Mechanism of Multibubble Sonoluminescence

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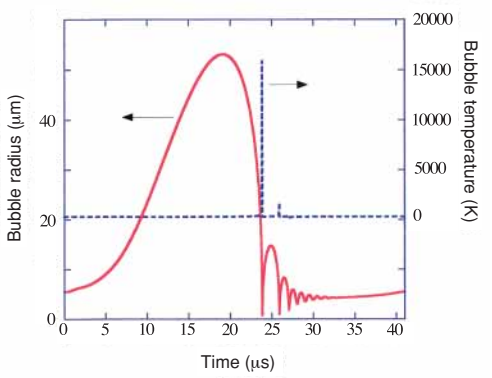
When a liquid is irradiated by strong ultrasound, many tiny gas bubbles appear. The bubbles repeat expansion and collapse according to the pressure oscillation of ultrasound. When ultrasound is strong enough, the light is emitted from collapsing bubbles, which is called multibubble sonoluminescence(MBSL). We have performed computer simulation of the bubble collapse under conditions of MBSL. We showed that the bubble temperature at the collapse is highest when the pressure amplitude of ultrasound is moderately low because at higher acoustic amplitudes the bubble content is mostly vapor. The light emission of MBSL is a combination of chemiluminescence and plasma emissions.



The bubble radius and the temperature inside the bubble as functions of time for one acoustic cycle

Development of a Multi-Functional Ceramic Catalyst for Reduction of Nosocomial Infectious Agents and Water Purification

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We have developed a composite ceramic catalyst bactericidally effective against organisms such as E. coli and MRSA (methicillin-resistant Staphylococcus aureus). The ceramic catalyst is a composite of an apatite coating and a titanium dioxide photocatalyst base which is capable of killing bacteria and adsorbing and decomposing organic materials. The surface treatment of the titanium dioxide and the adsorption of bacteria by the apatite makes even the weak light of a household fluorescent lamp sufficient to kill E. coli or MRSA.

In water treatment, the ceramic is effective at concentrations on the order of 5-30ppm and also acts to decompose bleach and other toxic organic materials. Safety and non-toxicity allow use in bathing areas or pools, in hospitals to prevent nosocomial infection, or for sterilizing or cleaning instruments and clothing. Chlorine-based chemical agents are generally used to purify bath water, which is problematic in terms of human safety and

Composite ceramic catalyst

environmental effects such as trihalomethane generation. In addition to greatly reducing the amount of such chlorine-based agents used and killing E. coli, use of the newly developed ceramic catalyst also dissolves organic material in bath water and breaks down bathtub scum. Other advantages include full bactericidal effectiveness at hot springs (alkaline water), absence of unpleasant odor, human safety, and low biofilm formation in pipes.