

Gas Bubble Generation

Demonstration of the MitoS P-Pump for use in the generation of monodisperse compressed air bubbles in mineral oil on a microfluidic chip



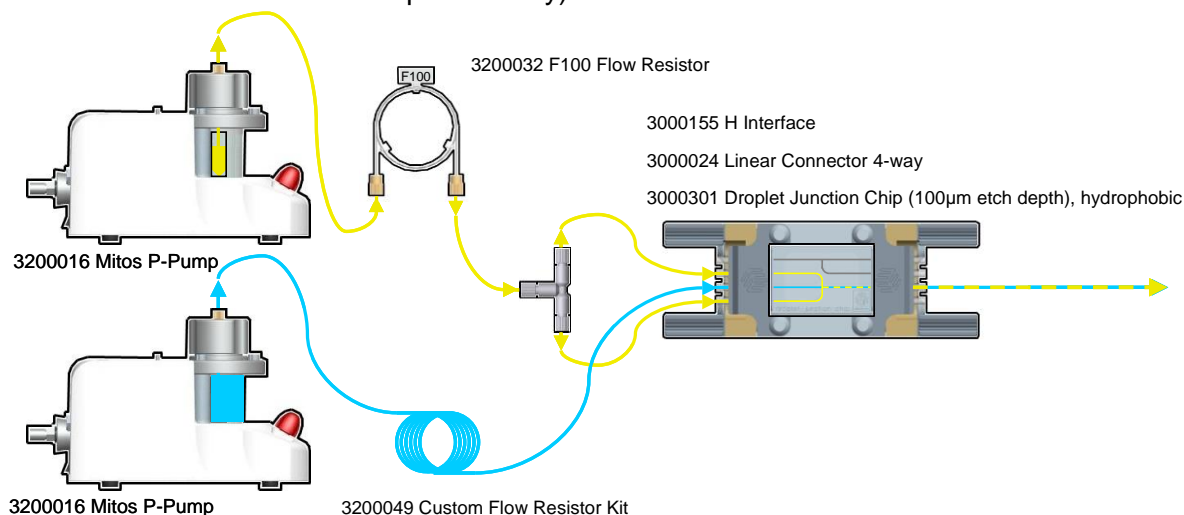
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About Gas Bubble Generation

Gas bubble generation on microfluidic chips is useful for the production of foams with micrometer sized gas bubbles dispersed in a liquid. Research in this field is enabling the development of advanced materials for science and industry. For many applications, it is important to generate monodisperse bubbles to obtain foams with consistent characteristics. This application note presents the Mitos P-Pump and Mitos Droplet Junction Chip for the generation of monodisperse gas bubbles.

Gas Bubble Generation Test Set-up

Gas was delivered to the chip using a Mitos P-Pump (Part No. 3200016) and Custom Flow Resistor Kit (Part No. 3200049) to bring the gas into the required flow rate range. The flow resistor interfaced directly into the Droplet Junction Chip (100 μ m etch depth), hydrophobic (Part No. 3000301) to minimize the compressible volume downstream. A second Mitos P-Pump provided the carrier oil flow into the chip via an F100 Flow Resistor (Part No. 3200032). A high speed video captured the gas bubble generation and the bubble monodispersity was measured using image analysis software. The gas used was compressed air and the carrier liquid was mineral oil with 5% v/v Span 80 (Span 80 is a surfactant used to increase droplet stability).



Experimental set-up for the generation of monodisperse gas bubbles on the Mitos droplet junction chip – hydrophobic with flow provided by the Mitos P-Pump

