

課題番号 : F-19-UT-0042  
利用形態 : 機器利用  
利用課題名(日本語) : グラフェンを用いたシリコンフォトニクスの研究  
Program Title (English) : Graphene-based Silicon Photonic Devices  
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キーワード/Keyword : シリコンフォトニクス、光変調器、グラフェン、リソグラフィ・露光・描画装置

## 1. 概要(Summary)

In Yamashita-Set Lab, we are working on high speed on chip-optical devices, integrated with graphene. Final goal is the fabrication and testing of high-speed graphene modulators and photodetectors on silicon waveguides.

## 2. 実験(Experimental)

### 【利用した主な装置】

超高速大面積電子線描画装置 (ADVANTEST F7000S-VD02), 高速シリコン深掘りエッチング装置 (SPTS MUC-21 ASE-Pegasus), 走査型電子顕微鏡 (SEM)

### 【実験方法】

In the Takeda cleanroom, we use F7000S-VD02 e-beam machine and negative and positive resists to fabricate silicon waveguides and functional devices of sub-micron sizes. Figure 1 shows a typical ridge waveguide with subwavelength grating couplers. And Figure 2 shows an array of bended and tapered silicon waveguides for reducing the loss caused by intra-reflection.

Both images were taken by the optical microscope in CR1. The etching was done by SPTS MUC-21 ASE-Pegasus.

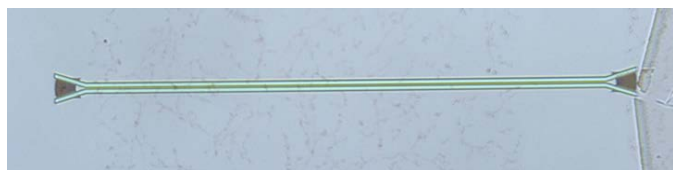


Figure 1 A typical ridge waveguide with subwavelength grating couplers

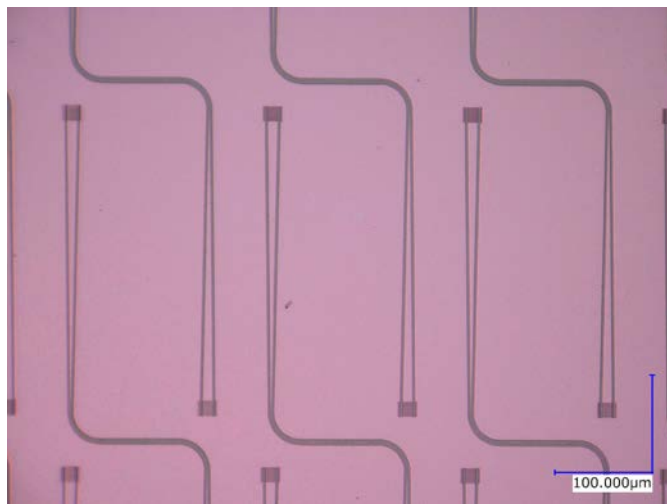


Figure 2 an array of bended and tapered silicon waveguides

## 3. 結果と考察(Results and Discussion)

In H31/R1 year, we mainly researched about the relationship between the nonlinearity and the design of the waveguides. It shows that the Kelly sidebands could be reduced by changing the design of the waveguides, such as bending, tapering, and stretching the cover length of graphene which could enhance the saturable absorption.

## 4. その他・特記事項(Others)

なし

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

B. Wu, Z. Luo, T.-H. Xiao, L. Jin, K. Goda, S. Y. Set, and S. Yamashita, “ Nonlinear Properties of Graphene Patterned Si Waveguides for Fiber Lasers”, 応用物理学会春季学術講演会, 14p-PB3-3, 上智大学四谷キャンパス, 2020年3月

## 6. 関連特許(Patent)

なし