WEB Ultrasonic Cleaning Technology Seminar 2012/5/10

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**True ultrasonic cleaning technology is the origin of ultrasonic deburring technology.**

**basic technology**

**1, Misunderstood ultrasonic cleaning technology 2007 status quo**

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| The screen on the right is an image of the degassing ultrasound matching.  This time, I found many of my images and videos in China being copied and used as the company's original experimental images without permission.  As a measure to prevent copying, I have composited my company's name on the images and published them.  The image on the right is a picture of the degassing ultrasonic wave matching. This time, I found many of my images and videos in China being copied without permission and published and used as the company's original experimental images. As a  measure to prevent copying, I have composited my company's name on  the images and published them. | 真・超音波洗浄の威力 |

Ultrasonic cleaning is a cleaning method that radiates powerful coarse and dense waves of 20 KHz or higher into water, i.e., ultrasonic waves, and uses the impact force when the bubbles (cavities) generated by the ultrasonic waves collapse.  
 Is this correct? Is it wrong? First, let's start by confirming this principle.

**Typical ultrasonic cleaning video**

The image you are about to see is that of ultrasonic waves emitted from CFC-113 (CFC-113), a typical cleaning solvent of the 20th century. As a reminder, similar images can be seen with almost all cleaning solvents other than water and water-based solvents. Chlorinated organic solvents, brominated solvents, hydrocarbon solvents, higher alcohol solvents, etc. are basically the same.

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| See the figure on the right. As you can see, bubbles are generated when ultrasonic waves are launched. The bubbles reach the liquid surface without collapsing and burst at the surface.  This is called the gas aeration phenomenon.  The bubbles do not collapse, break up, or shrink. This has been confirmed by a high-speed camera. This is simply a gas aeration phenomenon caused by ultrasonic waves. It has also been confirmed that the contents of these bubbles are air.  In other words, it is not the cavity. |  |

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| Nevertheless, the bubbles do not disappear. They continue to be generated as long as ultrasonic waves are applied. Countless bubbles connect from the surface of the diaphragm to the liquid surface like a column. Is the air dissolving infinitely? No way. In fact, the air will invade and re-dissolve from the liquid surface to the extent that it is removed by ultrasonic waves. Water is added on top of the hydrophobic solvent to create a zone of relative air blockage with water. The image on the right shows what happens. If  this condition is continued, the amount of air leaving as bubbles is greater than the amount of air entering from  the liquid surface, so the air will eventually disappear and the bubbles will disappear. That is where the real cavity occurs for the first time! Water is emulsified in an instant. |  |

**Results of video analysis**

\*The bubbles generated from the diaphragm surface (initially, at various locations in the tank) are air.  
 →The bubbles generated on the diaphragm surface (initially at various locations in the tank) are air.  
 The bubbles do not collapse in the liquid, but burst at the surface of the liquid and generate droplets.  
 →The bubbles do not collapse in the liquid, but burst at the surface of the liquid, creating the illusion of effective ultrasonic cleaning.  
 After about 10 seconds, numerous air bubbles are generated from the diaphragm surface.  
 →The ultrasonic waves are absorbed and blocked near the diaphragm surface due to the air bubbles, and disappear.  
 \*The bubbles continue to be generated.  
 →The bubbles will not disappear unless the air bubbles are stopped from entering from the liquid surface.

Therefore, this video is not a basic image of ultrasonic cleaning but an image showing ultrasonic waves being eliminated on the surface of the diaphragm.

**The biggest misconception about ultrasonic cleaning**

1. Visible bubbles generated in the liquid during ultrasonic oscillation are not cavities (which are expected to have cleaning ability).
2. The visible bubbles are simply air bubbles that serve to absorb and block ultrasonic waves.
3. If we are going to use ultrasonic cleaning properly, we must utilize real cavities.

**2. What is ultrasonic cleaning? Investigation of its correct principle**

Ultrasonic cleaning is a cleaning method that utilizes the impact force of cavities (at the time of creation and collapse) generated by ultrasonic waves.  
 Therefore, in order to understand ultrasonic cleaning, one must correctly understand the principle of how contamination is removed by the generation and decay of individual cavities generated by ultrasonic waves. Ultrasonic cleaning cannot be discussed if cavities are misunderstood. First, let's see how contamination is removed by ultrasonic cavities by means of a video.  
 The film was taken around 1990.

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| Contaminants on the glass substrate are being removed by cavities generated by ultrasonic waves. So-called bubbles do not exist. | キャビティー | Since the animation was hollowed out and animated, the base point is shaky, but please forgive me. The thickness of the glass is 5mm.  It is a frame-by-frame feed of a screen of 1/1000th of a second. |

**Ultrasonic cleaning Principle of dirt removal**

A major reason for the stagnation of ultrasonic cleaning technology over the past 20 years has been a misunderstanding of the basic understanding of what ultrasonic cleaning is.  
 Ultrasonic cleaning systems have made rapid progress in accordance with advances in peripheral technologies and customer demands. The ultrasonic cleaning system has rapidly progressed in accordance with the progress of peripheral technologies and customer demands, such as transport technology, instrumentation technology, sheet metal welding technology, and so on.  
 However, there has been no significant change in the basic content of ultrasonic cleaning technology, with only a few exceptions. Even if the appearance and transport technology evolve, ultrasonic cleaning technology will not be able to meet the demands of the times unless there is a fundamental innovation in the ultrasonic cleaning technology itself.  
 In order to fully utilize the innovative ultrasonic cleaning technology that responds to the new era, we must first ask what is ultrasonic cleaning? Why is dirt removed and why is it not removed? A deep understanding of the principles of ultrasonic cleaning and the elimination of misconceptions are necessary to fully utilize the innovative ultrasonic cleaning technology for the new era.

**Ultrasonic cleaning principles of dirt removal (get it right!)**

Ultrasonic cleaning is a cleaning method that emits powerful ultrasonic waves into a liquid and uses the impact force generated when cavities are created and extinguished. If cavities are not generated, it cannot be called ultrasonic cleaning.   
In other words, ultrasonic cleaning is a technology that uses cavities generated by ultrasonic waves for cleaning. Therefore, the basic requirement for understanding and effectively using ultrasonic cleaning is to correctly understand cavities and the phenomena of cavity generation and annihilation (cavitations).  
 A liquid is irradiated with powerful sound waves of 20 KHz or higher, i.e., ultrasonic waves. When a certain level of sound pressure change occurs in the liquid, so-called cavities are generated.  
 Cavities are composed of many vacuum nuclei (microcavities), the total size of which varies depending on the frequency and the magnitude of the sound pressure change.