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利用形態　　　　　　　　　:機器利用
利用課題名(日本語)　　　　:
Program Title (English)　　:Device applications of 1D hetero-nanotubes
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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、形状・形態観察、分析、電気計測

1. 概要(Summary)

To investigate transport properties and fabricate functional devices of SWNT-BNNT-MoS$_2$NT heterostructure nanotubes, individual suspended nanotubes are prepared over Si poles with confined Co catalysts on top, face transferred onto target chip, and contacted with connection metals. (SWNT: Single Wall Nanotube, BNNT: Boron Nitride Nanotube, MoS2NT: MoS2 Nanotube.)

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置, 超高速大面積電子線描画装置, 高速シリコン深掘りエッチング装置, 汎用ICPエッチング装置

【実験方法】

A marker layer was patterned by EBL (ADVANTEST F5112+VD01) and transferred to SiO$_2$/Si substrate by RIE (ULVAC CE-300I). The second layer for catalysts was patterned by EBL and then catalyst Co was sputtered onto. The third layer for poles was patterned by EBL as well, and the exposed area was etched away by RIE and DRIE (SPTS MUC-21) sequentially to produce several micrometer high poles for individual suspended SWNT growth and later SWNT-BNNT-MoS$_2$NT heterostructure formation. The as-grown heterostructure nanotubes were face transferred onto target chip, and metal connections were patterned by EBL (ADVANTEST F7000S-VD02). The contact metals of 2 nm Cr and 30 nm Pd were sputtered.
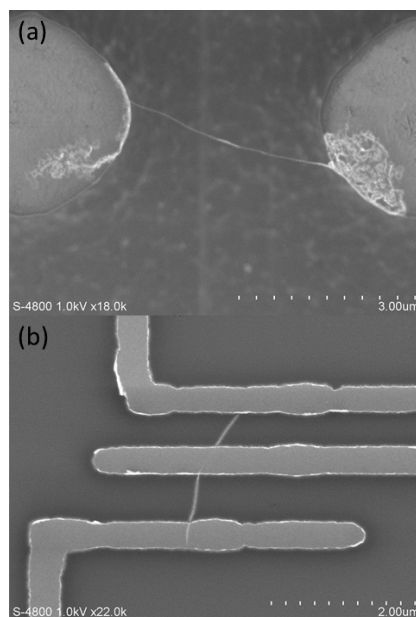
3. 結果と考察(Results and Discussion)

Fig. 1 SEM image of (a) as-grown individual heterostructure nanotube and (b) heterostructure nanotube device.

The desired individual SWNT-BNNT-MoS$_2$NT heterostructure nanotube shown in Fig. 1(a) is ideal for optical characterizations such as photoluminescence and Raman spectroscopy; it was then face transferred onto target substrate for further electrical and thermal measurements after contact metals deposition as shown in Fig. 1(b).

4. その他・特記事項(Others)

None

5. 論文・学会発表(Publication/Presentation)

None

6. 関連特許(Patent)

None