

課題番号 : F-17-UT-0058
利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : Enhanced Raman Scattering of Graphene using Silicon Photonic Nanocavity
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キーワード/Keyword : Raman scattering, graphene, photonic crystal, リソグラフィ・露光・描画装置

1. 概要(Summary)

We investigate the enhancement of the G' Raman scattering of graphene by coupling to the L3 silicon photonic nanocavity.

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、ステルスダイサー

【実験方法】

Resist is spin-coated on top of the Silicon on Insulator substrate. Afterward, photonic crystal pattern is drawn by the electron beam lithography, and the hole is etched by ICP dry etching. Then, the SiO₂ layer is etched using hydrofluoric acid and the substrate is divided into chips by a stealth dicer.

Graphene is grown on copper substrate and transferred onto the silicon photonic substrate. Optical measurements are performed on the samples.

3. 結果と考察(Results and Discussion)

We investigate excitation wavelength dependence (Figure 1) and observe the Raman peak enhancement when the emission is on-resonance with the cavity. Optical measurements show that the Raman can be efficiently coupled to the 2nd, 3rd, and 5th mode of the photonic cavity, and spatial imaging measurements confirm that the enhancement is confined at the cavity position. The emission wavelength of the enhanced Raman

scattering can be tuned by varying the lattice constant and radius of the photonic crystal.

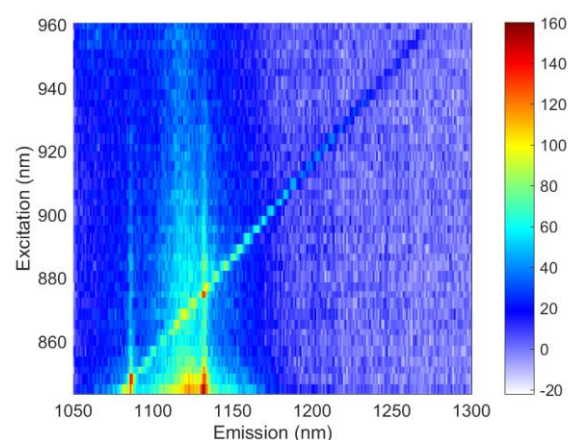


Figure 1. Photoluminescence excitation map of cavity-enhanced Raman scattering.

4. その他・特記事項(Others)

Collaborators: 柏昂太郎、井ノ上泰輝、千足昇平、丸山茂. This work is supported by JSPS (KAKENHI JP16K13613) and MEXT (Photon Frontier Network Program, Nanotechnology Platform).

5. 論文・学会発表(Publication/Presentation)

- (1) W. Gomulya, H. Machiya, K. Kashiwa, T. Inoue, S. Chiashi, S. Maruyama, Y. K. Kato, "Enhanced Raman Scattering of Graphene using Silicon Photonic Nanocavity", *The 5th Symposium on RIKEN Center for Advanced Photonics*, Sendai, Japan (November 2019, 2017)

6. 関連特許(Patent)

None