

課題番号 : F-16-OS-0049
利用形態 : 機器利用
利用課題名 (日本語) :
Program Title (English) : He⁺ irradiation for Anderson localization on single layer graphene
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1. 概要 (Summary)

Rendering a single layer graphene sheet insulating can potentially aid applications in electronics and optics. Insulation can be achieved by inducing Anderson localization by introducing defects in the atomic level. Past work has shown that only a small amount of defects is necessary for the effect (up to 5 %). This can be realized by He-ion irradiation with ion dose up to 500 ions/nm². In this work we aimed to replicate the past results of Nakaharai et al. and also to study the impact of the beam to different materials we are using for graphene support. The materials of choice were SiO₂ and Al₂O₃.

2. 実験 (Experimental)

【利用した主な装置】

High definition focused ion beam system

【実験方法】

We prepared a series of samples in order to irradiate with different dose: Graphene on Al₂O₃ and graphene on SiO₂. He-ion irradiation was performed to both the substrates and the graphene itself, using the high definition focused ion beam system at the nanofabrication platform. Besides the ion dose (50-2000 ions/nm²) we also experimented with parameters that can influence the irradiated patterns such as electrical current (0.6-15 pA) and field-of-view during irradiation. The irradiated samples were evaluated by SEM and AFM in NIMS.

3. 結果と考察 (Results and Discussion)

We found that the beam has a similar topographical/electronic impact on all surfaces, as evidenced by SEM and AFM ex-situ analysis. In addition, the beam impact increases with dose, producing better defined features as seen in Figure 1. Other parameters did not affect the fabricated features much.

It was also suggested that the dose of 50 ions/nm² is not enough to localize the graphene, as opposed to what was known in the literature by that time. Further work will determine the refined real value necessary for localization.

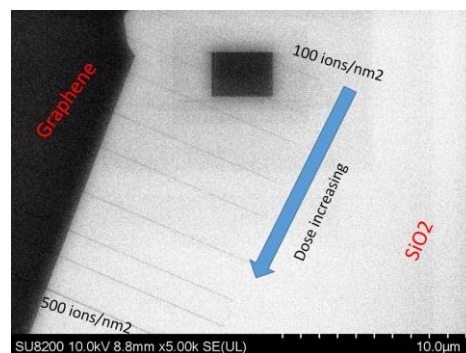


Figure 1 SEM micrograph showing lines fabricated by different doses in high definition focused ion beam system.

4. その他・特記事項 (Others)

•Reference

S. Nakaharai *et al.*, ACS Nano 7, (2013) 5694.

•JSPS KAKENHI Grant Number 16H03829

5. 論文・学会発表 (Publication/Presentation)

なし。

6. 関連特許 (Patent)

なし。