

# MICRO-SCALE BUBBLE GENERATOR MODEL BG-1000

GENERATE THE IDEAL SEED PARTICLES FOR  
WIND TUNNEL AND AERODYNAMIC FLOWS  
IN PLANAR AND VOLUMETRIC PIV

The Bubble Generator Model BG-1000 is a surfactant/water based bubble generator (patent pending\*) designed to produce large amount of bubbles as seed particles for Particle Image Velocimetry (PIV): planar and volumetric, for flow measurements in wind tunnels (opened or closed type) or open environment.

The bubbles with mean diameter of 15 microns are excellent to follow the flow, around small structures or in boundary layer, to provide measurement with the highest accuracy and spatial resolution. The high concentration output of  $10^7$  bubbles/s and the long residence time make this generator the best generator for your flow applications.



## Features and Benefits

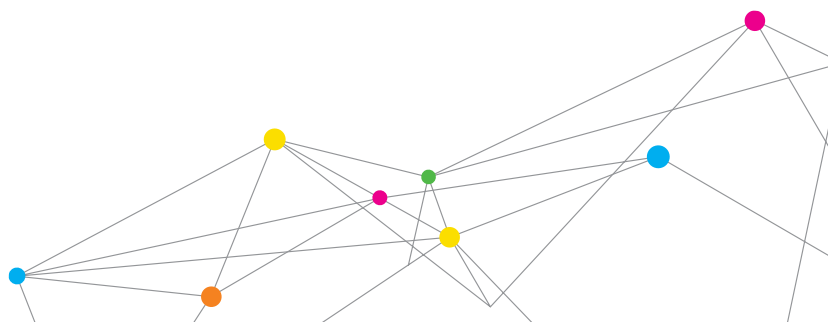
- + Bubbles with size of  $15\mu\text{m}$  having excellent fidelity to follow the flow even around small structures - bubbles with 100s microns in size do not typically follow the flow
- + Bubbles generating high intensity for large field of view or volume, at magnification of 0.025, without any glared point. Separate glared points generated from large bubble, dividing the scattering intensity and causing ambiguity in analysis
- + Long residence time of more than 30 minutes, making long time-resolved measurements feasible - large bubbles of 100s microns breaking easily due to the small surface tension
- + High bubble output of more than  $10^7$  bubbles/s and high concentration of 20,000 bubbles/cc, allowing the extraction of the smallest flow structure in your measurements - low bubble concentration requiring settling tank to accumulate bubbles for measurement
- + Non-toxic and do not stick on window surfaces due to the low viscosity of the surfactant/water mixture
- + Low Cost of operation and ownership with simple and easy maintenance procedure - no extra gas to purchase

## Ideal seed particles for wind tunnel and aerodynamic flows

For wind tunnel and aerodynamic flow measurements, the common seed particles employed are olive oil droplets of 0.5 to 1.0 micron in size. The small size in the olive oil droplets give good fidelity with the flow but the small scattering intensity limits the size of the measurement in both planar and volumetric PIV. The surfactant/water based bubbles with 15 microns mean size resolve such limitation, allowing planer PIV measurement with field of view of more than 1 m by 1 m and volumetric PIV with size of more than  $200\text{ mm}^3$ , while having excellent fidelity to follow the flow to resolve the smallest flow structures.



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## Applications

- + Wind tunnel flows
- + Airflows in large scale facilities
- + Two phase flows
- + Turbulent boundary layers
- + Flows around airfoil or objects
- + Wake flows

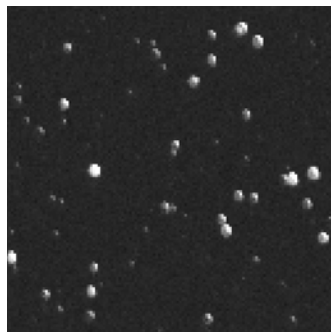
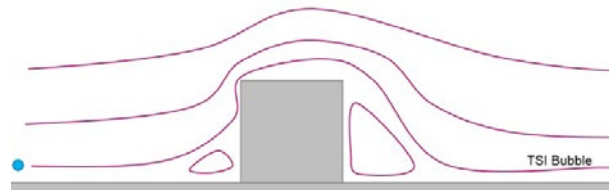


Image of bubbles providing high intensity for PIV measurements



High fidelity to follow the flow even around small structure

## Specifications

### Bubble Size

15  $\mu\text{m}$  (mean diameter)

### Bubble density

40  $\text{kg}/\text{m}^3$

### Aerosol output

$>10^7$  bubbles/sec

### Bubble images

9-16 pixels Gaussian (no glare points)

### Residence time

$>10$ s of minutes

### Relaxation time

$\sim 20$  microseconds

### Concentration at nozzle exit

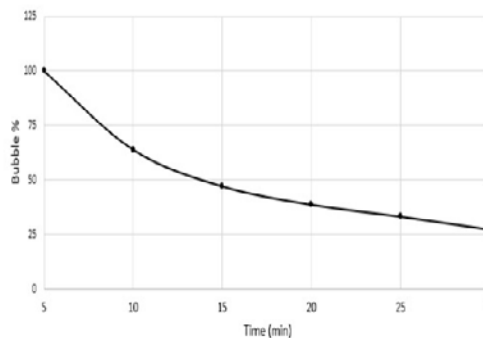
20,000/cc

### Number of nozzles

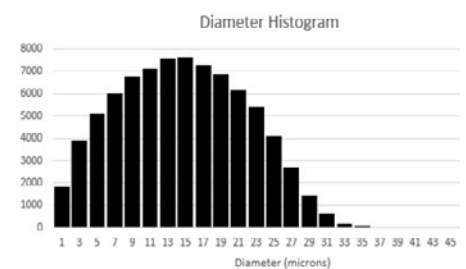
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Patent pending

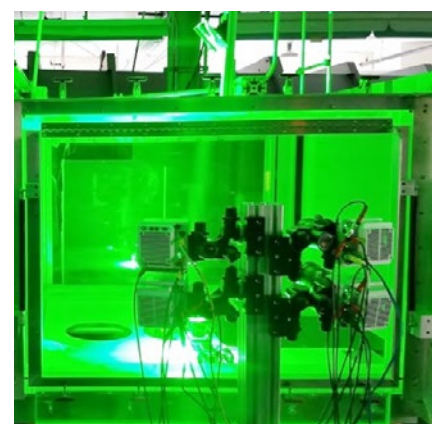
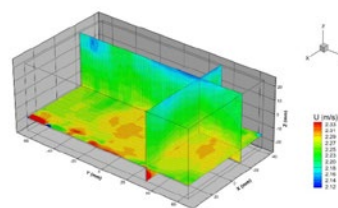
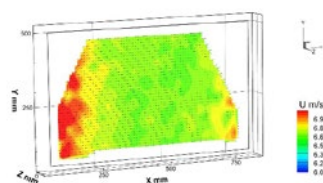
US 2011/0284648 A1



Bubbles with long residence time



Size distribution measured by Phase Doppler system



Volumetric PIV measurements and results in wind tunnel flow



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