課題番号　　:F-21-NM-0028
利用形態　　:技術補助
利用課題名（日本語）　　:マイクロ流路付き MoS_2-FET センサーにおける電気特性の溶液依存性観測
Program Title (English)　　:Observation of Solution Dependence of Electrical Properties in MoS_2-FET Sensor with Microfluidic Channel
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キーワード／Keyword　　:N&MEMS、リソグラフィ・露光・描画装置、二硫化モリブデン

1. 概要（Summary）

Ultrathin two-dimensional (2D) layered MoS_2 has been using as fascinating channel materials because of their exceptional electrical and chemical properties. In our laboratory, we have been trying to make molecular sensor based of MoS_2-FET. I tried to detect solvent molecule in this year but, we are aiming to detect solute molecules in solution for practical use as great molecular sensors.

2. 実験（Experimental）

【利用した主な装置】

125kV 電子ビーム描画装置、6 連自動蒸着装置

【実験方法】

The MoS_2 flakes was transferred onto the $SiO_2/p^{++}Si$ (001) substrate by scotch tape method. Thereafter, resist coating was performed onto the substrates followed by electron beam lithography to form the metallic source (S) and drain (D) contacts by operating ELS-F125 ultra high precision E-beam lithography system. Finally, 10 nm Nickel (Ni) and then 1500 nm gold (Au) was deposited by automatic E-gun evaporator followed by lift-off by using NMP, acetone and IPA solvents.

3. 結果と考察（Results and Discussion）

I investigated whether changing the solution flowing over the MoS_2 channel would cause a difference in the change in electrical properties (Id-Vg). A microfluidic channel made of PDMS was placed on top of a MoS_2-FET fabricated on the NIMS-NFP. The solution was then flowed into the device with microfluidic channels (Fig. 1). The flow rate of the solution was fixed at 100 ul/hour. By focusing on the difference in polarity of the solution molecules, we observed a difference in the Id-Vg change when two types of solutions, IPA and dodecane, were flowed (Fig. 2). I'd like to continue our experiments to explain why this difference in Id-Vg change occurs from various viewpoints, such as the difference in polarity and adsorption structure.

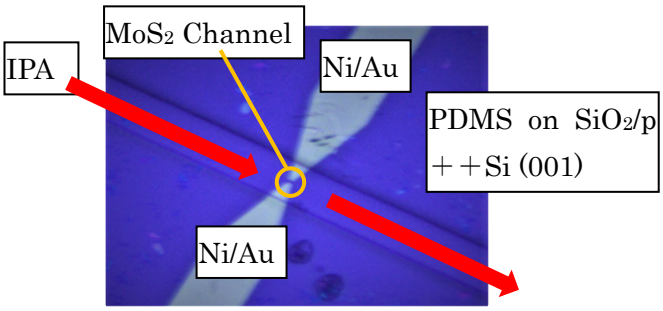

Fig. 1. The optical image of the fabricated device during flow of solution (IPA).

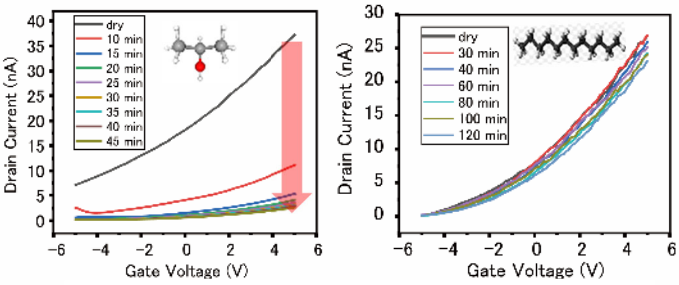

Fig. 2. The difference of Id-Vg shift between IPA (left) and dodecane (right).

4. その他・特記事項（Others）

・競争的資金：科研費　基盤研究(S) 19H05621
・技術支援者：大里啓孝（NIMS 微細加工 PF）

5. 論文・学会発表（Publication/Presentation）

なし。

6. 関連特許（Patent）

なし。