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$LiNbO_3$ waveguide based mirrorless fourier transform spectrometer

Zhi-mei Qi
Chinese Academy of Sciences, China

Abstract

Miniature Fourier transform infrared (FTIR) spectrometers are a portable analytical tool capable for rapid field detection and recognition of chemical and biological analytes. Owing to a large variety of applications, miniature FTIR spectrometers have attracted increasing interest from academic and industrial communities in the past decade. Rapid development of optical MEMS technology has led to implementation of miniature FTIR spectrometers based on millimeter-scale time-scanning Michelson interferometers. Such miniature FTIR spectrometers contain a mobile MEMS mirror to change the optical path difference (OPD), thereby still requiring an internal reference wavelength for accurate OPD measurement. Moreover, the MEMS mirror easily titles during large-range scanning, consequently impairing the interference signal and affecting the results measured with the spectrometer. Here we report a mirrorless stationary miniature FTIR spectrometer based on a $LiNbO_3$ waveguide Mach-Zehnder interferometer (MZI) with push-pull electrodes. The spectrometer retrieves spectra in a wavelength range 1100 nm to 1700 nm in which the $LiNbO_3$ waveguide MZI is a single-mode device. Interferogram of the MZI was produced by scanning a ramp voltage applied between the push-pull electrodes of the device. The OPD at a wavelength at a given ramp voltage is determined by a ratio of this voltage to the half-wave voltage corresponding to this wavelength, and the spectrometer does not need a reference laser for OPD measurement. The robust structure of the MZI with fiber coupling but without having a moving mirror and a reference laser renders the spectrometer simple and resistant to vibration and environmental interference. We have used the spectrometer as a NIR laser wavelength meter with a high accuracy.

Biography

Zhi-mei Qi was born in Inner Mongolia Autonomous Region, China, in 1967, received the Dr. Eng from Yokohama National University, Japan, in 2001. From 2001 to 2007, he worked as a JST postdoctoral fellow in AIST, Tsukuba city, Japan. In 2007 he joined Institute of Electronics, Chinese Academy of Sciences, where he currently works as a professor and a team leader for developing biochemical sensors based on optical waveguides and SPPs. He published more than 60 papers in the peer-reviewed journals, and holds 5 Japanese patents and 7 Chinese Patents. He is a lifetime OSA member.