Overview

Research was done to verify the possibility of using electrolysis microbubbles as a flow visualizer. Once concern was the speed at which the bubbles would rise. It was concluded that rise time should pose no concern to using microbubbles as a flow visualizer.

Calculations

$$Length = Entrance + \frac{1}{2} * Test\ Section = 36 + 10 = 46\ in$$

$$Fastest\ rise\ time\ (microbubbles < 50\mu m) = 0.039\ in/s$$

$$Slowest\ Flow\ Velocity: 0.1\frac{ft}{s} = 1.2\ in/s$$

$$Bubble\ Travel\ Time = 46\ in * 1.2\frac{in}{s} = 55.2\ s$$

$$Bubble\ Rise\ Height = 0.039\frac{in}{s} * 55.2\ s = 2.15\ in$$

Flow Depth is 3 in, which is greater than the worst-case rise height of 2.15 in.

Reference Plots

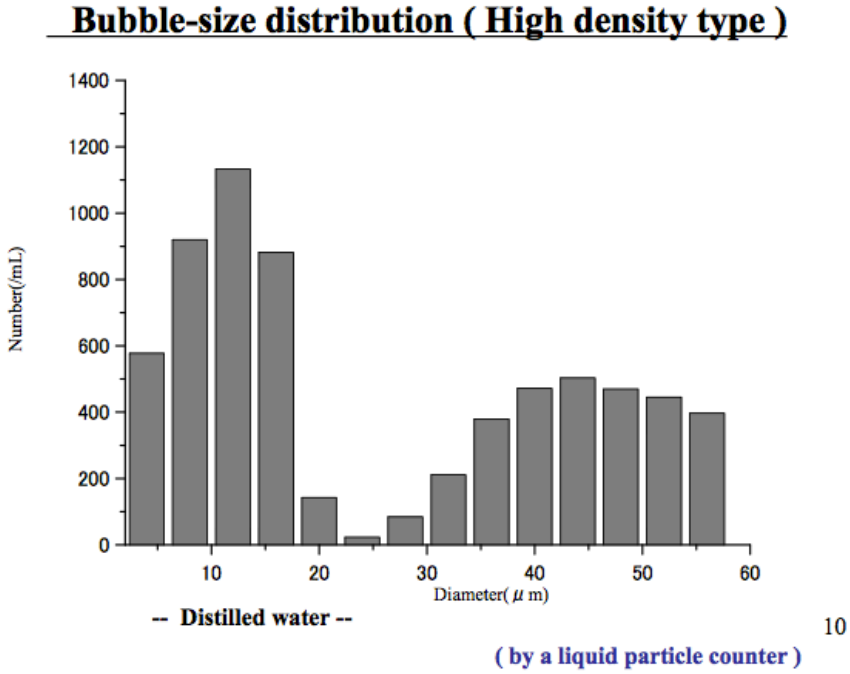

Figure 1: Microbubble Size Distribution
Source: "Fantastic Properties of Microbubbles". AIST. Dr. Masayoshi Takashi

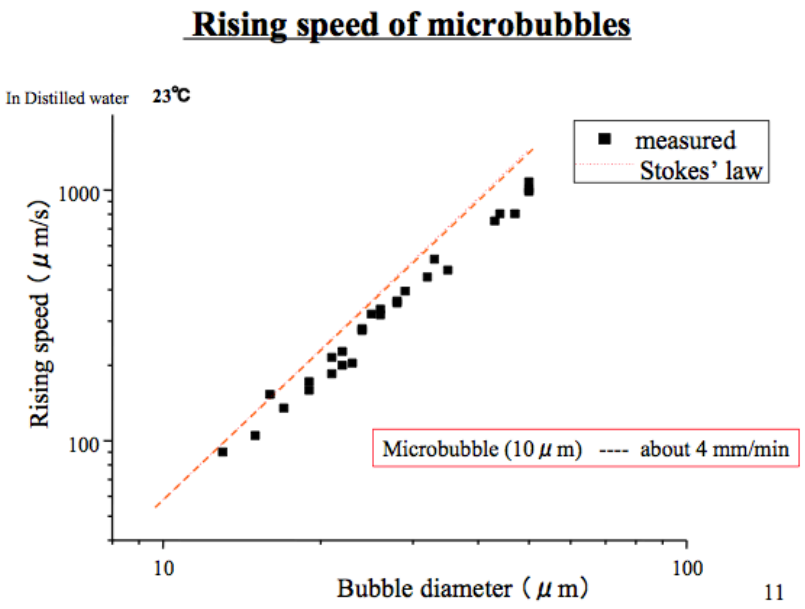

Figure 2: Bubble Rise Speed versus Size, Plot
Source: "Fantastic Properties of Microbubbles". AIST. Dr. Masayoshi Takashi

Microbubble Size (μm)	Rise Speed (μm/s)	Rise Speed (in/s)
10	70	0.003
20	200	0.008
30	450	0.018
40	700	0.028
50	1000	0.039

Figure 3: Bubble Rise Speed versus Size, Chart
(Approximated from Figure 2)