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利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : Photoconductivity spectroscopy of individual carbon nanotube
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キーワード/Keyword : Carbon nanotube, photoconductivity, excitons, リソグラフィ・露光・描画装置

1. 概要(Summary)

We investigate the electronic bandgap of single walled carbon nanotube using simultaneous measurement of Photoluminescence and Photoconductivity spectroscopy.

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置、汎用 ICP エッチング装置、アニール炉、ステルスダイサー、川崎ブランチスパッタリング装置

【実験方法】

A single walled carbon nanotube (SWCNT) based field effect transistor (FET) devices are fabricated using Si/SiO₂ substrate. The deep trenches of 500nm are also fabricated using electron beam lithography (EBL) and dry etching method. The samples are oxidized in an annealing furnace for 60 minutes at 1050°C.

The electrode of 2 nm Ti and 40 nm Pt are deposited using second EBL and sputtering technique for the photocurrent measurements. The electrodes are again patterned using EBL for the deposition of the catalyst area. The suspended carbon nanotubes are grown over the trenches through chemical vapor deposition method at 800°C for 1min. The Photoluminescence (PL) and Photoconductivity (PC) of suspended SWCNT based FET devices are characterized by home built microspectroscopy system. A continuous-wave Ti:sapphire laser of wavelength 750-950 nm is used to

focus on the sample by objective. An InGaAs photodiode array attached to a spectrometer is used to detect the signal from the nanotube.

3. 結果と考察(Results and Discussion)

We have successfully fabricated the SWCNT based FET devices as shown in Fig.1.

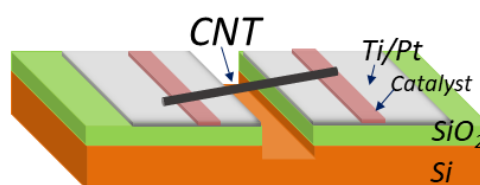


Fig.1 A schematic diagram of CNT based FET devices.

The simultaneous PL and PC are measured on SWCNT based FET devices. We performed excitation dependent PL measurements to verify the chirality of the suspended nanotube.

4. その他・特記事項(Others)

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5. 論文・学会発表(Publication/Presentation)

[1] A. Sharma, *et al.*, "Molecular screening effects on bandgap renormalization in air-suspended single-walled carbon nanotubes" conference on Fundamental Optical Processes in Semiconductors (FOPS) (August 4-9,2019), Canada.

6. 関連特許(Patent)

None