Cavitation Research in Sonochemistry: An overview

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In this overview, several topics will be taken up on diverse subjects such as historical overview of cavitation research in Japan, manipulation of cavitation, and possibilities of nanocavitation.

Every participant in this Symposium must agree with the understanding that without cavitation, almost no chemistry would be possible, since it may directly or indirectly affect the environment surrounding the substances dissolved in liquid. Collapsing cavitation yields high temperature, serving as a stage for pyrochemistry. Microjet may be of importance to physicochemical processes on surfaces. Inhomogeneous liquid flow may exert shear stress to macromolecules. Such is the importance of cavitation, but there remains a lot to explore its possibilities.

First, let us be reminded that there were several forerunners in Japan who contributed a lot to cavitation research. Kumamoto gave a review some 40 years ago [1], according to which the oldest sonochemical research had been carried out as early as 1936. Negishi [2] and Yoshioka and Ohmura [3] observed pulsed sonoluminescence.

Next, we should note that cavitation is becoming a controllable object, as evidenced by the experiments by Ohl’s group [4] and Iida’s group [5].

Finally, the speaker would like to raise a question: "Is nanocavitation impossible to realize using ultrasound?" Some researchers in mechanical engineering or fluid dynamics assert this, and it may be true if we stick to the conventional approach. However, since nanocavitation is becoming a hot topic in some fields [6, 7], we should explore any possibility.

Keywords: historical overview, sonochemistry in Japan, microcavitation, nanocavitation, sonoluminescence