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利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : Development of a novel silicon nanodisk array for molecular sensing
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1. 概要(Summary)

Metallic nanostructures are commonly exploited as basic elements for molecular sensing by virtue of surface plasmon resonance (SPR) on the nanostructures. However, their intrinsic high ohmic loss amplified by the SPR results in low energy efficiency and large photothermal heat generation, severely limiting their performance and practical utility. To overcome the above limitation, we demonstrated an all-dielectric molecular sensing platform based on a silicon nanodisk array. We explored the Mie resonance in the silicon nanodisk array as a counterpart of SPR on metals to enhance the light-molecule interaction in the near-field for the sensing applications.

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), 走査型電子顕微鏡 (Hitachi S-4700)

【実験方法】

We designed and fabricated the device based on a silicon-on-insulator (SOI) wafer. We utilized electron beam lithography (F7000) to write the device's pattern on a resist (HSQ) and used an inductively coupled plasma etcher to transfer the patterns from the resist to the SOI wafer. Then, the left resist was removed with hydrofluoric acid. After fabrication, we checked the structure of the fabricated devices by using a scanning electron microscope (SEM) (S-4700).

3. 結果と考察 (Results and Discussion)

The SEM images of the fabricated silicon photonic nanodisk array is shown in Figure 1. We used the fabricated device to perform optical sensing of various chemical molecules, such as pinene and tartaric acid. We successfully demonstrated a factor of >100 enhanced light-molecule interaction in the near-field for the sensing applications.

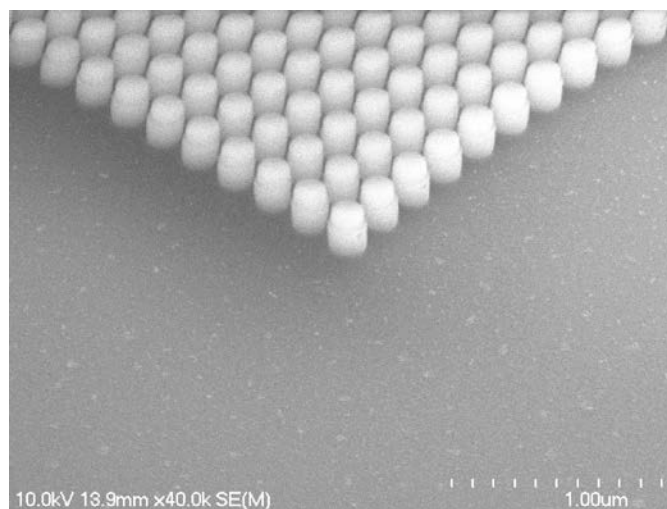


Figure 1. SEM images of the fabricated silicon nanodisk array

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