

課題番号 : F-14-UT-0042
利用形態 : 機器利用
利用課題名(日本語) : グラフェンを用いた電界効果トランジスタ
Program Title (English) : Field effect transistors using graphene
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1. 概要(Summary)

The intrinsic p-type behavior of graphene field-effect transistors under ambient conditions poses a fundamental challenge for the assembly of complex electronic devices such as integrated circuits. It is essential to tailor electronic structures of monolayer graphene in advance to the real applications. This is an important step for maximizing the graphene device performance. Here we fabricate the graphene field-effect transistors using photolithography procedures.

2. 実験(Experimental)

- Apparatus

MA6 Suss 6" Mask Aligner

- Experimental method

As-grown graphene was transferred using PMMA onto the silicon substrate. The source/drain electrodes were patterned on a monolayer graphene/SiO₂/Si substrate using a standard photolithography process. The Au/Ni electrodes were deposited in high vacuum condition using thermal evaporator with a quartz crystal thickness meter. Subsequently, the second photolithography step was adopted to remove graphene film exclusive of the channel region between source and drain by exposing the sample oxygen plasma.

3. 結果と考察(Results and Discussion)

SiO₂/Si with a desired thickness of SiO₂ were obtained by etching thermally oxidized SiO₂/Si stacks in dilute HF solutions. Fig.1 shows

corresponding optical image of graphene/SiO₂/Si substrate (90 nm thick oxide layer) between the source/drain electrodes (channel length = 50 μm, width = 50 μm) using a standard photolithography. The transfer characteristics of graphene device show ambipolar behavior with the stable Dirac point.

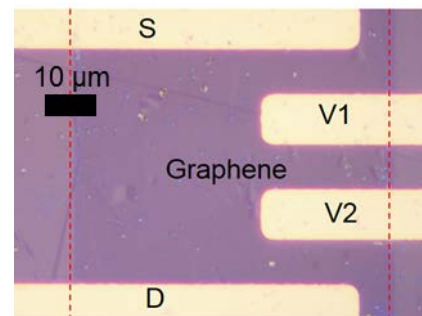


Fig. 1 Optical microscopy image of Graphene field-effect transistor.

4. その他・特記事項(Others)

- Collaborator: S. Aikawa, Research Institute for Science and Technology, Kougakuin University.

- Grant-in-Aid for Scientific Research on Innovative Areas, "Science of Atomic Layers (SATL)".

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5. 論文・学会発表(Publication/Presentation)

(1) S. Kim, X. Chen, K. Cui, K. Nagashio, S. Chiashi, and S. Maruyama, 5th A3 symposium on Emerging Materials, 平成 26 年 10 月 20 日

6. 関連特許(Patent)

なし