SCIENCE NEWS Online
THE WEEKLY NEWSMAGAZINE OF SCIENCE

Week of Aug. 24, 2002; Vol. 162, No. 8

Violent chemistry saps sonobubble energy

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Sound waves blasting a liquid can create a pulsating, microscopic bubble of gas so ferociously hot that it emits light and tears apart molecules as it collapses. In a controversial report last March, researchers offered evidence that such a so-called sonoluminescent bubble's implosion attains temperatures and pressures high enough to make atomic nuclei fuse together (SN: 3/9/02, p. 147: http://www.sciencenews.org/20020309/fob1.asp).

Now, the first experiment to directly measure the chemical-reaction rates in individual, sonoluminescent bubbles reveals that the recombining of atoms in a collapsing bubble probably limits its temperature. The new results seem to splash cold water on the fusion findings.

Kenneth S. Suslick of the University of Illinois at Urbana-Champaign was already skeptical of the March report's conclusions before conducting the chemical-reaction experiments, he says. "From our results, we find [the fusion] claims even more surprising." He and his Illinois colleague Yuri T. Didenko report the new measurements in the July 25 *Nature*.

To investigate reaction rates within single air bubbles in water, Didenko and Suslick laced the water with molecules that glow under ultraviolet light when bonded to compounds that form in the implosions. The glow's color identifies the chemicals, and its intensity indicates their abundances. The resulting chemical inventory revealed that a hundred times as much of a collapsing bubble's energy goes into chemical reactions as into light emissions.

The new study "has nothing to do with bubble fusion," contends Richard T. Lahey Jr. of Rensselaer Polytechnic Institute in Troy, N.Y., who coauthored the March report. Bubbles in the acetone used in the fusion experiment collapsed too quickly for many chemical reactions to occur, he says.

Suslick counters that because chemical dissociations occur in mere femtoseconds, reactions would have been well under way even in the acetone bubbles.

References and sources for this article

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Further Readings:

Weiss, P. 2002. Star in a jar? Hints of nuclear fusion found—maybe. *Science News* 161(March 9):147. Available at http://www.sciencenews.org/20020309/fob1.asp.

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From *Science News*, Vol. 162, No. 8, Aug. 24, 2002, p. 125.