the amount of heat created by assuming that all the water passing through the E-Cat is vaporized. That's obviously a very poor set-up that guarantees large errors simply because there is no way to be sure that *all* the water is vaporized. Yet, it is clear from this movie that this is the way the measurement was interpreted.

Even a poor experimental set-up can still tell you something if you use some elementary precautions. Simply by using two E-cats, one "active" and the other without the catalyst, it may be possible to see a difference if the excess heat exists. But Rossi has refused to address the question of a blank test. It may be worth mentioning at this point that the downfall of the 1986 "cold fusion" claims by Fleischmann and Pons started when they could not demonstrate to have peformed a blank test in their experiment.

Overall, Peter Ekstrom has a convincing point when he shows that the E-Cat is not producing any excess heat. As an answer, Rossi could find nothing better than calling Ekstrom "a clown". This answer was subsequently deleted from Rossi's blog, but it can still be found on the web, for instance here. This is just an example Mr. Rossi's general attitude regarding those who criticize him.

To all this, we may add other suspicious elements. Steven Krivit has correctly described several of the weak points of the claims by Rossi and Focardi. Then, we may add that the measurements made in Sweden showed that the copper purportedly created by nuclear transmutation in the E-Cat has the same isotopic composition as natural copper. That is simply not possible.

Of course, all this does not prove that the E-Cat cannot work as described, but the burden of proof rests on the inventors and it is clear that they are far away from being able to show that their device is an energy-producing machine based on nuclear fusion. It seems that the E-Cat story is rapidly moving to the realm of 'pathological science' . Grand claims of scientific revolutions supported by little or no evidence, ambitious recipes on how to save the world by some miracle machinery, gobbledygook masked as scientific theorizing, *ad hominem* insults to non-believers, etc.; it is a well-known pattern. From now on, we may expect to see another wave of conspiracy theorizing related to the E-cat. That too, shall pass.