

Separation of gases in the thin polymeric membranes – can “nano” deliver the breakthroughs for CO₂ capture?

Roman SELYANCHYN

Assistant Professor at the Multiscale Science and Engineering for Energy and the Environment Thrust,
International Institute for Carbon Neutral Energy Research, Kyushu University

日時: 2022 年 1 月 28 日 (金) 10:30~11:20

場所: オンライン開催 (Webex を使用予定)

Abstract:

The membrane-based separation of gases proved to be an energy-efficient process for several industrial applications. Currently, researchers actively study membrane-separation for more challenging tasks needed for the global management of industrial CO₂ emissions in both post- and pre-combustion separations from nitrogen and hydrogen, respectively. It is known that for cost-efficient post-combustion CO₂ separation and capture, membranes should have high CO₂ permeances (>1000 GPU, where GPU = 7.5×10⁻¹² m³(STP)m⁻²s⁻¹Pa⁻¹) and relevant CO₂/N₂ selectivities (>40). Meanwhile, separating CO₂ from the air, recently arisen as an essential issue requires even better membrane performance. Organic polymers, the materials predominantly used to fabricate the membranes, were investigated for several decades, have limited ability to achieve this performance. An empirically described trade-off between target gas permeability and selectivity, known as Robeson upper bound, prevents the membranes' development based on pure polymers.

This lecture will cover our research work related to the ultimate thinning of polymeric membranes to achieve better separation performance, aimed to overcome the bulk materials limitations. We will demonstrate how reaching the nanoscale region of membrane thicknesses has helped us develop the membranes with record permeances (*Chem. Lett.* **2019**, 48, 1351–1354). Also, we will discuss how higher CO₂ selectivities compared to bulk polymers can be achieved using the molecularly thin selective layers and controlled surface modification (*ACS Appl. Mater. Interfaces* **2020**, 12, 33196–33209). Finally, the applicability of the nanomembranes for the challenging task of direct air capture of CO₂ will be described (*Polym. J.* **2021**, 53, 111–119).

About the speaker:

2003: Masters' degree in theoretical physics, Uzhhorod National University, Ukraine

2012: Doctor of Engineering, Graduate School of Environmental Engineering, The University of Kitakyushu

2012-2013: JSPS fellow, The University of Kitakyushu

2014-2019: WPI Researcher, International Institute for Carbon Neutral Energy Research, Kyushu University

2019-present: Assistant professor, International Institute for Carbon Neutral Energy Research / Research Center for Negative Emissions Technologies, Kyushu University

参加要領

- 1) 参加費: 無料、2) 定員: 200 名、3) 申込方法: 氏名、所属、連絡先を明記の上、E-mailにてお申し込みください。4) 申込締切 2022 年 1 月 26 日 (水)

申込・問い合わせ先

白木 智丈 (九州大学大学院工学研究院応用化学部門)

E-mail: shiraki@mail.cstm.kyushu-u.ac.jp、電話: 092-802-2841