

課題番号 : F-16-UT-0148
利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : NIR spectrometer using a Schottky photodetector enhanced by grating-based SPR
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1. 概要(Summary)

Spectrum measurement in near infrared range was realized using a Schottky photodetector. The photodetector was fabricated by patterning an Au grating on the surface of n-type silicon. The common grating-based spectrometers utilizes the diffraction of gratings to separate different wavelengths and photodetectors to change the light to current. There is optical path between the two. However, the spectral resolution of grating-based spectrometers is lower because the shorter length of the optical path when the spectrometer is small-scale. In this work, the surface plasmon resonance (SPR) was used to select the sensitive wavelength of the Schottky photodetector. The light is coupled on the surface of the Au grating. Then the generated hot electrons are collected by the Schottky junction formed by Au and n-type silicon. The whole process occurs on the surface of the grating and inside the photodetector. Therefore, the optical path in conventional grating-based spectrometers is no longer necessary. In addition, a matrix calculation method is used to separate the signals of different wavelengths.

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置 ADVANTEST F5112+VD01

【実験方法】

E-beam exposure tool was used to make the photomask of the Au grating of the proposed photodetector. After the photomask was obtained, the lift-off process was used to form the Au grating on the surface of an n-type silicon wafer.

3. 結果と考察(Results and Discussion)

Spectrum of light with single and mixed multiple wavelengths from 1470 nm to 1570 nm were measured by a fabricated Schottky photodetector. The measured results were approximately consistent with those measured by two commercial spectrometers, which have 12 nm and 5 nm spectral resolutions respectively. The spectral resolution of the Schottky photodetector depends on the full width at half maximum value of the SPR curve, which can be further improved by optimizing the design of the grating.

4. その他・特記事項(Others)

なし.

5. 論文・学会発表(Publication/Presentation)

(1) Wenjing Chen, Tetsuo Kan, Yoshiharu Ajiki, Kiyoshi Matsumoto, and Isao Shimoyama, "NIR spectrometer using a Schottky photodetector enhanced by grating-based SPR," Optics Express, vol. 24, issue 22, pp. 25797-25804, 2016.

6. 関連特許(Patent)

なし.