CHEMICAL ENGINEERING SEMINAR

Siyoung Choi

Associate Professor, Department of Chemical & Biomolecular Engineering at Korea Advanced Institute of Science and Technology (KAIST)

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107 Chemical & Biomedical Engineering Building
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2D and 3D morphology control of self-assembled membranes

In this talk, we present how the morphology control of self-assemble membranes (one is polymeric membranes and the other is lipid membrane) can change their physical properties. The first part of the talk includes a membrane of the vanadium redox flow battery system. It generally requires high proton conductivity and selectivity against vanadium ions. We use the conventional ionomers (Nafion) that have high chemical/mechanical stability, but is expensive. By controlling their internal nanostructures using fluid/fluid interfaces, we show that its permeability of vanadium ions decreases by 1000 folds, thus reducing the membrane thickness as low as tens of nanometers (>100 times less ionomers compared to conventional membrane), while keeping the similar proton conductivity. In the second part is about a model lipid bilayer membrane that mimics cell membranes. We have developed an ensemble of large area freestanding lipid bilayers that facilitates fast visualization during the physicochemical change of the membranes. As an example, we study dynamics of a cholesterol composition-induced lipid reorganization, which is more relevant to homeotherms, rather than the temperature-induced one. Direct visualization of the planar membranes undergoing a composition-induced phase transition revealed a lot of new behaviors that have not been observed in temperature-induced phase transition.

About the Speaker

Professor Siyoung Choi received his B.S. in the Department of Chemical and Biomolecular Engineering from Korea Advance Institute of Science and Technology (KAIST) in 2005 and moved to University of California, Santa Barbara for his Ph. D. in 2011. After one year of post-doctoral training in the Department of Chemical Engineering and Material Science in the University of Minnesota, he began his independent career with his own grant at KAIST in 2013. He is now associate professor in Chemical and Biomolecular Engineering at KAIST since 2015 as well as in KAIST Institute of Nanocentury. His research interests include various transport phenomena such as mass transport and rheology, particularly focusing on dynamics at/near/across fluid/fluid interfaces.

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