Optimizing Scanning trajectory for laser nanoprinting of Micro-Optical Fabry-Perot Interferometer integrated 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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