

課題番号 : F-18-UT-0075
 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

1. 概要(Summary)

We investigate the electronic band 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、高速シリコン深掘りエッチング装置、クリーンドラフト潤沢超純水付、ステルスダイサ

【実験方法】

A single walled carbon nanotube (SWCNT) based field effect transistor (FET) devices are fabricated using silicon substrate of resistivity $\sim 0.01-0.02 \Omega \cdot \text{cm}$ and 300 nm oxide layer. The deep trenches of 500 nm are also fabricated using electron beam lithography and dry etching method. In order to cover trenches with oxide layer, the samples are again oxidized in an annealing furnace for 60 minutes at 1050 °C.

The contact electrode of 1.5 nm Ti and 4 nm Pt for the photocurrent measurements are deposited using an additional step of electron lithography and sputtering technique. The contact electrodes are again patterned using third step of electron beam lithography 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 1 min.

The 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. The PL is collected through the

same objective lens. An InGaAs photodiode array attached to a spectrometer is used to detect the signal from the nanotube. All measurements are done at room temperature in presence of dry nitrogen.

3. 結果と考察(Results and Discussion)

We have successfully fabricated the SWCNT based FET devices as shown in Fig. 1. In order to determine the aligned SWCNT between the trenches of gap 700 nm, we performed 2D PL scanning.

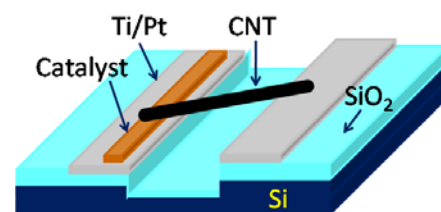


Fig. 1 A schematic diagram of CNT based FET devices.

The simultaneous PL and photocurrent are measured on SWCNT based FET devices. The correspondence nature of PL and PC indicates that the signal are coming from the same nanotube. We performed excitation dependent PL measurements to verify the chirality of the suspended nanotube. We investigated the angle of the suspended SWCNT through the laser polarization dependent PL.

4. その他・特記事項(Others)

Alka Sharma is an international JSPS fellow.

5. 論文・学会発表(Publication/Presentation)

None

6. 関連特許(Patent)

None