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1. 概要（Summary）

The main goal of our research is to develop an interferometer based on photonic integrated circuits (PIC) for distributed sensing using optical frequency domain reflectometry (OFDR) in order to reduce size, weight and cost of current system.

In this work we evaluate temperature sensing capabilities of OFDR system with PIC-based interferometer.

2. 実験（Experiment）

【利用した主な装置】

ステルスダイサー、高精細電子顕微鏡、LL 式高密度汎用スパッタリング装置

【実験方法】

Early prototypes of the PIC-based interferometer were fabricated using electron-beam lithography. In intermediate stages of the fabrication process the circuit was inspected by SEM Regulus 8230. At the last stage, the chip was coated with SiO_2 using sputtering machine CFS-4EP-LL and cut with stealth dicer.

An OFDR system was assembled by connecting tunable laser Santec TSL-550 and two avalanche photodetectors APD-430C to the ports of photonic chip with integrated interferometer and a waveguide Bragg grating (WBG). Laser was set to continuously sweep the wavelength in the range 1520 – 1570 nm. The interference signal received by two photodetectors was sampled by National Instruments digitizer PXI-5922 at 1 MS/s.

Temperature of the chip holder was changed by PTC heater in the range from 25 ºC to 80 ºC, while temperature was monitored by two thermocouples. The interference signals and temperature were measured at each temperature step.

3. 結果と考察（Results and Discussion）

STFT was applied to every recorded interference signal. From obtained spectrograms (Fig. 1) spectrums of WBG were extracted at different locations along the grating. From an approximated Bragg wavelength shifts caused by temperature change, a temperature sensitivity of WBG was measured to be 65 pm/ºC at location corresponding to the beginning of Bragg grating.

These results are demonstrating first distributed measurement of temperature using OFDR sensing system with interferometer based on PIC.

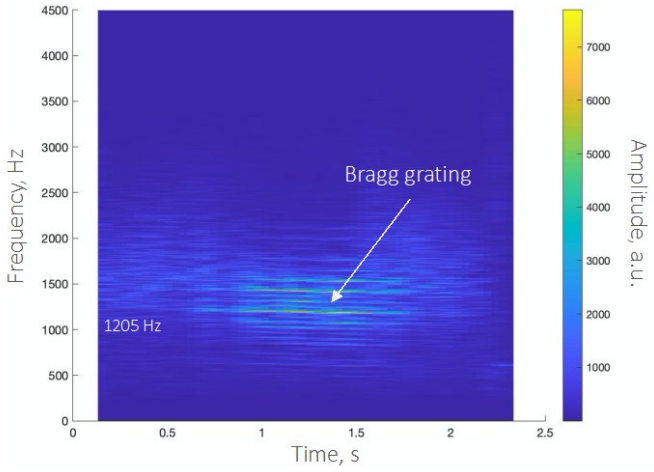

Figure. 1 Spectrogram of interferometer signal. Reflection from Bragg grating.

4. その他・特記事項(Others)

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5. 論文・学会発表(Publication/Presentation)

V. Shishkin, A. Higo, H. Murayama, Proceedings of Technical Committee on Optical Fiber Technologies (OFT) 2020, 3rd meeting, (2020).

6. 関連特許(Patent)

なし