Search
About Us

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NEWS
Front Page
Top Story
Nation
World
Sports
SportServer
Business
Technology
Politics
Opinions
Health & Science
Entertainment
Weird News
Special Reports

FEATURES
Newsletters
News Galleries
News Watcher
News Archive
News Forums
Mobile Services
Regional News
Video Vault
Today In Photos
Today In History
Horoscope
TV Listings
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Health & Science: Researchers say bubble fusion more difficult to reproduce than once thought

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By CHARLES CHOI, United Press International

CHAMPAIGN-URBANA, Ill. (July 24, 2002 3:44 p.m. EDT) - Although sound waves can generate temperatures as hot as the surface of the sun simply by squishing bubbles, the potential of tabletop nuclear "bubble fusion" raised earlier this year may have been exaggerated, new calculations suggest.

Experimental findings reported last March suggested tiny bubbles could trigger fusion reactions by collapsing in a neutron-loaded solution of acetone, a common, naturally occurring solvent used to make plastic, fibers, drugs and other chemicals. The research was led by Rusi Taleyarkhan at Oak Ridge National Laboratory in Tennessee.

Bubbles in liquids trapped and energized by ultrasound beams tend to flare with light in a phenomenon known as sonoluminescence, first observed in 1990. When bubbles inflated by sound waves collapse, the billionth-of-a-second-long implosions generate incredible pressures normally found at the bottom of the ocean along with temperatures of about 9,000 degrees Fahrenheit.

Such intense pressure and heat led to speculation fusion could take place, in which atomic nuclei are slammed together to liberate incredible forces with little radioactive waste. Taleyarkhan's team said they detected chemical byproducts of fusion in their souped-up paint thinner in a container the size of three coffee mugs.

"Our results make Taleyarkhan's increasingly unlikely," Kenneth Suslick, a chemist at the University of Illinois at Urbana-Champaign told United Press International.

Suslick and colleague Yuri Didenko analyzed the chemical reactions from the collapse of an isolated excited bubble, the byproducts formed. They reported their findings in the July 25 issue of the British journal *Nature*.

"This energy is converted into light emission, chemical reactions and mechanical energy," Suslick explained. "We were able to determine, for the first time, how much of the energy goes into the chemistry of the bubble."

Suslick and Didenko generated a bubble about the size of a red blood cell and trapped it in the center of a spherical container using soundwaves. They adjusted the pressure in the container to expand the bubble to 1,000 times its volume, then collapsed it repeatedly, using sensitive fluorescent chemicals to monitor the byproducts created.

They found that volatile molecules such as water, nitrogen and oxygen were ripped apart. Although less than one-thousandth of the energy involved

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fueled these chemical reactions, it was enough to eliminate the possibility that fusion could occur, they said.

The new findings suggest sound-triggered fusion is improbable in highly volatile fluids like acetone or water, Suslick said. However, "the possibility of fusion occurring in low volatility fluids, such as liquid metals and molten salts, cannot be ruled out at this time."

Tabletop fusion may be out of reach, but "there are other uses for sonoluminescent bubbles," said physicist Detlef Lohse of the University of Twente in Entschede, The Netherlands. For example, now that scientists understand the chemical processes of sonoluminescence more thoroughly, they might be able to harness it for applications in medicine and industry.

Suslick noted sonoluminescence is already helping to enhance the chemical reactions used to make pharmaceuticals. Quoting Russian intellectual Leon Trotsky, Suslick said the research should go "forward in all directions."

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