Frontier Chemistry Center
フロンティア化学教育研究センター

講演会

演 題：**High-performance poly(1,3-dioxolane)-based membranes for CO_2 capture**

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日 時：2025 年 7 月 22 日（火）13:30~14:30

場 所：フロンティア応用科学研究棟　2 階セミナー室

Abstract: The majority of electric power in the world is still generated by the combustion of fossil fuels (e.g., coal and natural gas), which produces enormous amounts of CO_2 in the flue gas being released to the atmosphere. To mitigate the CO_2 emissions, the CO_2 in the flue gas must be captured for utilization and sequestration without drastically increasing the cost of power production. Membrane technology has emerged as an attractive approach for CO_2 capture due to its high energy-efficiency, small footprint, and simplicity of operation and maintenance. As the flue gas has a huge volume and low CO_2 partial pressure, membrane materials should exhibit both high CO_2 permeability and CO_2/N_2 selectivity to minimize the size of the membrane skid and maximize the purity of the product.

Polymers containing poly(ethylene oxide) (PEO) chain segments demonstrate superior CO_2/N_2 separation properties owing to their polar ether oxygen groups exhibiting strong affinity towards CO_2. Poly(1,3-dioxolane) (PDXL) shows ether oxygen content higher than PEO and is expected to have higher CO_2/N_2 solubility selectivity. However, similar to PEO, the high crystallinity of PDXL greatly reduces its gas permeability. In this talk, I will introduce a series of amorphous PDXL-based branched or multi-block polymers we designed and synthesized. The PDXL-based membranes we developed show robust CO_2/N_2 separation performance when evaluated with simulated flue gas. The relationship between membrane material structure and gas transport properties will be discussed. This talk will demonstrate that branched and multi-block structures are effective routes to construct amorphous PDXL-based polymers and achieve superior gas separation performance.

References:

1) *Macromolecules*, **2022**, *55*, 382.; 2) *J. Membr. Sci.*, **2022**, *648*, 120352.; 3) *Chem. Mater.* **2024**, *36*, 9603.

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