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Emission time width measurement of single bubble sonoluminescence using Ar degassed phosphoric acid

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1. Introduction

By irradiating strongly ultrasonic waves to a previously deaerated liquid, single buble somoluminescence (SBSL) can be generated. Bubbles repeat generation, expansion, collapse, and light emission in accordance with cyclical sound pressure changes by ultrasonic waves. Upon luminescence of several ps, an extremely high temperature and high pressure environment of as much as 10,000 degrees, 1000 bars or more is generated inside bubbles[1], and it is also expected to be used as a reaction field for chemical reaction.

Research on SBSL is actively conducted, and temperature and pressure measurement of SBSL using sulfuric acid has been reported [2], but the mechanism of luminescence has yet to be elucidated. Our laboratory is also aiming to measure SBSL's high temporal resolution temperature, and in this research we acquire the SBSL emission spectrum, which is the first stage, using a spectrometer.

2. Apparatus

Fig.1 shows the experimental apparatus. In the experiment, argon degassed water is used. In order to increase the contact area between the ultrasonic oscillator and the round bottom flask, a plano-concave lens having the same curvature as the radius of 41.5 mm of the round bottom flask was placed in between and a donut- A vibrator is bonded with a two - part mixing type epoxy resin. The sinusoidal AC voltage generated by the function generator is amplified by an audio power amplifier, applied to the donut type ultrasonic transducer via an output transformer. The change in voltage generated by deformation of the pickup transducer attached to the bottom of the round bottom flask is monitored in real time with an oscilloscope and the strength of the ultrasonic vibration is confirmed doing.

Fig.2 shows an experimental schematic diagram of optical system. Time history of SBSL emission is measured by streak camera. Sweep of streak camera is triggered by PMT signal of SBSL emission.

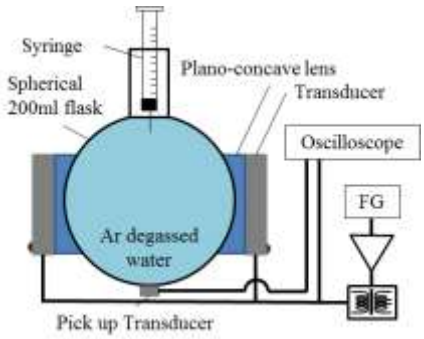

Fig.1. Schematic diagram of the experimental setup

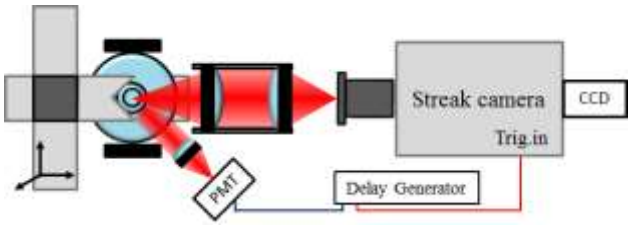

Fig.2. Schematic diagram of the optical system setup

3. Experimental results and discussion

Fig.3 and Table 1 show experimental conditions and experimental results. Emission time width of SBSL is reported 70~250 ps[3]. The time history is discrete distribution due to weak emission. In order to improve emission intensity, liquid is changed water to phosphoric acid.

Table 1. Experimental conditions

Slit width	100 μm
Time range	1 ns
CCD Exposure time	10 ms
MCP gain level	63 (max)
Trigger frequency	about 24 Hz

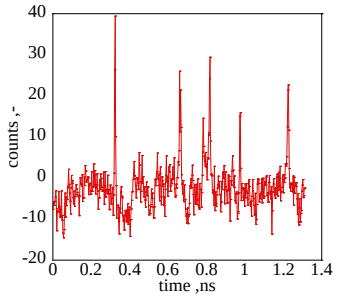

Fig.3. Time history of SBSL

References

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