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Micromachined Silicon Cantilever Paddle for High-Flow-Rate Sensing

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In this study, we exploit the bending-up of a cantilever paddle caused by residual stress to manufacture a micro-gas-flow-sensor for high-flow-rate sensing. Microsensors not only have a smaller physical size than their traditional counterparts, but also provide greater measurement accuracy and a higher sensitivity in the high gas flow velocity range. In this study, micro-electro-mechanical system (MEMS) techniques are used to deposit a silicon nitride layer on a silicon wafer to create a cantilever structure. A platinum layer is deposited on the silicon nitride layer to form a resistor and the structure is then etched to form a freestanding microcantilever. It is found that the cantilever slightly bends upward as a result of the released residual stress induced in the beam during the fabrication process. When airflow passes over the cantilever beam, a small deformation occurs. Variations in the airflow velocity can therefore be determined by measuring the changes in resistance caused by the beam deflection using an inductance-capacitance-resistance (LCR) meter. The experimental data indicate that the proposed gas flow sensor has a high sensitivity (0.0533 Ω/ms^{-1}), a high measurement limit (45 ms^{-1}) and a short response time (1.38 s).

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