※課題番号　：F-12-UT-0112
※支援課題名（日本語）　：GCIB を用いたリング共振器の共振波長制御
（日本学術振興会/先端拠点事業／JSPS Core-to-Core Program）
※Program　Title（in English）　：Resonant Frequency Control of Ring Resonator by GCIB
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※概要（Summary）：
電子ビーム露光装置を用いる事により,リング共振器を東大にて作製し,兵庫県立大のオリジナル技術である Gas Cluster Ion Beam (GCIB) エッチング技術によるリングの共振波長を制御する技術の開発中。

※実験（Experimental）：
The waveguide patterns were defined via electron beam lithography system and then etched by the reactive ion etching system using Cl_2 and O_2 as the etchants. For the GCIB processing, SF_6 gas was selected as the gas source. GCIB doses from 1 to 6×10^{14} ions/cm^2 were carried out to treat on microring resonators with the same design. To characterize the effects of GCIB process on waveguide trimming, the quasi-TE mode transmission spectra of microring resonators were measured by using a tunable laser at C-band before and after the GCIB process.

※結果と考察（Results and Discussion）：
The transmission measurement results of silicon ring resonators show that the resonant peaks can be shifted by GCIB treatment, with a peak-shift rate of 0.13 ± 0.03 nm/(10^{14} ions/cm^2). The AFM images indicate that the surface roughness does not increase obviously under the GCIB dose of 5×10^{14} ions/cm^2. Under the GCIB irradiation dose of 5×10^{14} ions/cm^2, the root mean square of surface roughness increases a little from 0.24 nm for the original surface to 0.68 nm for the GCIB treated surface. Due to the thinning down of waveguide by GCIB treatment, it can be observed that the resonant peak shifts proportionally with the increase of GCIB doses as shown in Fig.1. Since it is easy and to precisely control the GCIB irradiation dose, the GCIB treatment is a promising way to trim silicon microring resonators and other photonic devices for a designed add/drop wavelength.

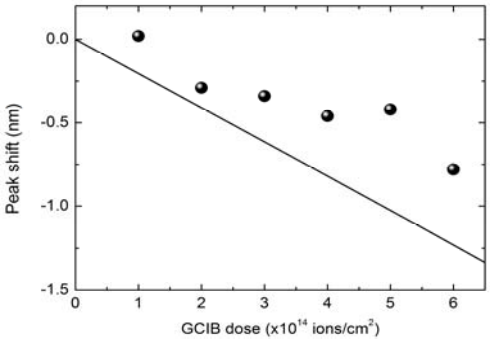

Fig. 1 Silicon microring resonators peak shift under various GCIB doses. The solid line is the estimation of peak shift as a function of GCIB doses.

※その他・特記事項（Others）：なし

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論文・学会発表
（Publication/Presentation）：
J. Cai, K. Sumie, N. Toyoda, Y. Ishikawa, and K. Wada, “Gas cluster ion beam treatment for silicon waveguide trimming”, 9*th* *IEEE International Conference on Group IV Photonics (GFP)*, San Diego, USA, 2012.08.29-31.

関連特許（Patent）：なし