occurs in the two-component case. In spite of the different growth patterns between the two cases, the values of the growth exponent are close to 1/2 in both cases. However, it has been found that the scaling components that constitute the growth exponent, i.e., the scaling exponent for the total radius of all nuclei and that for the number of nuclei, are different between the two cases. These scaling components are discussed in relation to a driving force for bubble nuclei to grow. In addition, the asymptotic behavior of the size distribution function of bubble nuclei is also discussed using these scaling parameters.

9:55–10:15 Break

Contributed Papers

10:15

3aPA5. Frequency effects on intense sonoluminescence and bubble dynamics in sulfuric acid. Shin-ichi Hatanaka and Shigeo Hayashi (Univ. of Electro-Commun., 1-5-1 Chofugaoka, Chofu, Tokyo 182-8585 Japan, hatanaka@pc.uec.ac.jp)

Emission intensity increased remarkably with decreasing frequency for both multibubble sonoluminescence (MBSL) and single-bubble sonoluminescence (SBSL) in a concentrated sulfuric acid solution dissolving xenon gas. The spectrum of MBSL in the sulfuric acid showed the emission bands of a large peak at 388 nm and small peaks at 360 and 418 nm. The increase of MBSL intensity at lower frequency was responsible for the increase of the band peak at 388 nm in addition to the increase in continuous spectrum. The bubble dynamics in the sulfuric acid was different from that in water. The intense SBSL was emitted when the bubble was moving on an ellipselike trajectory. The intense MBSL was emitted even when multiple bubbles formed bubble clusters, which could not emit light in the water case.

10:30

3aPA6. Experimental analysis of blackbody emission from sonoluminescence in sulfuric acid. Stephen D. Hopkins, Carlos G. Camara, and Seth J. Putterman (Phys. Dept., UCLA, 2-202 Knudsen Hall, Los Angeles, CA 90095)

The spectrum of emission from a single xenon bubble in concentrated sulfuric acid driven at 30 kHz is an excellent fit to Planck's law with a surface temperature of 8000 K. The measured flash width and emission radius are also consistent with blackbody emission. In this study the only fitting parameter available is the temperature [Phys. Rev. Lett. **95**, (2005)]. [Research funded by DARPA.]

10:45

3aPA7. Drop tube generates 10-W flashes of sonoluminescence. Brian A. Kappus, Avic Chakravarty,[a] , and Seth J. Putterman (Phys. Dept., UCLA, 1-129 Knudsen Hall, Los Angeles, CA 90095)

Use of a low vapor pressure liquid such as phosphoric acid, with dissolved xenon in a vertically exited tube, generates ~200-ns flashes of sonoluminescence with a peak power of 10 W. We are in the process of characterizing the bubble motion by use of backlighting, stroboscopic, and streak photography. We will also broach the topic of disequilibrium between atom and electron temperatures. [Research funded by DARPA. We thank Carlos Camara and Shahzad Khalid for valuable discussions.]
[a] Deceased.

11:00

3aPA8. Attempts to observe sonoluminescence from a single bubble driven at 10 MHz. Shahzad Khalid, Carlos G. Camara, and Seth J. Putterman (Phys. Dept., UCLA, 2-202 Knudsen Hall, Los Angeles, CA 90095)

A 10-MHz spherical transducer array is used to generate cavitation at its focus with a field of ~100 atm. Sonoluminescence as well as light-scattering measurements will be discussed. [Research funded by DARPA.]

11:15

3aPA9. Unidentified energy conversions in an oscillating bubble. Karel Vokurka (Phys. Dept., Tech. Univ. of Liberec, 46117 Liberec, Czech Republic) and Silvano Buogo (CNR IDAC, 00133 Roma, Italy)

Acoustic radiation of freely oscillating bubbles has been studied experimentally. The oscillating bubbles have been generated by underwater spark discharges. Recorded pressure waves made it possible to determine the acoustic energy radiated by the oscillating bubbles and the potential energy of the bubbles when attaining the first and second maximum volumes. Comparison of the potential and acoustic energies revealed that about 70% of the potential energy of the bubble available at the first maximum volume has been converted into an unidentified energy. A possible candidate for the energy conversion mechanism seems to be internal converging shock wave in the bubble interior. The presence of this wave can be observed indirectly in a radiated pressure wave. The measured energies are compared with energies computed using a suitable model. This comparison shows that the theoretical values agree with experimental data until the bubble attains the first minimum volume. However, at later times discrepancies are observed. [Work has been partly supported (K.V.) by the Czech Ministry of Education as the research project MSM 46747878501.]

11:30

3aPA10. Optical observation of collapses of two bubbles adhered to the quartz wall under ultrasound irradiation with high-speed video camera: Micro-jet arising from two collapsing bubbles. Kenji Yoshida, Shintaro Nakatani, and Yoshiaki Watanabe (Faculty of Eng., Doshisha Univ., 1-3 Tataramiyakotani, Kyotanabe, Kyoto, Japan, etf1103@mail4.doshisha.ac.jp)

The mechanical action of a micro-jet, which arises from the collapse of bubbles, has been widely used for ultrasonic cleaning and sonoporation in medical field. The generation mechanism of a micro-jet induced by the ultrasound irradiation is focused on. In previous theoretical and experimental researches, the generation mechanism is well known when a single bubble is adhered to a rigid wall. However, its mechanism is not understood in detail when multiple bubbles exist on rigid wall. The optical observation of multi-bubble collapse greatly contributes to the development of micro-jet applications. It was observed that the collapses of two bubbles adhered to the quartz wall in an ultrasound field with high speed video camera (HPV-1, SHIMADZU). Maximum recording rate of this high speed video camera is 1 000 000 frames/second. The emitted ultrasound frequency is 27 kHz. From the observation, one of two bubbles was deformed after these bubbles vibrate. The micro-jet was generated to the opposite side against the deformed bubble when the deformed one touches the other. Then, the direction of the micro-jet to the quartz wall was almost horizontal. The number of micro-jets increased every time the distorted bubble touched the other. Finally, five micro-jets to the various directions were observed at the same instant.