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Bubbling to extreme temperatures

By I. Peterson

Blasting intense, high-frequency sound through a liquid causes the formation of tiny gas bubbles, which then rapidly collapse. These little implosions can nevertheless be so violent that the compressed gas within a collapsing bubble emits a flash of light.

Using spectroscopic techniques, researchers have now established that temperatures inside these imploding bubbles can reach values comparable to those at the sun's surface. Chemist Kenneth S. Suslick and his coworkers at the University of Illinois at Urbana-Champaign report their findings in the Oct. 21 *Nature*.

The researchers targeted silicone oil saturated with argon gas and spiked with traces of metals such as chromium and molybdenum. These metal elements emit characteristic colors of light when excited. The relative intensity of the light at different wavelengths is an excellent thermometer for determining the temperature of the metal atoms and, hence, the implosion temperature of the gas inside a collapsing bubble, Suslick notes.

Measuring light emissions from a dense cloud of collapsing bubbles, Suslick's team found that the gas temperature gets as high as 5,100 kelvins. The resulting short-lived hot spots are like microscopic furnaces and can drive high-energy chemical reactions in an otherwise cold liquid, Suslick says.

The researchers can now use their novel thermometer to study the factors that influence the implosion temperature. They have already discovered that a solution's chemical composition has a strong effect. Dissolving a small amount of a gaseous hydrocarbon such as propane in the oil can lower the implosion temperature to 2,500 K.

References and sources for this article

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