

## 夾雑溶液下における 2 次元半導体 MoS<sub>2</sub> とアミド系分子間の 特異的相互作用

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Specific Interaction between Two-dimensional Semiconductor MoS<sub>2</sub> and Amide Molecules  
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*N, N*-dimethylformamide (DMF) is widely used as a solvent, but it has been reported to be toxic to the human body and cells. However, DMF molecule sensing in solution is not easy due to its stability and the coexistence of other polar molecules. In this study, we found specific and selective interactions between a defective site of molybdenum disulfide (MoS<sub>2</sub>), which is a two-dimensional semiconductor, and an amide-based molecule. We also attempted to demonstrate a molecular sensor under a contaminating solution using a field-effect device.

A field-effect transistor with a channel length of 1 μm was fabricated for MoS<sub>2</sub> transferred onto a SiO<sub>2</sub> substrate by mechanical exfoliation. A microchannel using polydimethylsiloxane was bonded on the substrate to hold and exchange the solution. DMF/NaCl aqueous solutions were introduced into the microchannel. The concentration of NaCl was 0.15 M, and the concentration of DMF was changed from 1 μL/mL to 200 μL/mL. By the measurement of the device under the solution, the change of the current value was observed corresponding to the concentration of DMF.

**Keywords :** *Amide Molecules, Molybdenum Disulfide, Biosensors*

*N,N*-ジメチルホルムアミド(DMF)は溶媒として広く用いられているが、人体および細胞に対して毒性を有することが報告されている<sup>1)2)</sup>。しかし、溶液中での DMF 分子センシングは DMF が安定な分子であることや、他の極性分子が存在することから容易ではない。本発表では、2 次元半導体である二硫化モリブデン(MoS<sub>2</sub>)の欠陥サイトとアミド系分子間における特異的相互作用を見出し、さらに電界効果型デバイスにより、夾雑溶液下における分子センサの実証を試みたので報告する。

機械的剥離法によって SiO<sub>2</sub> 基板上に転写した MoS<sub>2</sub> に対し、チャンネル長 1 μm の電界効果トランジスタを作製した。この基板上に、ポリジメチルシロキサンを用いたマイクロ流路を取り付けることで、溶液の保持と交換が可能な機構を作製した。その後、NaCl 濃度が 0.15 M, DMF 濃度が 1 μL/mL から 200 μL/mL になるよう調整した DMF/NaCl 水溶液を流路内に導入したところ、電流値に濃度依存性が確認された。

1) Jamalzadeh. L et al., *Avicenna J Med Biochem.*, 4(1):e33453. (2016)

2) N. Sun et al., *Sensors & Actuators: B. Chemical*, 261, 153-160 (2018)