

課題番号 : F-16-UT-0057
利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : Development of suspended membrane silicon nanowires for on-chip nonlinear optical signal processing
利用者名(日本語) : 呂国伟¹⁾, 程振洲²⁾, 肖廷辉²⁾
Username (English) : G. -W. Lu¹⁾, Z. Cheng²⁾, T. -H. Xiao²⁾
所属名(日本語) : 1) 東海大学創造科学技術研究機構, 2) 東京大学大学院理学系研究科
Affiliation (English) : 1) Institute of Innovative Science and Technology, Tokai University
2) School of Science, The University of Tokyo

1. 概要(Summary)

Due to the large χ^3 nonlinearity of the material and nanoscale mode confinement, silicon waveguides show extremely high optical nonlinearities which have been used to develop novel optical components for signal processing. Compared with χ^3 nonlinearity, namely four wave mixing, stimulated Brillouin-scattering (SBS), which involves coherent coupling between guided photon and phonon modes, has not been well developed on silicon platforms due to the poor photon confinement in traditional silicon waveguides. In this project, we plan to use suspended membrane silicon nanowires to develop high-efficiency SBS devices for realizing high-efficiency on-chip single processing functionalities for next-generation on-chip devices and systems.

2. 実験(Experiment)

【利用した主な装置】

高速大面積電子線描画装置 (F5112), 高速シリコン深堀りエッチング装置, 電子顕微鏡

【実験方法】

We designed and fabricated suspended membrane silicon nanowires based on a commercial silicon-on-insulator (SOI) wafer. We utilized electron beam lithography (F5112) to write the devices' patterns on a resist (ZEP-520A) and used a deep reactive ion etching machine (MUC21-ASE) to transfer the patterns from the resist to the wafer. We repeat the above processes for fabrication of

ridge waveguides and grating couplers, respectively. The buried oxide (BOX) below the photonic devices was finally removed by using hydrofluoric acid solution, such that the silicon nanowires are supported by two-side cantilevers. After fabrication, we checked the structure of the fabricated devices by using a scanning electron microscope (S-4700).

3. 結果と考察(Results and Discussion)

The scanning electron microscope image of the fabricated suspended membrane silicon nanowires is shown in Fig. 1. Suspended membrane silicon nanowires were successfully fabricated on the SOI wafer. The periodic holes beside the waveguide are used for removing the BOX. Now we are working on experimental testing of fabricated devices.

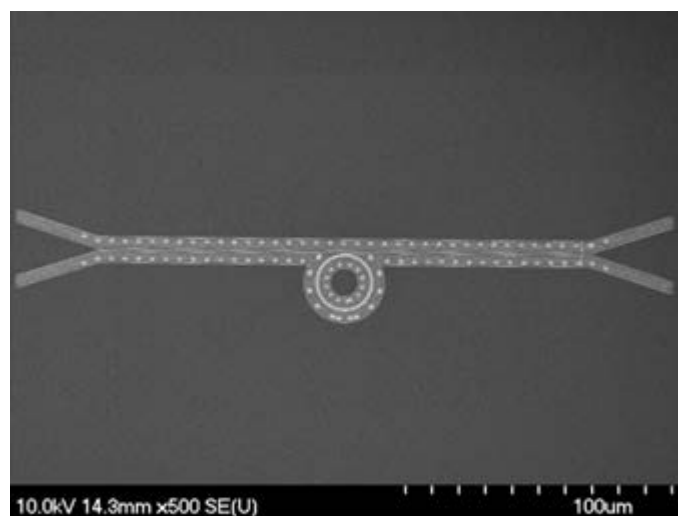


Figure1 Scanning electron microscope image of a silicon suspended membrane nanowire micro-ring resonator

4. その他・特記事項(Others) なし

5. 論文・学会発表(Publication/Presentation) なし

6. 関連特許(Patent) なし