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利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : Dielectric screening effects on photoluminescence of carbon nanotubes on hexagonal boron nitride
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1. 概要(Summary)

We investigate the photoluminescence of CNTs on *h*-BN in this project.

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置、クリーンドラフト潤沢超純水付、高速シリコン深掘りエッチング装置、ステルスダイサー

【実験方法】

We perform electron-beam lithography and dry etching to form the trenches, followed by oxidization to form ~ 70 nm-thick SiO₂. Catalyst regions near the trenches are patterned by a second electron beam lithography step. ~ 1.5 angstrom Fe film is deposited by electron-beam evaporator as catalyst for the CNT growth. CNTs are synthesized by alcohol chemical vapor deposition at 800 °C for 1 min. *h*-BN flakes are prepared on PDMS by mechanical exfoliation, and then transferred on target CNTs by using the micromanipulator system.

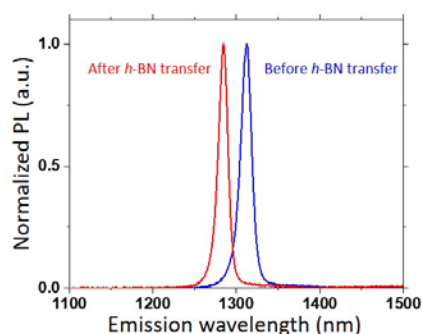


Figure 1. Normalized photoluminescence of the CNT before and after *h*-BN transfer.

3. 結果と考察(Results and Discussion)

After the transfer of *h*-BN on the suspended CNT, we observed redshift in PL to be ~ 30 nm as shown in Figure 1. We attribute this redshift to the dielectric screening effect from the *h*-BN flake.

4. その他・特記事項(Others)

Collaborators: Takashi Taniguchi, Kenji, Watanabe, Kosuke Nagashio. Work supported by JSPS (KAKENHI JP19K23593, JP16H05962), and MIC (SCOPE 191503001). K. O. is supported by JSPS Research Fellowship. We acknowledge the Advanced Manufacturing Support Team at RIKEN and T. Nishimura for technical assistance.

5. 論文・学会発表(Publication/Presentation)

[1] N. Fang, K. Otsuka, T. Taniguchi, K. Watanabe, K. Nagashio, Y. K. Kato, “Dielectric screening effects on photoluminescence of carbon nanotubes on hexagonal boron nitride”, 第 67 回応用物理学会春季学術講演会, 東京都(2020 年 3 月 12-15 日).

[2] N. Fang, K. Otsuka, T. Taniguchi, K. Watanabe, K. Nagashio, Y. K. Kato, “Dielectric screening effects on photoluminescence of carbon nanotubes on hexagonal boron nitride”, 第 58 回フラーレン・ナノチューブ・グラフェン総合シンポジウム, 東京都(2020 年 3 月 15-17 日).

6. 関連特許(Patent)

なし