課題番号 :F-16-UT-0016

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

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1. 概要(Summary)

The thermal conductivity of single walled carbon nanotube has been an intriguing topic since the theoretical prediction of the extraordinary high value due to its quasi-one-dimensional structure. Particularly, the length dependence of the thermal conductivity has long been investigated through molecular dynamics simulation, while no experiment has been conducted concerning to this problem. To measure the thermal conductivity of single single-walled carbon nanotube, the microdevice (by MEMS) specifically for this purpose have to be fabricated and then transfer the horizontally grown carbon nanotube onto it for thermal property investigation.

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置 ADVANTEST F7000S-VD01, 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】

Since the 400 nm wide serpentine Pt coil used for heating is realized by E-Beam lithography (ADVANTEST F7000S-VD01) to pattern the E-Beam resist for the following Cr/Pt electrodes deposition. A second E-Beam lithography comes to pattern the later suspended silicon nitride features. Subsequently, the unwanted silicon nitride is etched away with CHF_3 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 sample is immersed in KOH to etch the remaining silicon and release the silicon nitride pads. After the microdevice is ready, single-walled carbon nanotube will be transferred onto it with PMMA for the ultimate heat transfer measurements.

3. 結果と考察(Results and Discussion)

The desired microdevice for nanoscale heat transfer measurement have been achieved, shown in Fig. 1 is the Microscope image of it.

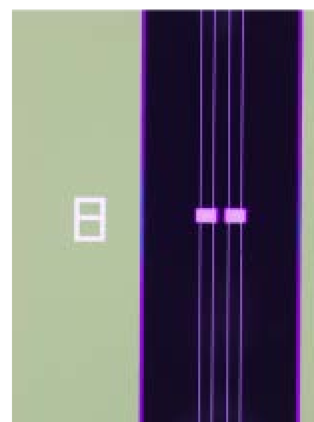

Fig. 1 Microscope image of the microdevice for nanoscale thermal investigation.

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 and JST-EC DG RTD Coordinated Research Project (JST-SICORP).

5. 論文・学会発表(Publication/Presentation)

None

6. 関連特許(Patent)

None