Results

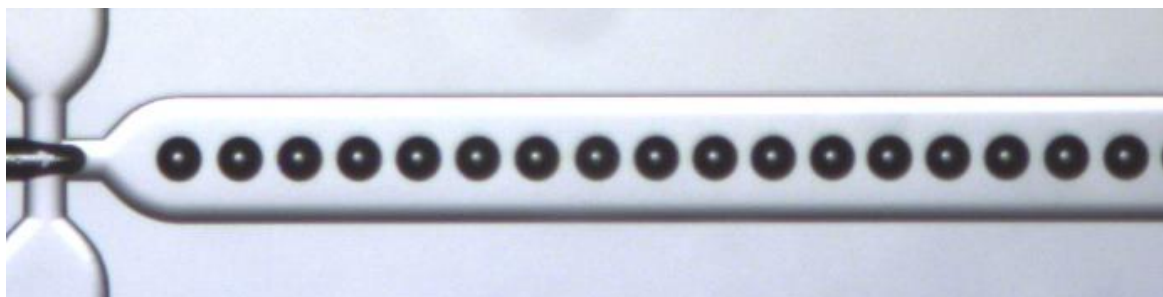
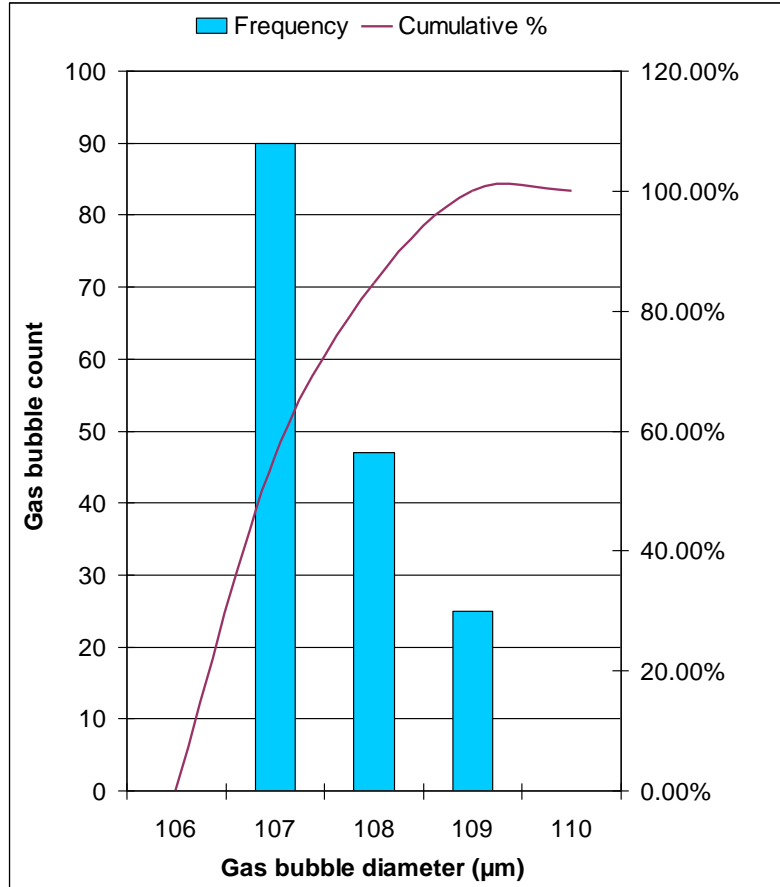


Image of compressed air bubbles (flow rate 2.1 $\mu\text{l}/\text{min}$) in a carrier phase of mineral oil with 5% v/v Span 80 (flow rate 16 $\mu\text{l}/\text{min}$) formed on the MitoS Droplet Junction Chip - Hydrophobic



Histogram of gas bubble size distribution with compressed air flow rate of 2.1 $\mu\text{l}/\text{min}$ and mineral oil with 5% v/v Span 80 flow rate of 16 $\mu\text{l}/\text{min}$. Sample data obtained with test set-up described above and processed using image analysis software

Measure of Distribution	Value
Mean Droplet Diameter	106.9 μm
Standard Deviation	0.7 μm
Minimum Droplet Diameter	106.4 μm
Maximum Droplet Diameter	108.9 μm
Coefficient of Variation	0.7 %

Table showing variation in gas bubble size

Conclusions

Highly monodisperse gas bubbles have been successfully generated on the Droplet Junction Chip (100 μm etch depth), hydrophobic. Monodispersity was achieved with the pulseless pressure pump technology of the MitoS P-Pump. This demonstration provides a test system and initial operating conditions for research into foam production.

Components List

Part No.	Part Description	#
3200016	Mitos P-Pump	2
3000024	Linear Connector 4-way	2
3000301	Droplet Junction Chip (100µm etch depth), hydrophobic	1
3000155	H Interface	1
3200049	Custom Flow Resistor Kit	1
3200271	F100 Flow Resistor	1



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