EFFECT OF ELECTROOSMOTIC FLOW ON THE ELECTROPHORETIC DEPOSITION OF ZEOLITE POWDER ON A POROUS ALUMINA SUPPORT

Hideyuki Negishi, National Institute of Advanced Industrial Science and Technology (AIST),
AIST Central 5, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565, Japan
h-negishi@aist.go.jp
Kyohei Ueno, Gifu University, 1-1 Yanagido, Gifu-city, 501-1193, Japan
Yasunori Oumi, Gifu University, 1-1 Yanagido, Gifu-city, 501-1193, Japan

Key Words: Electrophoretic deposition, Porous alumina support, Electroosmotic flow, Zeolite

Pervaporation separation of azeotropic and near-boiling-point mixtures by zeolite membranes offers substantial advantages over traditional distillation and extraction methods in terms of energy consumption. Typically, zeolite membranes are prepared by coating seed crystals on a porous support surface, followed by the secondary growth of the seed crystals by subsequent hydrothermal synthesis. The properties of the seed layer are known to strongly influence the separation performance of the prepared membrane [1]. Electrophoretic deposition (EPD) is a highly reproducible technology for the deposition of seed crystals on porous supports. Despite the effectiveness of EPD, only a few studies have investigated its use as a seeding method for the preparation of the zeolite membrane on porous alumina support. With the use of porous alumina support, seeding is conducted by placing electrodes of EPD on both sides of the support. In this case, two electrokinetic phenomena are observed: electrophoresis of the seed crystal particles and electroosmotic flow of the solvent within the porous alumina support [2]. Thus far, experiments for the simultaneous observation of electrophoresis of seed crystal particles and electroosmotic flow of the solvent within the support have not been systematically investigated.

In this study, the effect of the electroosmotic flow of the solvent within seeding on the porous aluminum support by EPD is investigated using solvents such as water, acetone, and methanol. When water and acetone are used, the direction of the electroosmotic flow is opposite to that of EPD, the strength of electroosmotic flow with water is higher than that with acetone. In contrast, with methanol, the direction of the electroosmotic flow is the same as that of EPD, with weak particle charge. The results showed that both the support and solvent contributed to the change in the strength and direction of the electroosmotic flow.

[1] H. Negishi, et. al., J. Am. Ceram. Soc., 89, 124-130 (2006)
[2] S. Haber, J. Colloid Interface Sci., 179, 380-390 (1996)