

Preface

Acoustic cavitation is the formation and subsequent collapse of bubbles in liquid irradiated with a powerful ultrasonic wave. Bubble dynamics are dynamics of bubble pulsation under intense ultrasound. Under certain conditions, a bubble violently collapses, resulting in high temperature and pressure inside a bubble. Light is emitted from a heated bubble (sonoluminescence), and chemical reactions take place inside the bubble (sonochemical reactions). Acoustic cavitation is useful for ultrasonic cleaning and sonochemistry. Many researchers have studied its medical applications such as cancer treatment and extracorporeal shock wave lithotripsy. Although there is no description on the medical applications herein, the description in this book on fundamental phenomena should be useful for readers who will study medical applications.

Although the phenomena have been studied for more than 100 years, considerable development in this field was brought about after the re-discovery of single-bubble sonoluminescence by Gaitan and Crum in 1989 (there is also an experimental report on single-bubble sonoluminescence published in 1962 [Young FR (2005) Sonoluminescence. CRC Press, Boca Raton]). Experimental evidence of plasma formation inside a bubble was found in optical spectra of single-bubble sonoluminescence in sulfuric acid by Flannigan and Suslick in 2005.

The present SpringerBrief in *Ultrasound and Sonochemistry* is written as an introduction to this field for students, researchers, engineers, educators, and teachers. For this purpose, many illustrations are added in order to help readers to understand the phenomena at a glance. Detailed derivation of mathematical equations of bubble dynamics is described for readers who will study the phenomena theoretically and numerically. There is no problem to skip such mathematical descriptions for readers who just want to understand the phenomena qualitatively. Chapter 1 focuses on acoustic cavitation, which is an introduction to the phenomena with many illustrations and photographs. Chapter 2 describes bubble dynamics, which most benefits readers who will study the phenomena theoretically and numerically. Chapter 3 highlights unsolved problems, which is written mostly for students and researchers who will work in this field.

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