

課題番号 : F-18-UT-0014
 利用形態 : 機器利用
 利用課題名(日本語) :
 Program Title (English) : Thermal conductivity measurement of single-walled carbon nanotubes by suspended micro thermometer
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 キーワード/Keyword : リソグラフィ・露光・描画装置, 膜加工・エッチング, carbon nanotube, thermal property

1. 概要(Summary)

The thermal conductivity of single walled carbon nanotube has been an intriguing topic though theoretical analysis has made extreme high prediction. Particularly, the bundle size effect of the thermal conductivity has long been observed, while no experiment has been conducted concerning to the quantitative dependency. Due to the particular difficulty in experimental verification of quasi-one dimensional material, the micro-device (by MEMS) specifically for this purpose have to be fabricated. The device should be pre-designed in order to produce proper electrical signal.

2. 実験(Experimental)

【利用した主な装置】

超高速大面積電子線描画装置, 光リソグラフィ装置 MA-6, 汎用 ICP エッチング装置, 高速シリコン深掘りエッチング装置

【実験方法】

400 nm wide pattern used for thermometer is realized by E-Beam lithography (ADVANTEST F5112+VD01) and the following deposition of Ti/Pt electrode is performed by Sputter in Maruyama-Lab. A second E-Beam lithography comes to pattern the later suspended silicon nitride features. Subsequently, the unwanted silicon nitride is etched away with CHF gas by ULVAC CE-300I. Next, a backside photolithography with Suss MA6 is conducted to pattern the window for the final release of the silicon nitride pad, then a Si

deep etching process by SPTS MUC-21 ASE-Pegasus 4 is followed. Finally, the release of the silicon nitride pads is performed in Maruyama-Lab by immersing the structure in hot KOH liquid. After the micro-device is ready, single-walled carbon nanotube will be transferred onto it with PMMA for the ultimate thermal conductivity measurements.

3. 結果と考察(Results and Discussion)

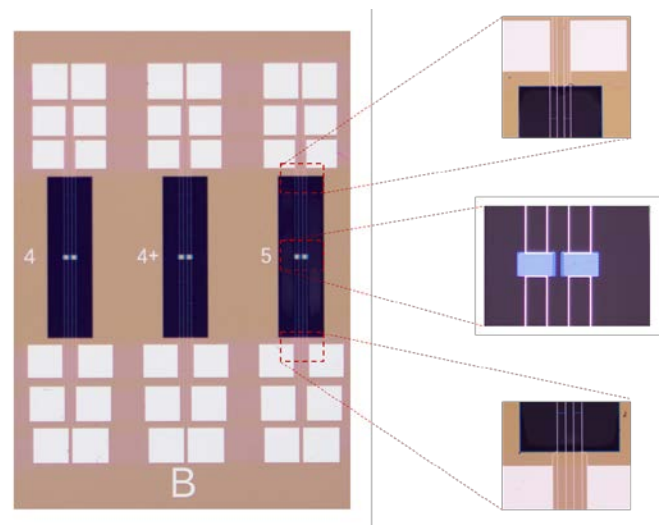


Fig.1 Microscope image of the micro-device for nanoscale thermal investigation.

4. その他・特記事項(Others)

・Part of this work was financially supported by JSPS KAKENHI Grant-in-Aid for Scientific Research

5. 論文・学会発表(Publication/Presentation)

None

6. 関連特許(Patent)

None