

課題番号 : F-20-UT-0056
 利用形態 : 機器利用
 利用課題名(日本語) :
 Program Title (English) : Hexagonal boron nitride as an ideal substrate for carbon nanotube photonics
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 キーワード/Keyword : リソグラフィ・露光・描画装置、Lithography, carbon nanotubes, hexagonal boron nitride

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 SiO_2 . 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.

3. 結果と考察(Results and Discussion)

After the transfer of *h*-BN on the suspended CNT, we observed redshift in E_{11} and E_{22} of ~ 50 meV. 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 in part by JSPS (KAKENHI JP19K23593, JP16H05962, JP19H00755), MIC (SCOPE 191503001), and MEXT (Nanotechnology Platform JPMXP09F19UT0075). Growth of hexagonal boron nitride crystals supported by the MEXT Element Strategy Initiative to Form Core Research Center, Grant Number JPMXP0112101001 and JST (CREST JPMJCR15F3). 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, A. Ishii, T. Taniguchi, K. Watanabe, K. Nagashio, and Y. K. Kato “Hexagonal Boron Nitride as an Ideal Substrate for Carbon Nanotube Photonics”, *ACS Photonics*, 7, 7, 1773 (2020).

6. 関連特許(Patent)

なし

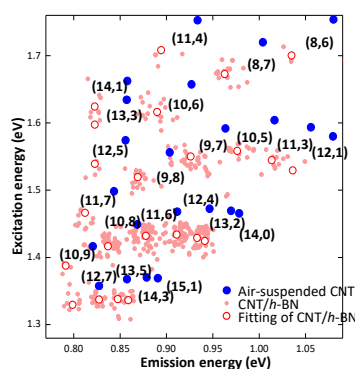


Figure 1. PLE peaks of CNT/*h*-BN samples, air-suspended CNTs, and fitted values.