

## Development of Piezoelectric Gas Micropumps with the PDMS Check Valve Design

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**Abstract :** This paper presents the design and fabrication of a novel piezoelectric actuator for a gas micropump with check valve having the advantages of miniature size, light weight and low power consumption. The micropump is designed to have eight major components, namely a stainless steel upper cover layer, a piezoelectric actuator, a stainless steel diaphragm, a PDMS chamber layer, two stainless steel channel layers with two valve seats, a PDMS check valve layer with two cantilever-type check valves and an acrylic substrate. A prototype of the gas micropump, with a size of 52 mm × 50 mm × 5.0 mm, is fabricated by precise manufacturing. This device is designed to pump gases with the capability of performing the self-priming and bubble-tolerant work mode by maximizing the stroke volume of the membrane as well as the compression ratio via minimization of the dead volume of the micropump chamber and channel. By experiment apparatus setup, we can get the real-time values of the flow rate of micropump and the displacement of the piezoelectric actuator, simultaneously. The gas micropump obtained higher output performance under the sinusoidal waveform of 250 Vpp. The micropump achieved the maximum pumping rates of 1185 ml/min and back pressure of 7.14 kPa at the corresponding frequency of 120 and 50 Hz.

**Keywords :** PDMS, check valve, micropump, piezoelectric

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