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Bubble bursts for bench-top nuclear fusion

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The claim that nuclear fusion can take place inside tiny imploding bubbles of acetone in bench-top experiments has suffered a deflating blow.

The first chemical analysis of the reactions inside a single imploding bubble suggests that the temperature should fall several million degrees short that needed for fusion.

However, Kenneth Suslick from the University of Illinois at Urbana-Champaign says his team's work does not rule out the possibility of reaching those searing temperatures in other liquids, like molten salts or metals. "It's a very long shot, but possible," he says.

The results are further evidence arguing against controversial research published in March, in which Rusi Taleyarkhan of Oak Ridge National Laboratory in Tennessee claimed to see evidence of fusion inside acetone bubbles.

Suslick has already said he believes Taleyarkhan's lab was contaminated with tritium - the very thing used as evidence of fusion (**New Scientist** magazine, 13 April 2002). And other labs that have tried to replicate Taleyarkhan's results have failed (**New Scientist** magazine, 9 March 2002).

Pumped up

The principle behind the experiments is not controversial. Researchers have long known that when bubbles are pumped up with sound waves and then allowed to collapse they can emit energy as heat and light - a phenomenon known as sonoluminescence.

Clouds of such bubbles can be as hot as 5000 °C. And researchers think that a single bubble collapsing perfectly symmetrically should get much hotter. Theoretically, it could reach the 10 million degrees needed for fusion to take place. But it has proven incredibly tricky to measure the temperature inside a single, tiny bubble.

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Suslick decided to estimate that temperature by measuring the photons, radicals and ions produced by energy-consuming reactions like the dissociation of water or nitrogen gas inside an air bubble in water.

Just seeing the reaction products is a breakthrough, since only tiny amounts of atoms are kicked out of the bubble. "It's a wonderful piece of work," says Andrea Prosperetti, a sonoluminescence expert from Johns Hopkins University in Baltimore.

Energy sapping

Suslick could only see reactions that spat products out into the water, rather than those that stayed within the bubble. These reactions sapped 0.01 per cent of the bubble's total potential energy, he says. But since the temperature is high enough for those reactions to occur, many more must be happening inside the bubble, hidden from view.

Suslick thinks the hotter the bubble gets, the more reactions will take place, sucking up more energy that would otherwise raise the temperature. "It's self-limiting. I don't think you can get beyond 15,000 to 20,000 degrees," he says.

The situation would be even worse for a volatile liquid like acetone, he says. But a liquid with low vapour pressure, like molten metal, would have fewer reactions going on inside and might get much hotter.

Suslick's lab has achieved sonoluminescence in molten salts, but has not yet been able to estimate those bubbles' temperature.

Journal reference: *Nature* (vol 418, p 394)

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