

課題番号 : F-18-UT-0070
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 double resonance in silicon photonic crystal nanocavities
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キーワード/Keyword : Raman scattering, graphene, photonic crystal

1. 概要(Summary)

We investigate the enhancement of the G' Raman scattering of graphene by coupling to the double resonance on the 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)

Excitation wavelength dependence show a large Raman peak enhancement when the excitation and emission wavelengths meet the double resonance condition. The enhanced Raman intensity is ~60 times higher than on-substrate Raman signal. The emission wavelength of the enhanced Raman scattering can be tuned by varying the radius of the photonic crystal.

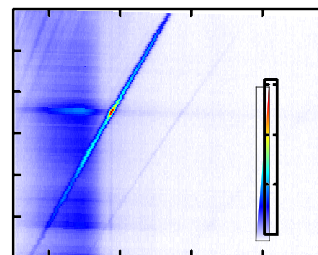


Figure 1. Photoluminescence excitation map of double resonance-enhanced Raman scattering.

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 JP25107002) and MEXT (Photon Frontier Network Program, Nanotechnology Platform). W. G. is an International Research Fellow of JSPS.

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 double resonance in silicon photonic crystal nanocavities", *Appl. Phys. Lett.* **113**, 081101 (2018)

(2) W. Gomulya, et al., "Enhanced Raman scattering of graphene using double resonance in silicon photonic crystal nanocavities", 7th Workshop on Nanotube Optics and Nanospectroscopy, Hakone, Japan (July 09, 2018)

6. 関連特許(Patent)

None