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 利用課題名(日本語) :
 Program Title (English) : Research on Photonic Integrated Circuits for OFDR sensing system
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1. 概要(Summary)

The main goal of our research is to develop an interferometer based on photonic integrated circuits for Optical Frequency Domain Reflectometry (OFDR) sensing system in order to reduce size, weight and cost of current system.

In this work we study HSQ resist thickness and exposure dose variations to find optimal conditions for fabrication of photonic integrated circuits.

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
 汎用 ICP エッチング装置
 高精細電子顕微鏡

【実験方法】

HSQ was spin-coated on four 2x2 cm Si chips at 1000, 2000, 3000 and 4000 rpm and baked at 150 °C for 2 min. Thickness of resist was measured by SEM Regulus 8230 and NanoSpec.

Electron beam lithography was performed on the chip with HSQ spin-coated at 3000 rpm. Twenty patterns of a grating coupler were placed on the same chip and fabricated with dose variations from 100 to 575 $\mu\text{C}/\text{cm}^2$ with incremental step of 25 $\mu\text{C}/\text{cm}^2$. After 4 minutes development in NMD-3, the chip was etched for 50 seconds using ULVAC CE-300I. Each pattern was checked by SEM.

3. 結果と考察(Results and Discussion)

HSQ thicknesses measured by SEM and NanoSpec are presented in following table:

Spin-coating, rpm	SEM, nm	NanoSpec, nm
1000	226	218
2000	155	145
3000	123	130
4000	115	120

Spin-coating at 1000 rpm provides HSQ thickness over 200 nm and allows etching of Si more than 220 nm, which is suitable for waveguides fabrication.

SEM inspection shows that exposure doses of less than 300 $\mu\text{C}/\text{cm}^2$ are not enough and more than 400 $\mu\text{C}/\text{cm}^2$ are leading to overexposure (Fig. 1).

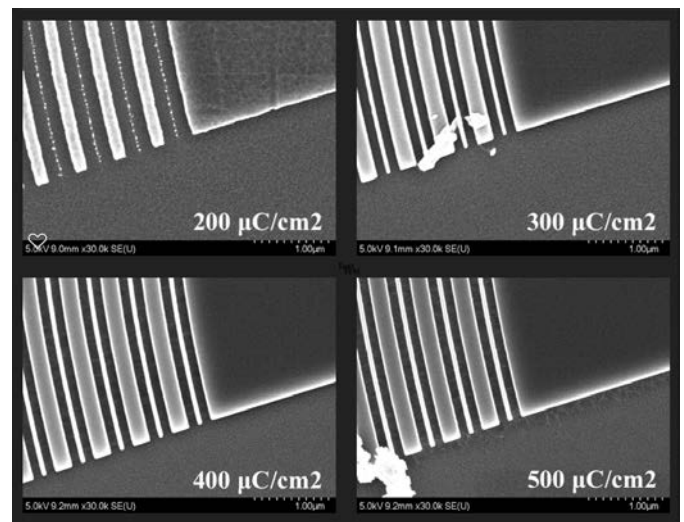


Figure 1. SEM pictures of fabricated patterns.

4. その他・特記事項(Others)

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5. 論文・学会発表 (Publication/Presentation)

V. Shishkin, K. Tanaka, H. Murayama,
Proceedings of 26th ISTE International Conference
on Transdisciplinary Engineering, (2019).

6. 関連特許 (Patent)

なし