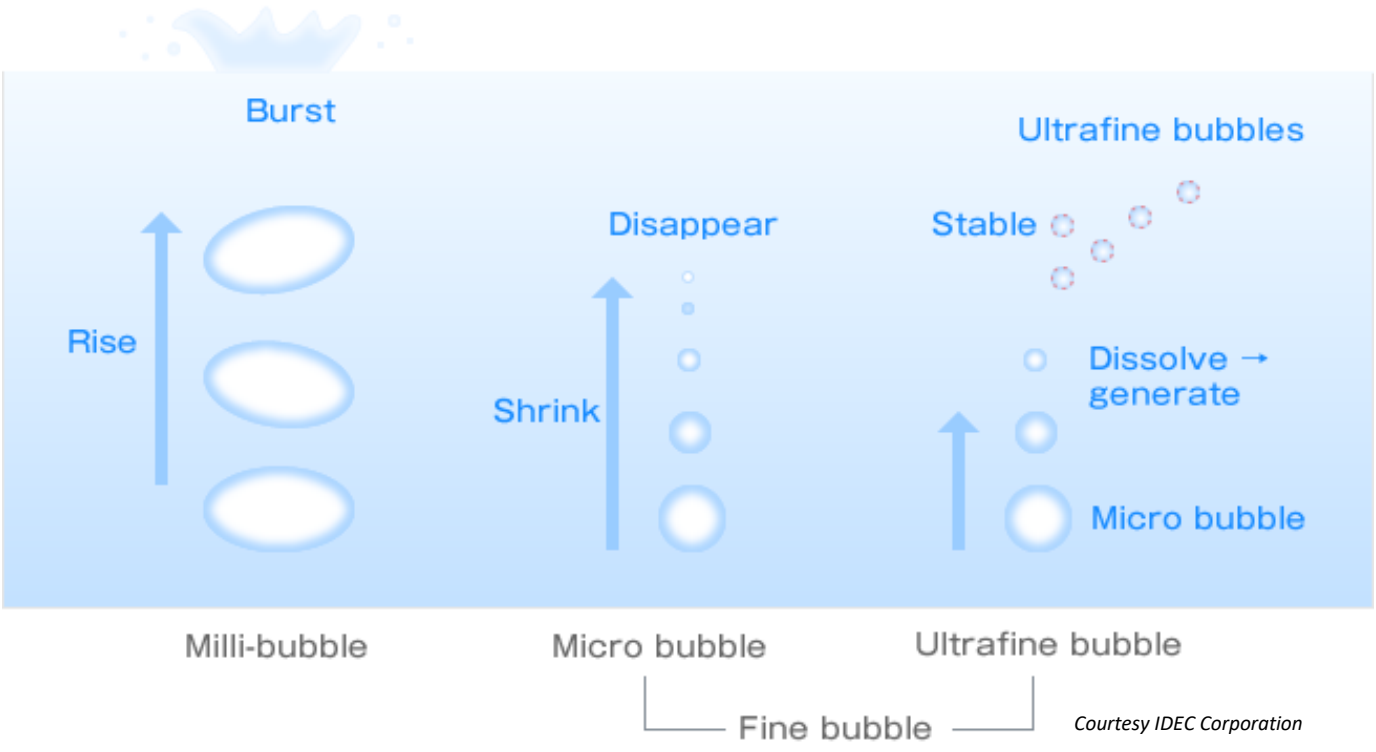
pure vision
TECHNOLOGIES™
Utilizing the elements of life

Technology

The Science of Fine and Ultra-fine Bubbles

Bubbles contained in a liquid are not all visible to the naked eye. Bubbles with the size of a few millimeters in diameter show visible surfacing action in a liquid (as in carbonated drinks, air diffusers and air stones). The presence of fine bubbles of dozens of microns in diameter can be confirmed with white turbidity in a liquid, because these bubbles are scattering substances. Bubbles in diameter smaller than the wavelength of light (400 – 700 nanometers) are called ultra-fine bubbles. They are too small to see, even with powerful microscopes, and have remarkable properties that larger bubbles do not possess. These bubbles do not rise, moving horizontally in liquid, maintaining their availability to implode and release gas into solution as needed. Ultra-fine bubbles can remain in liquid for extended periods of time, months under certain conditions, are electrically charged, and are under extremely high pressure as compared to larger bubbles.



Courtesy IDEC Corporation

Fine Bubble Characteristics

Fine bubble (Micro, Nano)

Rising Speed	Ordinary bubbles rise in water rapidly and burst on the water surface releasing the encapsulated gas into the atmosphere. Fine bubbles, on the other hand, stay in water because they are extremely slow to rise. Bubbles in diameter of 10 microns rise 3mm per minute.
Self-pressurizing Effect	As the bubble size becomes smaller, inner pressure increases due to surface tension of the interface between gas and liquid matter. Logically, the pressurization process is infinite. Pressurization promotes dissolution of gas into the water (Henry's Law) as the fine bubbles implode.
Surface Potential Characteristics	Because fine bubbles are negatively charged, they repel each other. Accordingly, fine bubbles do not bind to one another and bubble density is not reduced.
Collapsing	Fine bubbles are self-pressurized to burst, dissolving encapsulated gas into solution to maintain optimum levels.

Ultra-fine Bubbles (Nano-size)

Stability	Ultra-fine bubbles have been confirmed to stay in a liquid for over six months, moving horizontally in solution due to their Brownian movement. They do not rise to the surface for release into the atmosphere.
Transparency	Nano-size bubbles do not scatter visible light, making the water solution look transparent.

How We Measure our Bubbles

We utilize a Malvern Instruments particle analyzer or (NanoSight NS300) Link to Malvern in a new tab (https://www.malvern.com/en/products/product-range/nanosight-range/nanosight-ns300/?gclid=EAIaIQobChMI2P6J3Y2b1QIVQpN-Ch2iQAXPEAAYASAAEgKLcfD_BwE) to measure the ultra-fine bubbles our technology produces.

https://youtu.be/7G7lbnuyRmE

Malvern's Nano Tracking Analysis technology observes the Brownian motion of nano-particles in liquid in real time. Because the speed of particle depends on its diameter, the particle size distribution graph of diameter and number of particles can be obtained by measuring the Brownian motion pattern.

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