

Micro-Optical Fabry-Perot Interferometer on Single-Mode Fiber End-Face for Gas-Flow-Sensing

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Abstract: Here, we demonstrate a high performance fiber-tip gas flow sensor by integrating an optical Fabry-Perot interferometers onto single-mode fiber end-face with all-in-one 3D laser nanoprinting technique. The device comprises of a suspended disk-shaped reflection polymer diaphragm, along with eight folding-shaped supporting pillars. The diaphragm was fabricated with a diameter of 50 μm and a thickness of 5 μm , while the eight folding-shaped supporting pillars were incorporated to increase the elasticity of cavity length, varying from 10 μm to 25 μm . To optimize the reflectivity and modulation depth of polymer mirror, we adjusted the scanning trajectory and achieved optimal result. The all-in-one printing method increased the stability of the Fabry-Perot interferometer, resulting in high fringe contrast at spectrum. When utilized as a gas flow sensor, the fiber-tip Fabry-Perot interferometer with a cavity length of 25 μm exhibited a stable linear response to various gas flow values in the range of 80–120 mL/min. It demonstrated a sensitivity of 60 pm/mL/min with the position of 0.5 mm away from the gas outlet. The proposed method offers great flexibility and potential for preparing optical fiber end-face devices in fiber sensing, imaging, detection, and other applications.

Keywords: Fiber-tip; Laser nanoprinting; Fabry-Perot interferometers; Scanning trajectory; Gas flow sensor

Biography: Fei Xie received the Ph.D. degree from Jinan University, Guangzhou, China, in 2023. Since 2021, He has been with Institute of Information Technology, Handan University, Handan, China, as a Lecture. His research interests include two-photon polymerization direct laser writing, optofluidic sensors and optical bio-sensing. He has published over 10 academic research papers and been granted 3 invention patents.

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