課題番号　　:F-14-UT-0145
利用形態　　:機器利用
利用課題名（日本語）　　:スパッタ SiN によるシリコンフォトニクスプラットフォームに関する研究
Program Title (English)　　:A study on silicon photonics platform by sputtered silicon nitride
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1. 概要（Summary）

Silicon photonics realized on chip communication in micro meter scale with advantage of low power consumption and achievable high communication capacity by wavelength multiplexing (WDM). For further improvement on WDM, Large band gap and thermally stable material is important. Sputtered silicon nitride is well known and applied for CMOS end-of-line passivation; while little consideration was done for its possibility on optical application, especially after chemical vapor deposition (CVD) had become major film preparation method. In this study, the demonstration of a sputtered silicon nitride platform for silicon photonics is set as the object.

2. 実験（Experimental）

We prepared ring resonator and optical waveguides to estimate the transmission quality of the sputtered silicon nitride film, and measured thermo-optic behavior of the ring resonator. Both are important properties that affect WDM channel spacing, i.e. optical signal density. The fabrication process including film deposition, device patterning lithography as well as dry/wet etching process is all done using facilities in Takeda-Cleanroom.

3. 結果と考察（Results and Discussion）

Optical transmission of sputtered silicon nitride waveguide with cladding is similar to conventional Si waveguide. (Fig. 1) Optical loss mechanism should be dominated by inner scattering of the coarse film structure. The thermo-optic property of the silicon nitride was comparable to the CVD silicon nitride. (Fig. 2) As sputtered silicon nitride is free from N-H bonding absorption, which has a large absorption peak (~10 dB/cm) within communication range, it takes advantage on CVD for the larger available bandwidth. In a brief calculation, 3 times as many as channels could be implemented in WDM system using sputtered silicon nitride compared to Si platform.

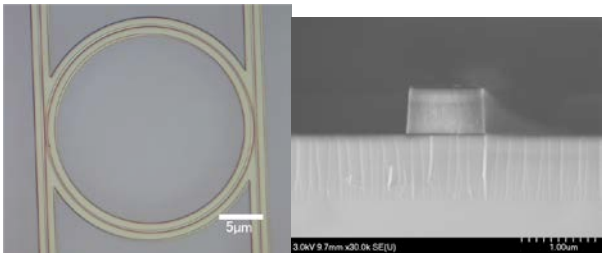

Fig. 1 Fabricated ring resonator. And cross section of a waveguide.

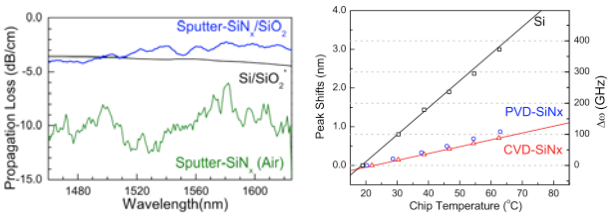

Fig. 2 Measured optical transmission and thermo-optic resonance peak shift of a ring resonator.

4. その他・特記事項（Others）

None

5. 論文・学会発表（Publication/Presentation）

(1)SPIE Group IV photonics 2014,
Ziyi Zhang, et al.
(2)JSAP 2014; The 75th Autumn Meeting
Ziyi Zhang, et al.

6. 関連特許（Patent）

None