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RESONATOR INTEGRATED OPTIC GYRO BASED ON SINGLE-POLARIZATION SILICON NITRIDE WAVEGUIDE RING RESONATOR

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Resonator integrated optic gyros (RIOGs) have been attracting much attention due to the advantages of low cost, small size, light weight and low power-consumption. With the development of the RIOG, polarization-induced noise is proved to be the main factor which limits the sensitivity of RIOG when temperature fluctuates. As the core sensing coil of the RIOG, the waveguide ring resonators (WRR) with high polarization dependent loss is introduced to suppress polarization noise for improving the long-term and temperature-dependent performances of the RIOG system. In this paper, a novel single-polarization silicon nitride waveguide ring resonator (WRR) is designed to suppress the polarization noise. Diameter, finesse, and quality factor of the WRR are 35 mm, 20.8, and 2.1×106, respectively. Its single-polarization performance is also proved by temperature sweep experiment. According to the experiments, the polarization dependent loss of the silicon nitride waveguide fabricated here is around 9.7 dB/cm. Compared with traditional silica WRR, by using the single-polarization silicon nitride WRR, the polarization induced peak-to-peak gyro bias drift is theoretically suppressed by more than 35 dB in full temperature range. According to the simulation, this error can be less than 0.3°/h when polarization dependent loss is higher than 16.7dB/cm, which is equal to the RIOG theoretical limited sensitivity. The RIOG based on the silicon nitride WRR is also built up and tested. The one-hour bias stability with 10 seconds integral time of the RIOG is around 2.5 deg/s, which is first report of the RIOG based on the silicon nitride WRR. This work proposes a feasible way to design the scheme of polarization noise suppression and provides a theoretical foundation for the future advance of integrated optic gyro at full temperature by using the single-polarization silicon nitride waveguide ring resonator.

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