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Cavitation concentration

Li HUAMAO
Dept of Physics, Jian Teacher's College
Jian, Jiangxi 343009, P.R of CHINA

ABSTRACT

This paper suggests a new acoustic terminology "Cavitation Concentration", and which may exist in the front of any jetting acoustic cavitation field with interface, and has been used to explain two recent experimental phenomena, the most obvious MBSL at gas-liquid interface and the most intense ultrasonic heating at solid-liquid interface , observed by the author .

INTRODUCTION

In recent ten years, with the rapid development of nonlinear acoustics, sonochemistry and ultrasonic medicine, the experimental and theoretical studies of acoustic cavitation have become a new focus in ultrasonic fundamental research [1], although there were many detailed works and good summary papers on acoustic cavitation be published, for example, ACOUSTIC CAVITATION edited by E.A.Neppiras [2] and ACOUSTIC CAVITATION AND BUBBLE DYNAMICS edited by A.A.Atchley and L.A.Crum [3]. Really, still a good many of chemical and/or physical phenomena implied in acoustic cavitation field are far from satisfactory studies, even are unknown, such as the most obvious MBSL (Multibubble Sonolumine-scence) at gas-liquid interface [4-5] and the most intense ultrasonic heating at solid-liquid interface [6] observed by the author are two suchlike phenomena. This paper introduces the experimental phenomena, and has a discussion on them, and based on the facts, finally suggests a new acoustic terminology "Cavitation concentration" which should be allowed to use formally.

EXPERIMENTAL PHENOMENA

1. Most obvious MBSL at gas-liquid interface

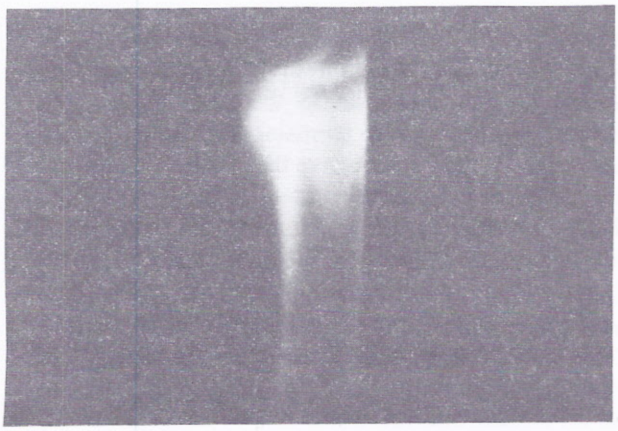

Fig.1 MBSL image

Fig.1 is a MBSL image taken by camera in dark room. The MBSL is radiated out from the luminol-alkaline aqueous solution cavitated by ultrasound in glass cell with air outlet. But it should be noted that the most obvious MBSL is at the gas-liquid interface, in the concrete, concentrating at the swollen front of the jetting cavitated solution. However, As shown in the image, under the swollen part, the MBSL brightness degrates, and finally becomes unmeasurable at bottom ultrasonic trancducer.

2. Most intense ultrasonic heating at solid-liquid interface

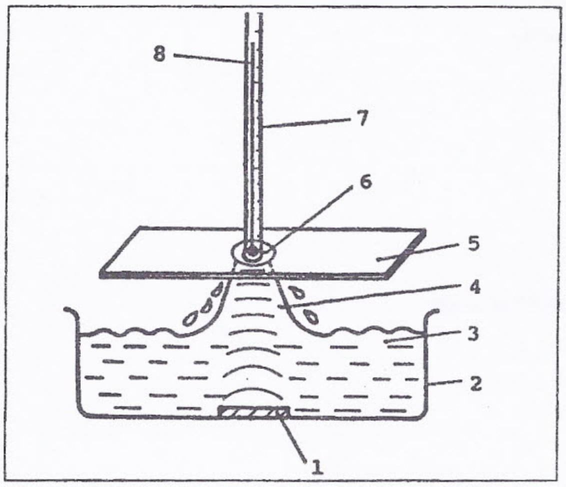

Fig.2 experimental set-up of ultrasonic fountain heating

1--ultrasonic transducer 2--cell
3—tapwater 4--ultrasonic fountain
5--plastic target 6--molten measuring area
7—thermometer 8--mercury column

Fig.2 is the experimental set-up. Let the ultrasonic fountain to jet upward a plain thin plastic target (e.g. ABS plate), one can find the temperature of the measuring area (opposite to the under jetted area directly contacting the fountain) on the target rise immediately , and can observe the plastics melting and deforming of the measuring area (it is newfangled that hardly any melting and deforming on the under jetted area can be discovered after the experiment). The most intense temperature of around 250℃ in the melting area on top of the front of the fountain has be got by a 25W electric power of ultrasound, but the temperature can degrade while the target falls down from the point of the swollen fountain front.

DISCUSSIONS

Differing from an ordinary water cloumn jetted from spraying pool, the above swollen jetting solution and ultrasonic fountain resulting from acoustic cavitation can be considered as a jetting acoustic cavitation field, and certainly, a so-called uncontinuous field interface exists between the air or plastic plate and the cavitated liquid solution or water. Since the swaying field-interface, some extranous cavitation bubble nuclei, air, dust and coarse or cracked plastic surface etc. would enter into the cavitated host liquid and aggravate the cavitating effect at the field interface. Besides, the acoustic radiation pressure and streaming in the ultrasoinc cavitation field may force some cavitation bubble nuclei in the host liquid to aggregate at its front. Hence, a site for concentrating cavitation event would be built in there, and their chemical effect, and/or thermal and mechanical effects of the concentrating multiple bubble cavitation are intensified.

CONCLUSIONS

As indicated above, any jetting cavitation field with interface, regardless of gas-liquid or solid-liquid, would give rise to the cavitation concentrating phenomena at the front of the field. It is the cavitaion concentration that makes the most obvious MBSL at the gas-liquid interface and the most intense ultrasonic heat at the solid-liquid interface. So, up to date, the cavitation concentration, as a new acoustic terminology, should be allowed to suggest and to use formally.

Acknowledgements

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