

課題番号 : F-16-AT-0133
 利用形態 : 技術代行
 利用課題名 (日本語) :
 Program Title(English) : Development of thermoelectric device based on hybrid material
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1. 概要 (Summary)

We measured conductivity of two types of individual Bi nanowires using nanoscale twin-probe configuration. We find that conductance of the Bi nanowire encapsulated in PEDOT:PSS is lower than that of the bare Bi nanowire. This is opposite to electricity-generating performance of two thermoelectric devices fabricated using both materials separately.

2. 実験 (Experimental)

【利用した主な装置】

ナノプローバ (N-6000SS)

【実験方法】

Tungsten tips was utilized as probes to measure conductivity along the longitudinal axis of each nanowire as shown in Fig. 1 and Fig. 2. Since the material was very soft, care was taken to avoid the tips smashing the nanowires during tip-sample approach. Applied bias was swept between -0.1 V and +0.1 V while the current was measured (Fig. 3). Each bias changing step was 0.01 V. For a single wire, several I-V spectra was obtained for each probing arrangement repeatability. The same measurement was done on several nanowires for reproducibility.

3. 結果と考察 (Results and Discussion)

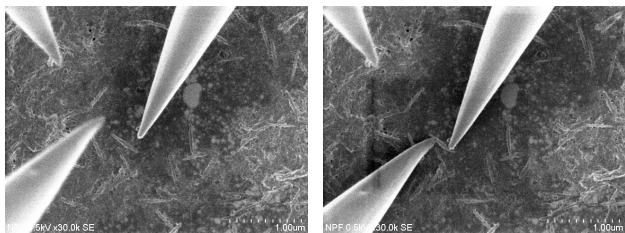


Fig. 1 Probing configuration for a PEDOT:PSS Bi nanowire in the measurement.

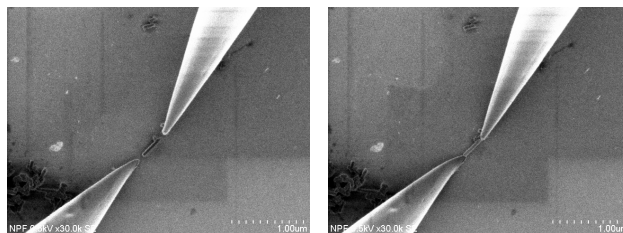


Fig. 2 Probing configuration for a bare Bi nanowire in the measurement.

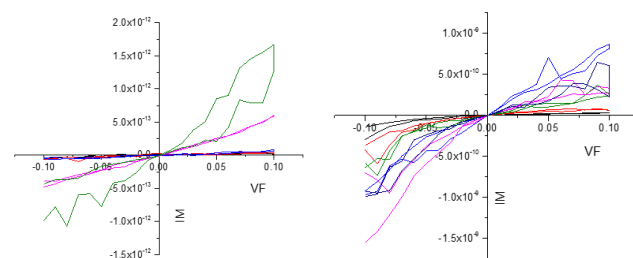


Fig. 3 I-V spectra for the PEDOT:PSS Bi nanowires (left) and the bare Bi nanowires.

Considering the results, conductance of the encapsulated Bi nanowires is lower than that of the bare Bi nanowires, not as expected. Since electronic transport of the Bi wire is larger than that of the PEDOT:PSS material, we attribute this to the penetration of the tip through an ultra-thin insulating layer covering the bare nanowire, which is the cause of lower electricity generation, to the Bi material inside.

4. その他・特記事項 (Others)

None.

5. 論文・学会発表 (Publication/Presentation)

[1] W. Thongkham, et. al., (in preparation)

6. 関連特許 (Patent)

None.